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Magnox Reactor Graphite Characterisation Stage 2 – Final Active Analysis Stage

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Executive Summary

This report describes the findings of the active graphite analysis and model verification phase of Stage 2 of a programme of work to improve the radiological characterisation of irradiated Magnox core graphite. This work was undertaken by Babcock under the NDA's Direct Research Portfolio (DRP). The overall objective of the work is to assist NDA in its assessment of management options for UK reactor graphite wastes. The primary aim of this project is to improve confidence in graphite radionuclide inventories by validating or highlighting any weaknesses in the derived radionuclide inventory of Magnox core graphite in the Radioactive Waste Inventory (RWI).

The objectives for the last part of Stage 2 work described in this report were to:

- improve precursor data for the reactor graphite for specific elements;
- make comparisons between active sample results and those predicted by models developed earlier in the project;
- investigate the potential scalability of inventory predictions used for Sizewell and Wylfa reactor models for application to another reactor;
- analyse active and modelled sample data to draw conclusions on fuel failure;
- investigate the impact of graphite density loss on specific activity.

The findings of this work, together with conclusions from earlier stages of the project, are discussed in the report in terms of the reliability of model predictions and RWI estimates by comparison with analysis results from reactor samples. The main conclusions were:

- The agreement between the RWI and Monte Carlo N-Particle – FISPACT (MCNP-FISPACT) predictions are generally within the uncertainty bands noted in the RWI for nuclides where easy comparisons can be made, as shown in previous whole core calculations and for example by comparison with sample results for C-14. A direct comparison between sample results and the RWI data is difficult as the samples were taken before the stations stopped generating and the RWI only provides an average specific activity for the whole of the graphite waste stream. However the location and timing of sample recovery and analysis is accommodated in the FISPACT calculations and good agreement is found within the uncertainty levels declared in equivalent RWI predictions.
- The FISPACT calculations undertaken result in a greater number of predicted nuclides due to the increased number of precursors included and the larger number of activation pathways included in the code compared to equivalent RWI calculations.
- Both FISPACT and RWI models are incapable of accurately describing nuclides that are affected by processes other than activation of bulk graphite. These include important nuclides such as Cl-36 and H-3 where both the concentration of the nuclide and its precursors can be changed by chemical and physical processes over the lifetime of the reactor. This is demonstrated by the poor agreement (greater than an order of magnitude) between the results obtained for these nuclides from samples from all the reactors, whereas reasonable to good agreement was found for less volatile nuclides. For Cl-36 and H-3, which are important nuclides in terms of disposability with respect to near surface (H-3 and Cl-36) and deep repositories (Cl-36), the RWI and FISPACT models significantly over predict the results obtained

from analysis of samples. However, for these relatively mobile nuclides this finding relies on the samples having maintained their inventories while they were in long term storage and there is a significant risk that this may not be the case.

- Failed fuel cartridges have not had a significant effect on the activity of analysed samples as indicated by very low fission product and uranic/trans-uranic radionuclide concentrations measured.

- Graphite density loss was found to have a limited effect on predicted activation levels over a wide range of densities. Therefore scalability of results between reactors should not be significantly affected by this factor. Evidence for scalability between reactors was also found by comparison of scaled predictions with active analysis results of samples from Hunterston A. This assessment could have been improved by better knowledge of sample history and reactor design information.

Recommendations have been made in the report for future work to improve knowledge of graphite radionuclide inventories.

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1 INTRODUCTION

This report describes the findings of the active graphite analysis and model verification phase of Stage 2 of a programme of work to improve confidence in the radiological inventory of irradiated Magnox core graphite. This work was undertaken by Babcock under the NDA's Direct Research Portfolio (DRP). The overall objective of the project is to assist the NDA in its assessment of management options for UK reactor graphite wastes.

There are over 99,000 tonnes (79,000 m^3) of graphite in the UK arising from operational and reactor decommissioning activities. This accounts for 33% of the total volume of ILW wastes destined for disposal in the Geological Disposal Facility (GDF). However, this volume is a less significant contribution to the overall GDF footprint because of the more compact repository systems designed for this type of waste.

At least 20% of the graphite inventory destined for the GDF is classified as Low Level Waste (LLW) but is not suitable for disposal at the Low Level Waste Repository (LLWR). Therefore, there is the potential for a significant reduction in the amount of graphite consigned to the GDF if an alternative management option for LLW graphite could be utilised. Based on current estimates of graphite radionuclide content graphite is also predicted to be a significant contributor to some of the long-lived mobile nuclides (e.g. Cl-36) that the GDF is required to manage..

The current NDA position on graphite management is stated in its 2011 strategy document [1] as follows "Decommissioning of the UK reactor fleet will generate substantial amounts of radioactive waste. A significant proportion of these reactor decommissioning wastes will be graphite. We have an ongoing commitment to consider the best way to manage these wastes, as recognised by CoRWM's recommendation 8 and Government's response. We are undertaking a programme of work considering the options for the management of reactor graphite".

There are a number of management/treatment options in varying stages of development that may enable the use of alternative disposal routes including; the reduction of activity in the waste to levels that would enable disposal outside the GDF, or reduction in volumes that would allow a reduction in the GDF ILW footprint. However, it is recognised that the GDF footprint may be dominated by other materials it also has to accommodate e.g. spent fuel, and that graphite disposal arrangements will be less of a problem because of its low dose compared to other wastes, radiological characteristics and less onerous packaging and handling requirements.

A key requirement in the assessment of the benefits of suitable management/treatment options is a comprehensive understanding of the radionuclide inventory of the graphite waste. Data published in the 2007 UK Radioactive Waste Inventory [2] for Magnox reactor graphite declares significant uncertainties in the concentrations of key radionuclides. The predicted inventory is also based on a relatively short list of uniform precursor elements (elements that form radionuclides during irradiation) across the fleet, combined with a very simple methodology to calculate total inventories from each reactor core. An important objective of this programme was to validate or highlight any weaknesses in this approach and the derived inventory in the RWI, making use of the existing archive of reactor core samples as appropriate.

2 PREVIOUS WORK STAGES

The work carried out under Stage 1 [3] of this project identified a forward programme to help improve the reliability and accuracy of the radionuclide inventory of Magnox reactor core graphite. That work utilised a Data Quality Objectives (DQO) methodology to direct and focus work to be conducted in the subsequent Stage 2 [4] to maximise benefits and to ensure overall programme objectives were achieved.

Stage 2 involved an assessment of the archive of existing active graphite samples taken at various times and locations from the cores of the fleet of Magnox reactors, together with the development of an activation model of 2 representative Magnox cores to predict their graphite radionuclide inventory. The two representative reactors were Sizewell and Wylfa. These reactors were chosen because they were typical of the general types of Magnox core design and also had a sufficient coverage in the sample archive such that inventories could be quantified using the combined approach of modelling validated by sample analysis. For the other Magnox reactors there was a very limited quantity of suitable samples in the archive.

The experimental and modelling programme defined in Stage 1 and the inactive element of Stage 2 are reported in an earlier report [5]. The report included the specification of analysis requirements (e.g. limits of detection for each element and radionuclide to be analysed by National Physical Laboratory (NPL)). The 'inactive' phase also involved recovery of unirradiated graphite samples from the archive and their chemical analysis for elements that are precursors to key radionuclides, followed by modelling of their activation in reactor using MCNP-FISPACT codes. Predictions for the inventory of whole cores were made for the chosen reactors and compared with RWI predictions. The 'active' phase of Stage 2 involved recovery and analysis of identified irradiated samples chosen from the Magnox archive, and modelling of their irradiation history and activation to test the validity of the code predictions. The results from the active phase of Stage 2 are reported independently in this document. Due to various delays in acquiring a suitable set of active samples, the active sample analysis proceeded significantly slower. The active Stage 2 work package was therefore split and reported separately but its findings relate back to some assumptions and data uncertainties left unanswered at the end of the whole core modelling [4]. In addition, following a request from Magnox/NDA, a number of Hunterston A graphite samples were analysed alongside those from Wylfa and Sizewell. These additional samples were accommodated in the programme and were also used to test scalability of predictions between reactors.

2.1 Summary of Findings of Previous Work Packages

Previous inactive phase reports [4,5] described the initial programme to analyse the concentration of key impurities in graphite, and the development of neutron flux and graphite activation models for two Magnox cores to predict whole core inventories.

These reports [4,5] confirmed that:

- Inactive graphite samples for representative reactors had been recovered from Downton archive;
- Analysis had been conducted for the full range of precursor concentrations as specified in Stage 1 work;

Development and optimisation of activation models has been used to predict inventories for key nuclides and compare them with RWI data. These reports concluded that:

- Reasonable agreement was found between RWI data and model predictions for C-14 and other nuclides, based on activation of measured precursor concentrations in unirradiated graphite and not taking account of other processes that can influence inventories. Where differences were found between inventories they were assessed and found to be mainly associated with differences in precursor concentrations and activation pathways used in the calculations;

- For a limited number of precursors, the limits of detection achieved using the chosen analytical methods were not sufficient to enable meaningful calculations for certain nuclides (mainly nuclides of less significance to disposability but some nuclides of importance, e.g. Cl-36);

- The activation results were found not to be sensitive to the precise location from which candidate samples were recovered from the moderator bricks. Samples trepanned from core channel surfaces were modelled and assessed as representative of activation levels deeper into the bulk moderator (i.e. samples taken at close to channel surfaces were adequate to represent activation of the bulk moderator brick at that location), but sample location across the core did show significant differences in irradiation conditions particularly outside the flux flattened zone and into the reflector region.

The objectives of the subsequent Stage 2 active work, which is the subject of this report, were:

- To improve precursor data of the reactor graphite for identified elements e.g. Cl and Cs;

- To make comparisons between active sample results and those predicted for the sample by modelling, including RWI data;

- To investigate the scalability of Sizewell and Wylfa reactor models to Hunterston[1] by;

    - modelling;

    - comparison of laboratory results to predicted results, based on analysed precursor concentrations;

- To analyse active and modelled sample data to draw conclusions on graphite contamination due to fuel failure;

- To investigate the impact of graphite density loss on specific activity.

[1] Analysis and assessment of Hunterston moderator and fuel sleeve graphite samples was included into the programme of work during the project because of interest in alternative management options for graphite at this reactor site including near surface disposal.

3 INVENTORY GENERATION METHODOLOGIES

The Magnox core graphite data in the RWI is predicted using a generic Lotus Notes spreadsheet to perform activation calculations of a set of precursors using an estimated neutron flux history and spectrum. The calculations are performed on simplified reactor core geometries to generate an average activation inventory for the core and reflector regions.

The new activation model developed in this project follows a similar process to that used to derive the graphite inventory in the RWI. However, it uses more complex models of the reactor core geometries and neutron spectra and a more extensive set of precursors and activation pathways and cross sections. The more detailed modelling used in this study of the core flux and spectrum therefore provides a higher resolution over the core, as compared to RWI methodology. As discussed later in this report, it also allows the activation levels of samples to be predicted, which can then be compared to laboratory analysis results to verify code treatments and predictions.

4 PRECURSOR INVENTORIES FOR NEW ACTIVATION MODEL

For a limited number of precursors, the limits of detection (LoD) achieved using the chosen analytical methods in Stage 1 were not sufficient to enable meaningful code calculations for certain nuclides. For chlorine, some high levels were recorded in the initial NPL work which were assumed could to be due to contamination. To overcome this problem an assessment was conducted of alternative techniques and sample preparation methodologies and Imperial College (IC) was contracted via NPL to undertake further precursor determination studies using neutron activation analysis (NAA), which offered better limits of detection and required less sample preparation. The graphite analysed by IC was taken from the stock of graphite still held by NPL after their initial analysis campaign. The samples were also treated to remove the surface layer in order to remove any chlorine contamination that may have occurred. NAA also enabled certain other nuclides to be measured at lower limits of detection than achieved previously e.g. Cs.

The resulting data sets for each core graphite (incorporating NPL and IC data) were merged together to generate a set of precursor data for the FISPACT calculations. The precursor data set for each reactor core comprised the precursor elements that were initially analysed (whether it reached LoD or not) by NPL, along with any element that achieved its LoD in the IC data that appears in the list of potentially important precursors [3], subject to the following criteria:

- Where an element has measurable data (that is, has achieved LoD) for all samples analysed (e.g. calcium, aluminium, barium), all data was considered;
- The lowest recorded set of LoDs was used where LoDs were not reached by either NPL or IC measurements;
- Where an element has a mixture of positive and LoD data (e.g. europium, gadolinium, samarium) only that positive data was used.

This meant that the final set of precursors would consist only of positive data, or in the case where only LoD data was recorded the default result used was from the most sensitive measurement technique.

As an example, Table 1 lists the elemental precursors used for Wylfa (the concentrations marked in green did not reach their LoD).

A total of 35 elements have been included made up of 28 elements analysed by NPL, plus 7 additional elements that achieved LoD from IC results. Even though certain elemental precursors did not achieve LoD in either study (e.g. neodymium, caesium, uranium) they were included at the LoD levels.

	NPL			Imperial College		
	Sample Concentration (PPB)			Sample Concentration (PPB)		
	Pallet 23 Box 102 Wylfa	Wylfa 1 Box 97	Wylfa 1 Box 95	IMP090601	IMP090607	IMP090608
Al				11000	2700	1300
B	120	123	63			
Ba	1390	163	319	8000	5100	13000
Be	0.1	0.1	0.1			
Ca	32000	24700	25000	44000	45000	26000
Ce	99	100	100			
Cl	5620	1990	4220	2300	5700	2300
Co	9.3	6.7	12		38	28
Cs	9900	10000	10000	110	120	110
Cu	295	38	69			
Dy				13		20
Eu	10	10	10	5.4		13
Fe	4460	2650	4010			
Gd	11	10	12			
K	357	224	124			
La				170		200
Li	60	224	432			
Mg	317	194	226			
Mn				110	36	8.4
Mo	119	112	134			
N	13000	9900	10500			
Na	595	611	103		2400	1100
Nd	30	31	31	1200	1200	1100
Ni	962	1220	3090			
Rb	0.1	0.1	0.1	1200	2400	2200
Se	0.5	0.51	0.51	3700	3900	3500
Sm	30	31	31	32	30	40
Sr	337	183	226	870		720
Te	200	200	210	1000	1000	910
Th	10	10	10	2500	1900	860
Ti				5200	3300	8500
U	500	510	510	70	140	180
V				8800	7800	5700
W				69		
Zn	215	55	100			

Table 1: Elemental data provided by NPL and Imperial College for Wylfa (excluding C)

Between samples and between analysis techniques there was occasionally a large difference in results for some elements (e.g. Ba). To accommodate this spread of results, each precursor data set was further analysed to derive the average and maximum precursors by using the “AVERAGE” and “MAX” function in Microsoft Excel 2007. This generated two inventories, denoted FISPACT - MAX and FISPACT - AVE.

The new precursor data are given in Appendix 2. The most notable impact of the new precursor data was substantiation of chlorine measurements used in previous whole core calculations [4] and a reduction in the caesium concentration bounded by the lower LoD obtained using NAA. In addition to precursor concentrations calculated from inactive analysis, a set of RWMD precursor data (compiled by John Jowett) was also utilised. This served as a benchmark precursor set for comparison between reactors as this data is generic and formulated from a wider set of graphite data.

5 REACTOR GRAPHITE ACTIVATION MODELLING

FISPACT was used for the activation modelling. FISPACT requires 5 key pieces of information to undertake a modelling program;

1) Neutron flux;
2) Neutron energy spectrum;
3) Duration of irradiation;
4) Neutron data libraries;
5) Material precursors.

FISPACT uses the neutron history (items 1 to 4, above) to predict activation of the precursors present in the core graphite (item 5, above) as described in more detail elsewhere [4]. The modelling used in this task was adapted to enable comparison of laboratory analysis results with code predictions for the sample to help verify the model (i.e. accounting for the time of sample removal from the reactor core, the delay/decay to laboratory analysis and the location of the sample in the core). This compares to previous work where the aim was to calculate whole core inventories after stations had ceased generating. Previous reports have detailed the method used to derive neutron flux profiles and energy spectra [3,4,5] and predict whole core inventories and will not be discussed in further detail here.

5.1 Sizewell A and Wylfa

The neutron flux and energy spectrum have been derived previously using MCNP. Duration of irradiation has been obtained from reactor operational thermal history. Neutron data are provided as part of the FISPACT code and material precursors have been previously outlined in Section 4.

Unlike previous work [4,5], the duration of the irradiation is now dependent not on the total operational history of the reactor, but on when samples were removed from the reactor, and then decay time to laboratory analysis.

Sizewell A had samples trepanned in 1998 and 2002, and Wylfa had samples trepanned in 1997 and 2003. Since there is no further information about trepanning dates other than the year that samples were removed, they are assumed to have been removed after the last full month of irradiation in the previous year. For example, in the case of samples removed in 1997 from Wylfa, it is assumed that this corresponds to 1st January 1997. Each reactor utilised three different sets of material precursor data (see Appendix 2). These sets of precursor data were then individually modelled to be irradiated for their lifetime and decayed to generate data to the 1st of July, 2011. This date was chosen as it is close to the date of receipt and analysis of the active sample data by NPL.

5.2 Hunterston A

In order to comment on the scalability of the reactor modelling to other reactors in the UK fleet, it was proposed to use FISPACT analysis of Hunterston A reactor graphite. However, it should be noted that information provided on reactor sample history was very limited and some details of reactor design and operation was not available to the project, affecting the quality of the comparisons that could be made between analysis results and predicted

nuclide concentrations. Unlike Wylfa and Sizewell A, no specific reactor modelling has been undertaken on Hunterston A.

Hunterston A consisted of two reactors, each with a designed thermal output of 525 MW(th) generating a combined net total of 280 MW(e) [6]. It began operations in 1964 and ceased operations in 1990.

Unlike the majority of the Magnox fleet, Hunterston A utilised graphite fuel element sleeves – tubes of graphite that contained the fuel elements – which were made of a lower grade of graphite to the core called VFT [7].

Some limited active samples from Hunterston A were made available for analysis by Magnox. These samples included graphite fuel sleeves as well as some moderator samples. The moderator samples were of very poor provenance and there was no information available on whether they had been pre-tested, thus only a limited set of measurements were undertaken including gross alpha and gross beta and gamma spectroscopy. Fuel sleeves received a full set of nuclide specific measurements.

Precursor measurements were also undertaken for inactive sleeve samples supplied by Magnox. These data are given in Appendix 3. Particular care was taken during sample preparation to avoid contamination of the material for analysis. This included the machining and recovery of sub-surface samples from the sleeve (using precursor free tooling e.g. for chlorine and cobalt) as the sleeves may have been surface contaminated previously during storage and handling.

In total, 28 active samples were retrieved from Hunterston A. Seven of these consisted of VFT graphite fuel sleeves retrieved in 1991 and the remaining 21 were trepanned PGA core samples retrieved in 1998.

Generally, the sleeve samples were less pure than moderator samples, with consistently large variations in concentrations for certain elements across the results. Therefore unlike previous (Wylfa and Sizewell A) modelling campaigns, the Hunterston A modelling of fuel sleeves used average and maximum precursor concentrations, as well as minimum, to ensure that the whole range of results was captured.

Since no precursor data was available for Hunterston core graphite, the maximum and average concentrations were taken as the average of the Sizewell and Wylfa precursor concentrations for the equivalent grade of graphite, since both reactors were constructed at a similar date.

Since no specific MCNP modelling of Hunterston A has been undertaken, key input parameters were extrapolated from Wylfa and Sizewell A models. This consisted of neutron flux and energy spectra.

Whilst the neutron energy spectra could be directly taken from the models (previous reports [4,5] have shown that similar positions within Wylfa and Sizewell A reactors have the same energy spectra), it was decided to calculate an average spectrum for each position for the irradiation of the VFT sleeves. The results are presented in Appendix 4.

The Hunterston A neutron flux was also required to calculate activation levels. Technical literature [6] provides detailed comparative data for the different Magnox reactors, in particular, the average thermal fuel rating rate, which is related to the amount of thermal neutron flux in the reactor. Sizewell and Hunterston were built at approximately the same time and to a similar power output, so for the core graphite samples, where fuel channel positions were available, spectra and flux data could be directly imported. However, as no

charge face plan was available from Magnox for Hunterston A reactor 2, some interpolation from Wylfa and Sizewell reactor charge faces was needed and assumptions were made about sample locations. For this reason the predicted inventories should be treated as indicative of core inventories, which is judged sufficient for the purposes of this scalability study and given other uncertainties in sleeve provenance.

Appendix 5 outlines the calculations undertaken to generate a useable neutron flux, scaled from calculations undertaken on Sizewell A and Wylfa, the irradiation duration, and neutron energy spectra. Because there is insufficient data on where the fuel sleeves were positioned within the core, for comparative purposes they were assumed to reside in a mid-position within the fuelled region in the core. This assumption was judged to be reasonable given the large flux fattened zone of the core combined with fuel management strategies to shuffle fuel between high burn up centre of the core and the low burn up edges of the core.

6 IMPACT OF GRAPHITE DEGRADATION AND DENSITY LOSS

Under prolonged intense radiation, as found in a commercial reactor, graphite degrades, resulting in a measurable density loss. This loss is primarily due to oxidation by means of radiolysis of the coolant.

Wylfa is known to have experienced relatively high levels of graphite density loss due to the higher power output and lifetime of the reactor. To investigate the impact of this phenomenon on neutron spectra and activation, MCNP was run to determine how varying the graphite density in the reactor would alter the neutron spectra at different points. One of the objectives of this work was to determine whether density loss needed to be addressed in inventory predictions for a reactor core and for scaling between reactor cores of different density. An investigation was performed to determine how density loss affects the neutron energy spectrum within the graphite samples and the resulting impact on activation. These density loss steps (see Table 2 below) are based on a staggered density loss up to a maximum of 40%.

Density Loss	
Loss	**Density (g/cc)**
0%	1.740
5%	1.653
10%	1.566
15%	1.479
20%	1.392
25%	1.305
30%	1.218
40%	1.044

Table 2: Density loss in graphite

It should be noted that although the loss of density will alter the moderating power of the graphite, the overall neutron flux would be managed by station operators to maintain constant reactor power at required levels. Therefore density loss will not have a significant effect on net neutron flux levels or fission rates and hence activation levels.

7 RESULTS OF ANALYSES

Results from radiochemical analysis for all samples were provided as Bq/g by NPL. Each sample was analysed according to the specification formulated in earlier stages of the work [3,4,5]. The analysis included gamma spectroscopy of all samples and nuclide specific analysis for certain nuclides. Nuclide specific analysis mainly focussed on important mobile nuclides such as C-14, H-3 and Cl-36 but also included 'fuel' nuclides (fissile/alphas) for certain samples. Due to the small sample size available and destructive testing (combustion or dissolution for nuclide specific analysis) it was not possible to do full nuclide specific analysis on all samples.

The results of the active analysis of samples are presented in individual results sheets for each sample in Appendices 6 and 7 of this report. Alongside each active analysis result, the predicted results from the activation model are presented, together with data from the RWI. For each sample the analysis undertaken varied according to the specification provided by Babcock. Some of the tables therefore do not contain data for specific nuclides as they were not measured for that particular sample. These samples are also shown as zero points in the comparison figures shown in the following sections e.g. sample 11 and 18 in Figure 1 below.

All data presented in Appendices 6 & 7 have been decayed (or back decayed for RWI predictions) to the time of sample analysis to enable comparison between laboratory results and those predicted by the FISPACT model, and also to allow comparison with RWI estimates for the relevant ILW waste streams from each station.

The RWI provides only a single average specific activity for each station's ILW graphite and therefore comparison is made with this value back decayed to the time of sample analysis. For long half-life nuclides (e.g. C-14), the result of back decay was not significant, but for shorter half-life nuclides (e.g. Co-60) the decay correction was very large. For Hunterston sleeves, the RWI provides a specific activity for the waste stream and not to individual sleeves. Therefore direct comparisons between the two are difficult.

Direct comparison of moderator analysis results with RWI data does not account for the fact that the samples were taken whilst the reactors were still operating, whereas this is accounted for in FISPACT calculations. This has less of an impact for Sizewell as samples were taken closer to time of station shutdown.

The data provided by the FISPACT model includes predictions across the core volume and into regions of lower than average neutron flux identified by core/brick number (vertically) or channel number (horizontal). The Appendices to this report also contain a brief discussion on each radionuclide and how the active analysis compares to the FISPACT predictions. The sample specific activities of relevant nuclides are also compared to proposed near surface repository (PNSR) or LLWR specific activity limits (but not overall waste stream inventory). The conditions for acceptance for the PNSR (trench or vault) were developed as part of Stage 1 work [3].

It should be noted that the only samples available to this project for analysis were historical material not intended for radiochemical analysis. Although the samples were found to be carefully stored in sealed and labelled plastic bags, the more labile elements could still be affected and there is a risk that the material may have deteriorated during the many years of storage in the sample archive at Berkeley.

The nuclides that were most likely to be lost from the archive samples were H-3 and halides (Cl-36 and I-129) due to the potential for these nuclides to migrate through the sample and desorb from its surface. The usual practice for quantification of H-3 in solids is for samples to be taken carefully and analysed or solubilised as soon as possible after recovery; if storage is required, specialised packaging and refrigeration is often employed. However, H-3 generated in graphite by activation is more tenacious than in some other solids and requires high temperatures for it to be removed (as found in analysis methodologies where high temperature combustion is required to ensure recovery of H-3 for measurement). This tenacity is exhibited in the samples analysed herein as significant inventories were measured in most samples, although less than predicted by FISPACT. The nuclide most likely to be lost is Cl-36 and previous experiences have indicated that the release rate can be very rapid from irradiated graphite with a high surface area to volume [8], not unlike the size of samples available to this study. Therefore the low levels of Cl-36 found in the analysed samples may not be as representative of whole core inventories if these samples behaved similarly whilst in storage at Berkeley.

Previous modelling work undertaken as part of this programme had indicated that the location of the samples near to channel tube wall faces was unlikely to have a significant impact on its neutron activation inventory compared to the bulk of the moderator, and so the samples would be representative of the wider core graphite within the context of wider uncertainties in the activation model. This may not be the case for samples that are affected by mechanisms such as sorption/desorption of nuclides or precursors or contamination from fuel. All samples were found to contain insignificant amounts of the nuclides that would suggest fuel contamination.

7.1 Sizewell A

Tables comparing active analysis undertaken by NPL and the FISPACT modelling undertaken by Babcock can be found in Appendix 6. Summary tables for some important nuclides are also provided in Appendix 6 in Table 25 to Table 28.

Generally where results were above LoD, the modelling of Sizewell A predicted activities within an order of magnitude of NPL results, and quite often within a factor of 2. Results that did not fall within an order of magnitude were probably due to poor inactive precursor data, or because activation is not the only mechanism that influences specific activities for certain nuclides (e.g. mobile nuclides such as Cl-36 and H-3 where other formation, deposition and volatilisation mechanisms can influence both precursor and nuclide behaviour). For example, there is generally good agreement between calculated and measured activities for C-14 and Co-60. However Cl-36 and H-3 are significantly over predicted by the calculations and the RWI (noting previous comments about direct comparison with RWI due to the decay correction and it also not reflecting irradiation/decay history of each sample). The RWI data is also an average figure for the core as compared to the sample specific FISPACT calculation for each sample location. The model predictions of radionuclide concentrations that generally displayed better agreement with analysis results occurred when FISPACT used the NPL/IC measured inactive precursors.

7.2 Wylfa

Tables comparing the active analysis of the Wylfa samples and the FISPACT modelling can be found in Appendix 7. Summary tables for some important nuclides are also provided in Appendix 7 in Table 55 toTable 58.

As was observed for Sizewell A, the FISPACT modeling results and RWI data for Wylfa showed a higher degree of agreement with the active analyses for the less complex

radionuclides (such as Co-60 and C-14) (noting previous comments about direct comparison with RWI).

However, again as with Sizewell A, there are also certain key radionuclides (H-3, Cl-36, Cs-134/137) that show poor agreement between samples and predictions. This was judged mostly likely due to the more complex behaviour of these radionuclides or their precursors. For these nuclides, the laboratory measured levels were generally significantly below RWI and calculated predictions and may indicate sample deterioration during storage.

Unlike Sizewell A, Wylfa active samples have been taken from a much larger axial variation within the same fuel channel (given by the core number down the channel). This allowed meaningful graphs to be drawn up comparing active analysis results and FISPACT predictions for the average and maximum precursor inventories, presented in Figure 1 and Figure 2 for some key radionuclides. Note that where no active data has been analysed a "zero" reading is recorded. Additionally, on Figure 1 (channel 1608/03) the data point for active samples taken from core 9 has recorded an activity of ~60,000 Bq/g, and as a result is partially hidden by the FISPACT data. The core number (or brick number) used in the Figures is the location of the trepanned sample in the fuel channel.

Figure 1 and Figure 2 show that the FISPACT models generally predict activities within an order of magnitude of the active analysis (and quite often within a factor of 2) for some key radionuclides. However, the activities at the extreme edges of the core tend to be under-predicted. This under-estimation of activity at the top and bottom of the core is thought to be due to physical phenomena and structures at the top and bottom of the core that have not been incorporatedin the model.

Generally, the core graphite samples were found to have too high a specific activity for H-3, C-14 and Co-60 (at time of analysis) to be placed in the LLWR, or the "trench" section of a conceptual near surface repository as shown in the Appendices of results comparing specific activity of samples with planned GDF acceptance criteria.

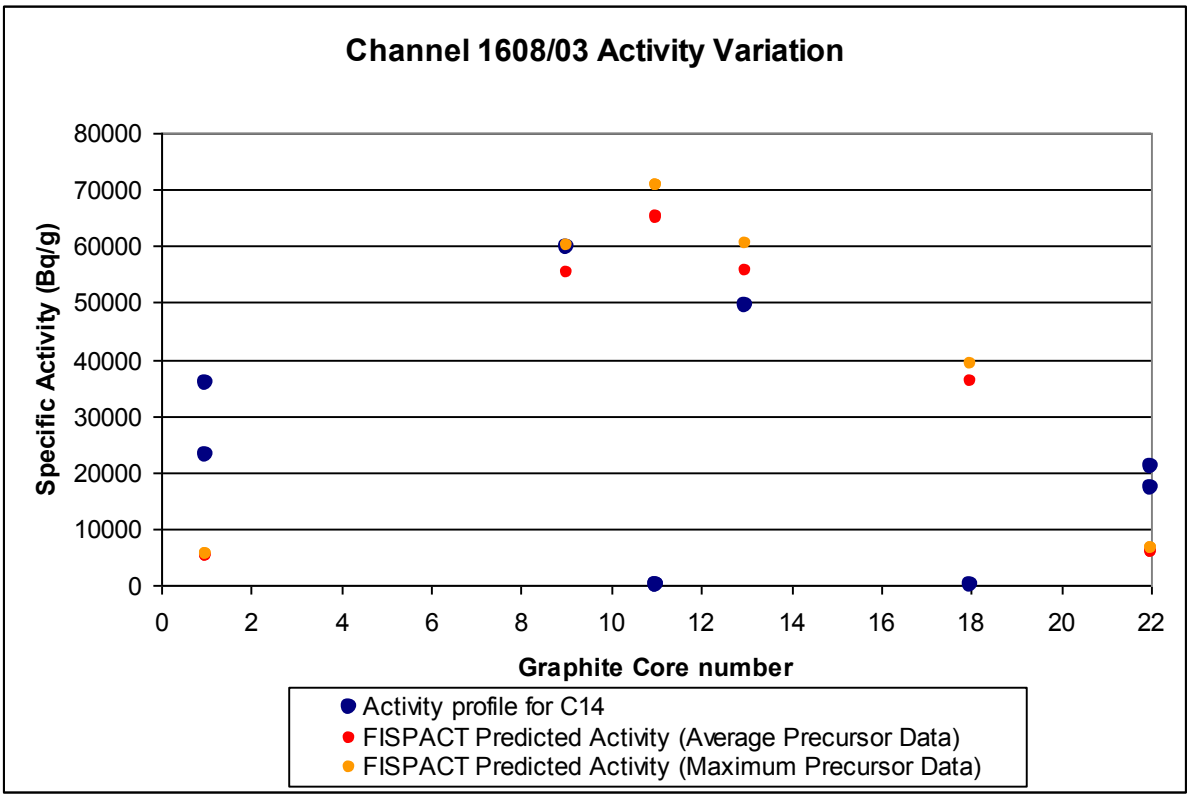

Figure 1: Graph depicting the relationship between active analysis and predicted activity for Channel 1608/03 for C-14

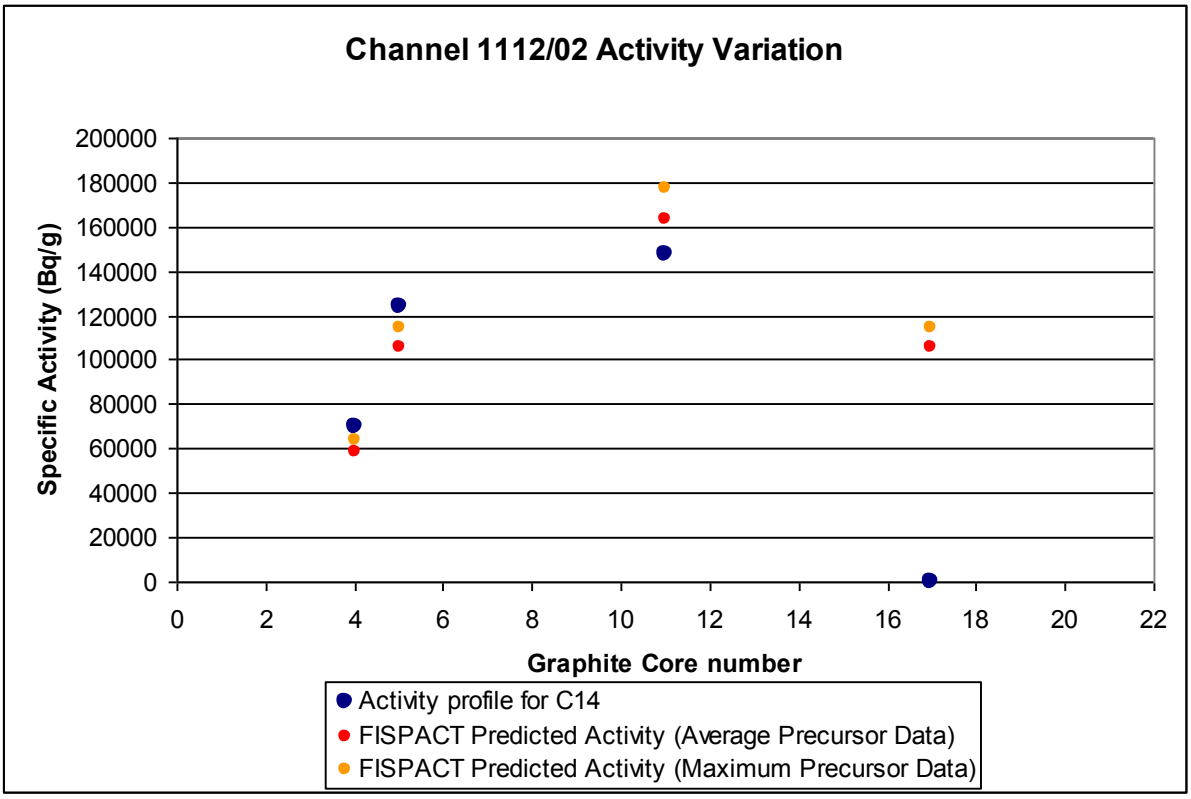

Figure 2: Graph depicting the relationship between active analysis and predicted activity for Channel 1112/02 for C-14

7.3 Hunterston A

Results for Hunterston A modelling are presented in Appendix 8. Summary tables for some important nuclides are also provided in Appendix 8 in Table 87 toTable 90.

As previously discussed, active sleeve samples have all been compared to a point that is midway along the fuelled region in the core, due to insufficient data on the management of the fuel sleeves within the reactor. Samples with IDs IM100287 to IM100306 are Hunterston A graphite sleeves removed in 1991 whilst the remaining samples (IM100307-327) are PGA core graphite removed in 1998. Also, RWI data for the sleeves only provides information on Hunterston silo inventories and not for specific fuel elements. Therefore direct comparison with sample results can only be approximate.

As with Sizewell A and Wylfa, active samples were compared to FISPACT models and results commented upon in detail in Appendix 8. This comparison found that the modelled and active samples typically had a very good (within a factor of two) agreement for C-14 for VFT sleeve sets using NPL/IC inactive precursors (see Figure 3). Samples are labelled in no particular order but grouped purely for comparison with the appropriate code prediction as little sample history or location information was available. A good level of agreement was found for Co-60 analysis of PGA core graphite (see Figure 4).

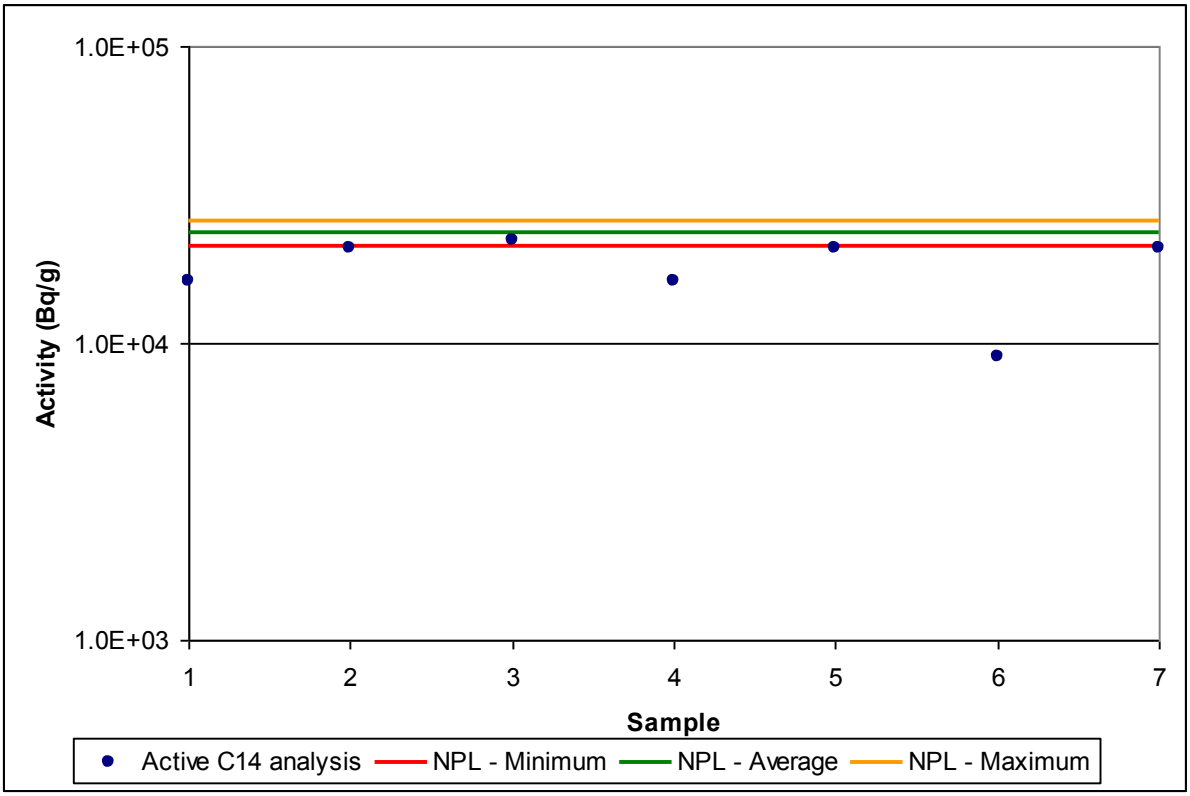

Figure 3: Activity profile for C-14 in fuel sleeves comparing active results to FISPACT

Other radionuclides, which in the Sizewell A and Wylfa studies showed a good level of agreement (Co-60, Ba-133 and Eu-154/155), again showed a good degree of agreement. However, the activity varied significantly for these samples in the modelled scenarios probably due to variation in measured precursor concentrations. For example, active analysis showed Ba-133 activity for sleeve samples varying between ~7 Bq/g up to ~100 Bq/g (see Figure 5). In itself, this is not a cause for concern, as it could be due to local

variations in flux, however when Co-60 activity is also considered, there is little variation in activity (~300 - ~700 Bq/g), which suggests the variation is due to precursor concentrations.

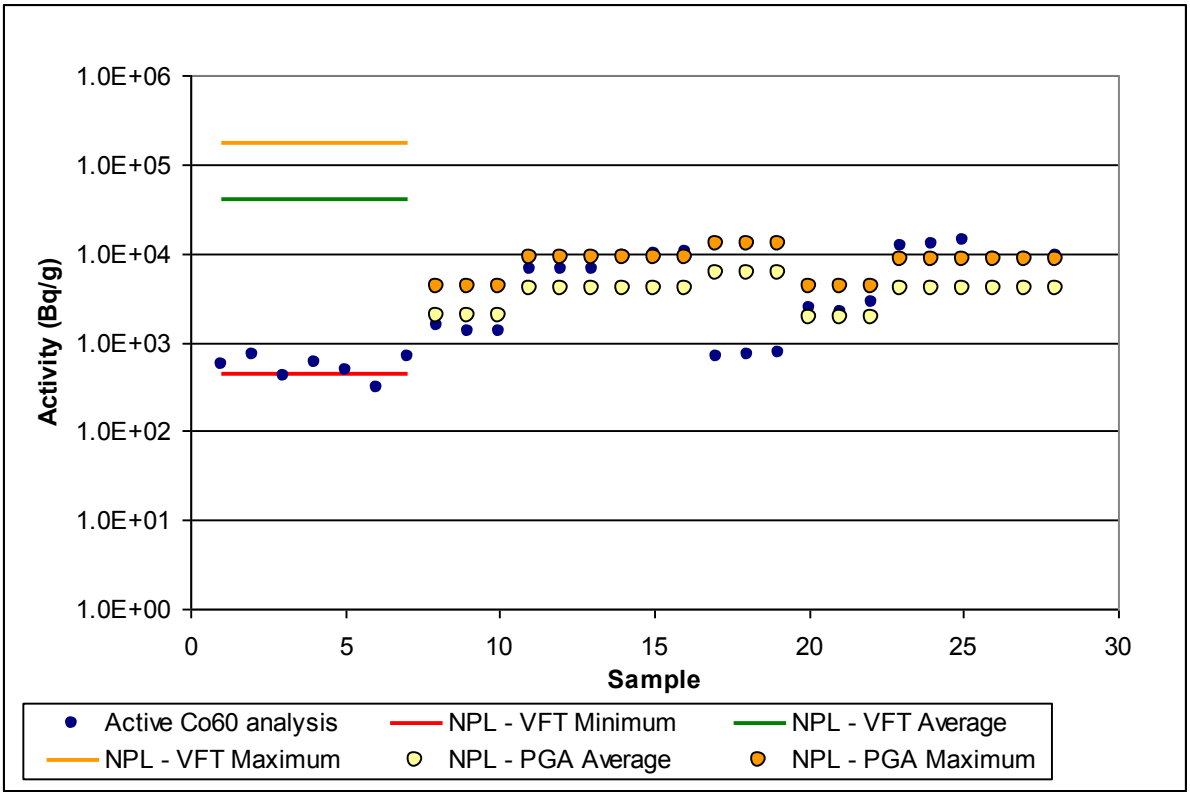

Figure 4: Activity profile for Co-60 comparing active results to FISPACT

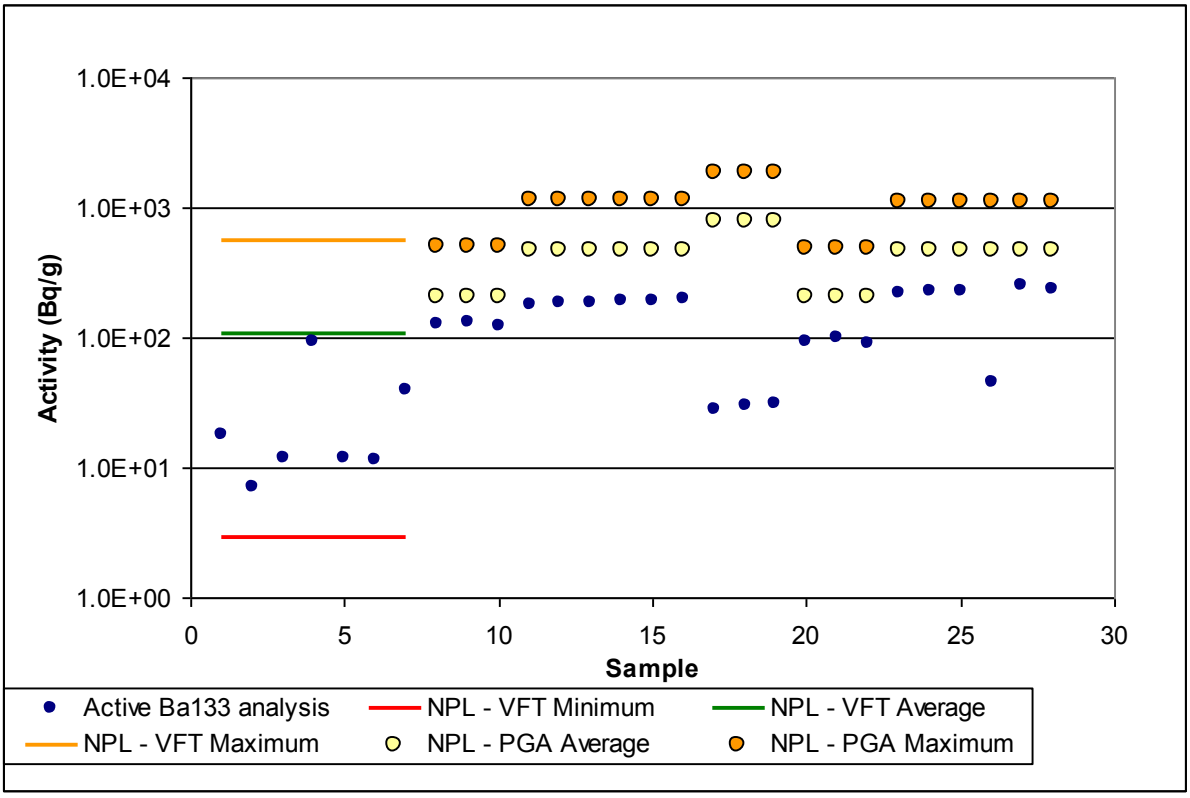

Figure 5: Activity profile for Ba-133 comparing active results to FISPACT

It can also be seen from the active results that H-3 and caesium radionuclides have again been over predicted. As with Wylfa and Sizewell A, this is likely due to volatility and mobility of these radionuclides (and precursors) under core conditions.

During Wylfa and Sizewell A modelling, it was noted that variations in the precursor concentrations resulted in large changes in activity. The PGA graphite here was of relatively high purity compared to VFT graphite used in Hunterston A fuel sleeves. These sleeves had activity variations of as much as three orders of magnitude when using the same flux and energy spectra but different precursor sets (max, min or average). In the case of Co-60 for example, Figure 4 and Table 90 shows a variance of a factor of 400 when using the minimum and maximum precursor concentrations.

7.4 Impact of Graphite Degradation

This section provides a brief discussion on the results of graphite degradation. The quantitative results for the graphite degradation calculations can be found in Appendix 9.

By decreasing the graphite density, the energy spectrum was found to have shifted to a slightly harder spectrum, with neutrons typically existing at a higher energy, as would be expected due to the reduced moderation from less dense graphite. However the neutron flux would remain relatively constant and controlled by operators in order to maintain the reactor at a constant power.

By applying this to calculations based on the centre of Sizewell A for samples removed in 1998, it can be seen that until density losses in excess of 20% were achieved, the actual change in activity (for key radionuclides) was within the error margins reported by NPL (~20%), with the exception of Eu-154 and Eu-155.

A loss in the density of the graphite results in a corresponding decrease in the activation rate of C-14, Co-60 and Ba-133 as well as a decrease in the burn-up rate of Eu-154 and Eu-155 [4]. The mass/density correction of these radionuclides in the carbon matrix increases the activity concentration (Bq/g) of each radionuclide, except C-14 which would be expected to be lost at the same or possibly at a higher rate as the density of C-12. Given that carbon makes up > 99.9% of the mass of a graphite sample, the loss of 25% carbon would reduce the mass of a 1g sample to 0.75g. This in turn results in the activity for all radionuclides (except C-14) to be increased by the reciprocal of this loss when expressed as specific activity.

It is difficult to compare density loss model predictions with active analysis results as density measurements were not carried out on active samples. However it would appear that density loss does not have a significant impact on total inventories compared to other uncertainties, and the most significant impact of density loss is to increase specific activities and to reduce the total mass of graphite requiring disposal.

8 RESULTS OF WHOLE CORE MODELLING AND COMPARISON OF PREDICTIONS WITH RWI

Table 3 and Table 4 list some key nuclides from the 2007 RWI for Sizewell A and Wylfa and compares predictions with those calculated by whole core FISPACT models reported in the whole core modelling part of this project [4]. Three sets of data have been compared to the RWI; calculations based on Jowett precursors, and the maximum and average precursors found by inactive graphite analysis by NPL (not including the more recent IC results reported in this task). Observations and comments are given below relating to some of the more important nuclides. It should be noted that .neither FISPACT or RWI predictions accounted for any mobility of nuclides or their precursors

8.1 Sizewell A – Reactor 1

Nuclide	RWI	Jowett (Bq/m^3)	NPL Max (Bq/m^3)	NPL Average (Bq/m^3)
H3	1.00E+09	3.61E+09	3.53E+09	3.24E+09
C14	1.00E+11	2.23E+11	1.47E+11	1.27E+11
Cl36	3.00E+08	2.99E+08	1.45E+09	1.11E+09
Na22	N/A	0.00E+00	0.00E+00	0.00E+00
Co60	3.00E+04	1.49E+05	8.09E+04	5.40E+04
Kr85	N/A	5.37E+07	7.26E+04	7.25E+04
Nb94	8.00E+05	3.00E+08	4.41E+01	4.72E+02
Ag108m	2.00E+06	2.04E+06	0.00E+00	0.00E+00
Sn121m	2.00E+08	2.22E+05	4.74E+04	4.74E+04
I129	N/A	1.08E+04	1.99E+03	1.99E+03
Cs134	N/A	3.70E-04	5.80E-02	5.80E-02
Ba133	2.00E+05	2.22E+06	1.47E+06	8.19E+05
Cs137	N/A	4.29E+07	5.91E+07	5.89E+07
Pm145	8.00E+04	1.28E+06	8.43E+05	8.43E+05
Eu152	6.00E+03	1.60E+03	1.70E+04	1.70E+04
Eu154	1.00E+05	7.51E+05	3.17E+06	3.17E+06
Eu155	N/A	1.60E+03	3.64E+03	3.65E+03
Ho166m	3.00E+06	1.26E+07	3.62E+03	3.78E+03

Table 3: **Comparison of key radionuclides between the 2007 RWI and FISPACT calculations based on NPL and Jowett precursor information for Sizewell A**

Table 3 compares the existing RWI07 to the analysis carried out using FISPACT on the three sets of elemental precursors for Sizewell A. The FISPACT calculations predict generally higher activities and this is thought to be due to FISPACT using more activation chains, and inclusion of more precursors than the existing RWI calculations considered

Table 3 also shows that there was up to a factor of approximately three difference with RWI predicted H-3 activity, depending on the set of precursors used. Active sample measurement recovered significantly less H-3 than predicted by RWI or FISPACT

It is unknown if RWI07 accounted for regeneration of H-3. H-3 is regenerated through the following pathway:

Li6(n,a)H3(β-)He3(n,p)H3,

which accounts for ~80-85% of activity at end of operational life in core graphite and ~65% of activity at end of operational life in reflector graphite. ;

There is general agreement in C-14 activity predictions. FISPACT calculations utilising the NPL data gave very good agreement with the existing RWI07. Active analysis results point to an under-prediction of C-14 in the RWI but probably within its declared uncertainty bands;

Table 3 shows that there is up to a factor of five difference in Cl-36 activity. The inactive graphite provided for analysis was suspected to have been contaminated with chlorine given higher chlorine precursors compared to Jowett levels. Active measurements recovered substantially less Cl-36 than predicted by RWI or FISPACT;

Table 3 also shows that there is up to a factor of five difference in Co-60 activity and that activity calculations for Co-60 based on analysis for the inactive graphite samples by NPL give better agreement to the RWI than that based on equivalent Jowett calculations.

8.2 Wylfa – Reactor 1

Nuclide	RWI	Jowett (Bq/m^3)	NPL Max (Bq/m^3)	NPL Average (Bq/m^3)
H3	2.00E+09	3.61E+09	2.15E+10	1.19E+10
C14	7.00E+10	2.25E+11	1.48E+11	1.37E+11
Cl36	2.00E+08	2.87E+08	2.23E+09	1.57E+09
Na22	N/A	0.00E+00	0.00E+00	0.00E+00
Co60	3.00E+04	1.76E+05	1.10E+05	7.88E+04
Kr85	N/A	6.79E+07	8.45E+04	8.50E+04
Nb94	2.00E+05	3.01E+08	8.24E+01	6.27E+01
Ag108m	2.00E+06	9.79E+06	4.82E-03	7.04E-03
Sn121m	1.00E+08	2.30E+05	5.02E+04	5.05E+04
I129	N/A	1.17E+04	1.89E+03	1.90E+03
Cs134	N/A	3.72E-06	1.82E-04	1.82E-04
Ba133	1.00E+05	2.51E+06	1.29E+06	5.83E+05
Cs137	N/A	4.61E+07	6.90E+07	6.97E+07
Pm145	7.00E+04	1.27E+06	8.42E+05	8.42E+05
Eu152	2.00E+05	1.58E+04	1.41E+04	1.41E+04
Eu154	3.00E+05	3.36E+06	4.14E+06	4.13E+06
Eu155	N/A	5.19E+03	4.66E+03	4.65E+03
Ho166m	2.00E+06	1.03E+07	4.83E+03	4.95E+03

Table 4: Comparison of key radionuclides between the 2007 RWI and FISPACT calculations based on NPL and John Jowett precursor information for Wylfa

Table 4 compares the existing RWI07 to the analysis carried out using FISPACT on the three sets of elemental precursors for Wylfa. FISPACT predicts generally higher activities than 2007 RWI.

Table 4 shows that there is up to a factor of ten difference in H-3 activity predictions. Utilising NPL precursors, especially the maximum recorded value, H-3 levels are higher. This is due to significantly higher lithium precursor concentrations measured in Wylfa and possibly the inclusion of the pathway to H-3 from He-3. Utilising generic Jowett precursor information, there is only a minor difference between the FISPACT calculated and RWI07 figure for H-3.

Active sample measurement recovered significantly less H-3 than predicted by RWI or FISPACT.

Table 4 also shows that there is up to a factor of three difference in C-14 activity predictions. It is unknown why the values reported in the 2007 RWI for C-14 activity for Wylfa 2007 RWI is slightly less than those reported for Sizewell A. The analysis of the inactive graphite by NPL found that nitrogen (the primary precursor, along with C-13 for C-14 activation) was very similar for all samples analysed in all reactors for all grades (PGA and PGB). FISPACT predicts inventories higher than that reported in the RWI07 but still within its uncertainty bands. Active analysis results of Wylfa samples also indicate a significant under-estimate of the C-14 levels in the RWI compared with measured values.

Table 4 shows that there is up to a factor of ten difference in Cl-36 activity. This is due to the higher Cl-35 levels reported in inactive NPL measurements, and substantiated by IC NAA measurements. Active measurements recovered substantially less Cl-36 than predicted by RWI or FISPACT.

Table 4 shows that there is up to a factor of five difference in Co-60 activity. As seen previously in the Sizewell data,Co-60 activity is lower in the calculations based on inactive graphite precursors measured for this project by NPL than from the Jowett precursors and is more consistent with that reported in RWI07.

9 DISCUSSION AND CONCLUSIONS

The primary objective of this project was to improve confidence or highlight any weaknesses in the derived radionuclide inventory of Magnox core graphite in the RWI. The prime objective of the work described in this report was to test the validity of model predictions for whole cores using samples held in the NDA archive of irradiated graphite. This required laboratory analysis of historic samples for a range of nuclides and then comparison of the results with model predictions for the individual samples, taking into account time of sampling, the location of the sample in the core and the decay time to analysis. Scalability between reactors was also examined as part of this study including the effect of density changes in the moderator between different reactors. Considered against the task objectives and drawing from the results of substantive work on whole core modelling [4], the following conclusions can be drawn from the findings of this study.

- The methodology used to derive the Magnox graphite data in the RWI follows a similar but much simpler scheme to that used in this study. It involves a predicted neutron flux and spectrum being applied to simplified core geometry, and the use of Lotus spread sheet activation calculations to predict nuclide inventories. The findings of this study have indicated that this approach is adequate for most nuclides provided that the input precursor concentrations are satisfactory in terms of completeness and accuracy, and that all important activation pathways are considered with reliable cross sections. The FISPACT code and databases used in this study are an industry standard that are regularly assessed and updated. The lotus spread sheet calculations contain a very limited precursor list with generic concentrations for each element that are applied across the Magnox fleet; the neutron activation pathways and decay schemes are also not as complete as used in FISPACT although may be adequate for RWI purposes.

- The more complex models utilised in this study have indicated that the errors introduced by the relatively simple geometry are within larger errors associated with other aspects of the models input data and treatment of these data. The more important errors are associated with precursor concentrations, the more complex behaviour of some nuclides, and the activation routes included in the model.

- The detailed modelling used in this study of the core flux and spectrum provides a higher resolution over the core, as compared to the scheme used to derive RWI estimates, and indicates the sensitivity of predicted concentration to location within the core and sample locations. Where nuclide concentrations are found to be sensitive to flux over the complete irradiation history of the core, there is predicted to be differences in nuclide concentrations between the flux flattened regions and the extremities of the core where flux is lower, as demonstrated by sample analysis results. However, as the core is designed to have a large flux flattened zone covering most of the core, the uniform flux approach taken to predict the RWI is adequate given that the most important uncertainties are associated with precursor concentration and code treatments of activation processes.

- The agreement between the RWI and MCNP-FISPACT predictions are generally within the uncertainty bands noted in the RWI for nuclides where easy comparisons can be made, as shown in previous whole core calculations and for example by comparison with sample results for C-14. A direct comparison between sample results and the RWI data is difficult as the samples were taken before the stations ceased generating and the RWI provides only an average specific activity for the whole of the graphite waste stream. However the location and timing of sample recovery and analysis is accommodated in the FISPACT calculations and good

agreement is found within uncertainties levels declared in equivalent RWI predictions.

- The FISPACT calculations undertaken result in a greater number of predicted nuclides due to the increased number of precursors included and the larger number of activation pathways included in the code. The new precursor data reported in the Appendices in this report has improved the quality of the data set for some specific elements. The impact of this new data is that earlier measurements for specific elements have been substantiated or improved for some important elements (e.g. Cl and Cs).

- Both FISPACT and RWI models are incapable of accurately describing nuclides that are affected by processes other than activation of bulk graphite. These include important nuclides such as Cl-36 and H-3 where both the concentration of the nuclide and its precursors can be changed by chemical and physical processes over the lifetime of the reactor. This is demonstrated by the poor agreement (greater than an order of magnitude) between the results obtained for these nuclides from samples from all the reactors, whereas reasonable to good agreement was found for less volatile nuclides. For Cl-36 and H-3, which are important nuclides in terms of disposability with respect to near surface (H-3 and Cl-36) and deep repositories (Cl-36), the RWI and FISPACT models significantly overpredict the results obtained from analysis of samples. However, for these relatively mobile nuclides this finding relies on the samples having maintained their inventories while they were in long term storage and there is a significant risk that this may not be the case.

- C-14 inventories are an important factor in disposability options for graphite and also for assessing the feasibility of decontamination procedures. The inventories predicted and measured in this study for C-14 are in reasonable agreement with the RWI and laboratory results. Previous pathway analysis undertaken in this project [4] has indicated that the predicted C-14 was generated by a combination of activation of N-14 and C-13.The route from C-13 was found to be minor to N-14 activation but nevertheless still a significant fraction of the predicted inventory (routes from gas-born precursors, e.g. N_2, were not considered in this study). Most of the decontamination strategies for graphite rely on the preferential removal of C-14 from bulk graphite, mainly based on the assumption that C-14 origination from N-14 or gas borne sources has a different chemistry to bulk graphite. However, the overall efficiency of a process will be constrained by C-14 origination from activation of the bulk graphite C-13 inventory, if present in significant amounts as predicted by pathway analysis in this study.

- Failed fuel cartridges have not had a significant effect on the activity of analysed samples as indicated by very low fission product and uranic/trans-uranic radionuclide concentrations measured. Extrapolation of this finding to all other Magnox reactors would require confirmatory sampling particularly at stations where significant fuel degradation has occurred.

- Graphite density loss was found to have a limited effect on predicted activation levels over a wide range of densities. Therefore scalability of results between reactors should not be significantly affected by this factor. Evidence for scalability between reactors was also found by comparison of scaled predictions with active analysis results of samples from Hunterston A. This assessment could have been improved by better knowledge of sample history and reactor design information.

10 RECOMMENDATIONS

1. As demonstrated from the findings in this report, accurate precursor concentrations are key to the success of activation calculations and inventory estimates. This study recovered a relatively limited number of unirradiated graphite samples for analysis from a restricted number of reactors and during this exercise a significant amount of knowledge was gained in terms of sample analysis strategies and techniques. Consideration should be given to a full reactor fleet sampling plan which covers a fuller set of samples from all reactors (including AGRs) and a statistically larger set of analyses. This would reduce the risk of unexpected or uncertain inventories.

2. Consideration should be given to improving the schemes used to predict the RWI for Magnox core graphite. This could include widening the precursor list and improving the calculation methodology to predict inventories generated by neutron activation. A first step could be to use the precursor data derived in this study within the existing or enhanced Magnox schemes (more cross sections to be included) and then compare with results from FISPACT or equivalent state-of-the-art codes for verification.

3. For some important nuclides (e.g. Cl-36 and H-3 in relation to disposal), the uncertainty introduced by analysis of historic samples is difficult to address. Consideration should be given to retrieval of end-of-life samples for quantification of the more mobile nuclides, mainly Cl-36 and H-3. This would require specialised recovery strategies to obtain larger and deeper samples to avoid deterioration of the sample between station and sub-sampling for analysis at the laboratory and to ensure the sample is representative of the bulk graphite (i.e. not the surface). Care also needs to be taken in recovery, handling and storage. Where new samples are taken from operational stations -potentially Wylfa and AGRs - consideration should be given to retrieval for radiochemical analysis in addition to standard physical/mechanical tests. The number of samples required would not be significant due to the uniform geometry of the core but would need to account for the different thermal and hydraulic condition that different locations have been exposed to.

4. Consideration should be given to determining the split between C-14 generated by various activation routes. This split is an important factor in the success of decontamination strategies. This could be assessed by more detailed activation pathway analysis using FISPACT or a similar code, but it is likely that this is best understood via laboratory trials such as thermal desorption techniques.

5. No significant contamination was observed in this study but consideration should be given to quantifying fuel contamination of graphite in any reactors where significant fuel problems have occurred.

11 REFERENCES

1 NDA Strategy, April 2011

2 The 2007 UK Radioactive Waste Inventory, NDA-RWMD, NDA/RWMD/004, March 2008

3 Graphite Characterisation Stage 1 - Define Characterisation Programme, UKAEA/TSG(09)0532, S. Parry and J. Cox, June 2009

4 Graphite Characterisation Stage 2 – Inactive and Active Graphite Analysis and Graphite Inventory Modelling, Issue 1, UKAEA/TSG(10)0658, A. Lansdell and M. Newland, March 2011

5 Graphite Characterisation Interim Report (Stage 2 – Inactive Analysis and Inventory Modelling), UKAEA/TSG(09)0607, S. Parry and A. Lansdell, December 2009

6 Magnox Fuel Element Data Manual, BNFL, B. Cooke, August 1974

7 Rütgers Group – http://www.ruetgers-group.com/en/home.html

8 Graphite Decommissioning. Options for Graphite Treatment, Recycling, or Disposal, including a discussion of Safety-Related Issues, Electric Power Research Institute, March 2006

APPENDIX 1 – IMPERIAL COLLEGE INACTIVE GRAPHITE ASSESSMENT

Imperial College London

Reactor Centre
Materials Assessment
and Health Physics Group

Customer : Simon Jerome
Organisation : National Physical Laboratory
Samples received : 17th March 2010
Report issued : 23rd March 2010
Our ref. : PL01
Samples analysed as received

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

Customer No. IMP090454 Sizewell			Customer No. IMP090551 Sizewell			Customer No. IMP090601 WYLFA		
MAHPG No. PL0101			MAHPG No. PL0102			MAHPG No. PL0103		
Element	Concentration (mg/kg)	Uncertainty 2 σ (mg/kg)	Element	Concentration (mg/kg)	Uncertainty 2 σ (mg/kg)	Element	Concentration (mg/kg)	Uncertainty 2 σ (mg/kg)
Na	0.20	0.05	Na	0.44	0.07	Na	< 0.27	
Mg	< 8.3		Mg	< 8.9		Mg	< 9.5	
Al	1.3	0.1	Al	1.6	0.1	Al	11	1
Si	< 1200		Si	< 810		Si	< 1300	
S	< 270		S	< 290		S	< 250	
Cl	< 0.45		Cl	0.51	0.13	Cl	2.3	0.3
K	< 5.1		K	< 2.2		K	< 6.0	
Ca	33	5	Ca	32	5	Ca	44	6
Ti	4.8	1.2	Ti	4.8	1.3	Ti	5.2	1.2
V	7.9	0.4	V	8.3	0.4	V	8.8	0.4
Mn	0.009	0.002	Mn	0.011	0.002	Mn	0.11	0.01
Co	< 0.03		Co	< 0.032		Co	< 0.031	
Ni	< 11		Ni	< 8.4		Ni	< 14	
Cu	< 1.6		Cu	< 1.7		Cu	< 1.6	
Zn	< 7.6		Zn	< 4.2		Zn	< 7.7	
Ga	< 0.10		Ga	< 0.047		Ga	< 0.081	
Ge	< 1.4		Ge	< 0.89		Ge	< 1.5	
As	< 0.12		As	< 0.057		As	< 0.14	
Se	< 3.8		Se	< 3.9		Se	< 3.7	
Br	< 0.06		Br	< 0.083		Br	< 0.13	
Rb	< 1.2		Rb	< 1.2		Rb	< 1.2	
Sr	< 0.79		Sr	0.70	0.2	Sr	0.87	0.2
Y	< 0.19		Y	< 0.20		Y	< 0.21	
Nb	< 22		Nb	< 23		Nb	< 22	
Mo	< 2.4		Mo	< 3.0		Mo	< 1.6	
Ru	< 1.4		Ru	< 0.7		Ru	< 1.6	
Rh	< 0.0038		Rh	< 0.0045		Rh	< 0.0035	
Pd	< 0.73		Pd	< 0.50		Pd	< 0.77	
Ag	< 0.68		Ag	< 0.71		Ag	< 0.76	
Cd	< 1.9		Cd	< 1.4		Cd	< 3.3	
In	< 0.00075		In	< 0.00040		In	< 0.0010	
Sn	< 2.8		Sn	< 2.9		Sn	< 2.9	
Sb	< 0.24		Sb	< 0.66		Sb	< 0.26	
Te	< 1.0		Te	< 1.0		Te	< 1.0	
I	< 0.07		I	< 0.071		I	< 0.071	
Cs	< 0.095		Cs	< 0.060		Cs	< 0.11	
Ba	4.5	0.4	Ba	4.6	0.4	Ba	8.0	0.6
La	< 0.19		La	0.12	0.04	La	0.17	0.04
Pr	< 1.0		Pr	< 0.40		Pr	< 0.78	
Nd	< 1.2		Nd	< 1.0		Nd	< 1.2	
Sm	< 0.02		Sm	< 0.014		Sm	< 0.032	

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Eu	0.0019	0.0004	Eu	0.0016	0.0003	Eu	0.0054	0.0005
Gd	< 1.4		Gd	< 1.4		Gd	< 1.3	
Tb	< 2.7		Tb	< 1.7		Tb	< 2.2	
Dy	0.0076	0.001	Dy	0.010	0.001	Dy	0.013	0.001
Ho	< 0.048		Ho	< 0.036		Ho	< 0.040	
Er	< 0.27		Er	< 0.24		Er	< 0.27	
Tm	< 8.0		Tm	< 5.7		Tm	< 8.7	
Yb	< 0.52		Yb	< 0.41		Yb	< 0.74	
Lu	< 0.020		Lu	< 0.014		Lu	< 0.022	
Hf	< 0.72		Hf	< 0.88		Hf	< 0.75	
Ta	< 6.0		Ta	< 6.5		Ta	< 6.5	
W	0.20	0.05	W	0.12	0.05	W	0.069	0.052
Re	< 0.032		Re	< 0.022		Re	< 0.035	
Ir	< 0.035		Ir	< 0.014		Ir	< 0.031	
Pt	< 4.5		Pt	< 2.2		Pt	< 3.6	
Au	< 0.0077		Au	< 0.0069		Au	< 0.0084	
Hg	< 10		Hg	< 8.1		Hg	< 14	
Th	< 1.6		Th	< 1.7		Th	< 2.5	
U	< 0.11		U	< 0.090		U	< 0.070	

Copy no. 1	Name	Signature	Date
Prepared by	S. Kafala		24/3/2010
Checked by	N.M. Baghini		24/3/2010

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Eu	0.0019	0.0004	Eu	0.0016	0.0003	Eu	0.0054	0.0005
Gd	< 1.4		Gd	< 1.4		Gd	< 1.3	
Tb	< 2.7		Tb	< 1.7		Tb	< 2.2	
Dy	0.0076	0.001	Dy	0.010	0.001	Dy	0.013	0.001
Ho	< 0.048		Ho	< 0.036		Ho	< 0.040	
Er	< 0.27		Er	< 0.24		Er	< 0.27	
Tm	< 8.0		Tm	< 5.7		Tm	< 8.7	
Yb	< 0.52		Yb	< 0.41		Yb	< 0.74	
Lu	< 0.020		Lu	< 0.014		Lu	< 0.022	
Hf	< 0.72		Hf	< 0.88		Hf	< 0.75	
Ta	< 6.0		Ta	< 6.5		Ta	< 6.5	
W	0.20	0.05	W	0.12	0.05	W	0.069	0.052
Re	< 0.032		Re	< 0.022		Re	< 0.035	
Ir	< 0.035		Ir	< 0.014		Ir	< 0.031	
Pt	< 4.5		Pt	< 2.2		Pt	< 3.6	
Au	< 0.0077		Au	< 0.0069		Au	< 0.0084	
Hg	< 10		Hg	< 8.1		Hg	< 14	
Th	< 1.6		Th	< 1.7		Th	< 2.5	
U	< 0.11		U	< 0.090		U	< 0.070	

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Prepared by	S. Kafala		24/3/2010
Checked by	N.M. Baghini		24/3/2010

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Eu	<	0.0070		Eu		0.013	0.001	Eu	< 0.0028	
Gd	<	1.5		Gd	<	1.2		Gd	< 0.49	
Tb	<	3.3		Tb	<	2.2		Tb	< 1.2	
Dy	<	0.0023		Dy		0.020	0.001	Dy	0.012	0.005
Ho	<	0.058		Ho	<	0.080		Ho	< 0.040	
Er	<	0.31		Er	<	0.47		Er	< 0.29	
Tm	<	9.2		Tm	<	12		Tm	< 7.4	
Yb	<	1.0		Yb	<	0.74		Yb	< 0.45	
Lu	<	0.024		Lu	<	0.027		Lu	< 0.015	
Hf	<	2.2		Hf	<	1.7		Hf	< 0.71	
Ta	<	6.3		Ta	<	5.5		Ta	< 2.4	
W	<	1.6		W	<	0.081		W	< 0.069	
Re	<	0.13		Re	<	0.043		Re	< 0.052	
Ir	<	0.029		Ir	<	0.044		Ir	< 0.025	
Pt	<	4.7		Pt	<	2.5		Pt	< 1.6	
Au	<	0.0093		Au	<	0.012		Au	< 0.0059	
Hg	<	15		Hg	<	6.8		Hg	< 4.9	
Th	<	1.9		Th	<	0.86		Th	< 0.68	
U	<	0.14		U	<	0.18		U	< 0.090	

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Checked by	N.M. Baghini		24/3/2010

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Reactor Centre
Materials Assessment
and Health Physics Group

Customer : Simon Jerome
Organisation : National Physical Laboratory
Samples received : 17th March 2010
Report issued : 23rd March 2010
Our ref. : PL01
Samples analysed as received

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

Customer no. IMP090676 Sizewell			Customer no. IMP091292 Hinckley "A"			Customer no. IMP091113 Trawsfynydd		
MAHPG No. PL0107			MAHPG No. PL0108			MAHPG No. PL0109		
Element	Concentration (mg/kg)	Uncertainty 2 σ (mg/kg)	Element	Concentration (mg/kg)	Uncertainty 2 σ (mg/kg)	Element	Concentration (mg/kg)	Uncertainty 2 σ (mg/kg)
Na	< 0.44		Na	0.41	0.12	Na	0.44	0.10
Mg	< 11		Mg	< 12		Mg	< 10	
Al	0.76	0.09	Al	0.74	0.09	Al	1.4	0.1
Si	< 1600		Si	< 1600		Si	< 1300	
S	< 320		S	< 300		S	< 260	
Cl	0.42	0.13	Cl	< 0.58	0.13	Cl	1.5	0.2
K	< 5.9		K	< 6.6		K	< 5.7	
Ca	54	7	Ca	37	6	Ca	< 4.1	
Ti	< 4.0	0.6	Ti	< 4.3	0.6	Ti	< 3.3	
V	9.9	0.5	V	14	1	V	9.5	0.4
Mn	0.035	0.003	Mn	0.0054	0.0012	Mn	0.024	0.003
Co	0.044	0.015	Co	< 0.042		Co	< 0.033	
Ni	< 18		Ni	< 14		Ni	< 13	
Cu	< 2.0		Cu	< 2.3		Cu	< 1.7	
Zn	< 8.3		Zn	< 6.4		Zn	< 7.3	
Ga	< 0.085		Ga	< 0.079		Ga	< 0.072	
Ge	< 1.1		Ge	< 1.0		Ge	< 1.0	
As	< 0.15		As	< 0.11		As	< 0.11	
Se	< 4.4		Se	< 4.9		Se	< 3.7	
Br	< 0.061		Br	< 0.095		Br	< 0.051	
Rb	< 1.5		Rb	< 38		Rb	< 1.3	
Sr	0.73	0.24	Sr	0.73	0.2	Sr	0.88	0.23
Y	< 0.25		Y	< 0.29		Y	< 0.22	
Nb	< 28		Nb	< 32		Nb	< 24	
Mo	< 2.9		Mo	< 3.1		Mo	< 2.5	
Ru	< 1.3		Ru	< 1.2		Ru	< 1.3	
Rh	< 0.0075		Rh	< 0.0042		Rh	< 0.0051	
Pd	< 0.85		Pd	< 0.76		Pd	< 0.71	
Ag	< 0.79		Ag	< 1.0		Ag	< 0.67	
Cd	< 1.5		Cd	< 1.8		Cd	< 1.8	
In	< 0.00082		In	< 0.00058		In	< 0.00089	
Sn	< 3.4		Sn	< 3.3		Sn	< 2.9	
Sb	< 0.27		Sb	< 0.23		Sb	< 0.20	
Te	< 1.2		Te	< 1.4		Te	< 1.1	
I	< 0.085		I	< 0.10		I	< 0.079	
Cs	< 0.082		Cs	< 0.088		Cs	< 0.080	
Ba	5.9	0.5	Ba	3.3	0.4	Ba	2.8	0.3
La	< 0.21		La	< 0.17		La	< 0.16	
Pr	< 1.2		Pr	< 1.0		Pr	< 0.86	
Nd	< 1.3		Nd	< 1.7		Nd	< 1.3	

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Sm	0.038	0.01	Sm	0.043	0.01	Sm	< 0.019	
Eu	0.0021	0.0003	Eu	0.0020	0.0003	Eu	0.0029	0.0004
Gd	< 1.7		Gd	< 1.9		Gd	< 1.4	
Tb	< 3.2		Tb	< 1.3		Tb	< 2.5	
Dy	0.0054	0.0008	Dy	0.0037	0.0007	Dy	0.0041	0.0007
Ho	< 0.059		Ho	< 0.055		Ho	< 0.050	
Er	< 0.34		Er	< 0.28		Er	< 0.28	
Tm	< 10		Tm	< 8.6		Tm	< 8.0	
Yb	< 0.72		Yb	< 0.66		Yb	< 0.66	
Lu	< 0.022		Lu	< 0.021		Lu	< 0.019	
Hf	< 1.0		Hf	< 1.9		Hf	< 1.2	
Ta	< 7.7		Ta	< 9.0		Ta	< 6.8	
W	< 0.19		W	< 0.12		W	< 0.15	
Re	< 0.038		Re	< 0.034		Re	< 0.031	
Ir	< 0.028		Ir	< 0.029		Ir	< 0.030	
Pt	< 2.9		Pt	< 4.8		Pt	< 4.4	
Au	< 0.0086		Au	< 0.0088		Au	< 0.010	
Hg	< 8.7		Hg	< 9.7		Hg	< 11	
Th	< 1.7		Th	< 2.3		Th	< 2.4	
U	< 0.10		U	< 0.10		U	< 0.12	

Copy no. 1	Name	Signature	Date
Prepared by	S. Kafala		24/3/2010
Checked by	N.M. Baghini		24/3/2010

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http://www.imperial-consultants.co.uk

APPENDIX 2 – SIZEWELL A, WYLFA AND JOWETT PRECURSOR DATA

For Sizewell A and Wylfa, both average and maximum data are presented in terms of concentration (wt%).

Sizewell A

FISPACT - MAX	
Element	**Conc. wt%**
Al	1.600E-04
B	1.470E-05
Ba	5.900E-04
Be	1.000E-08
Ca	5.400E-03
Ce	1.000E-05
Cl	2.260E-04
Co	4.400E-06
Cs	6.000E-06
Cu	1.700E-05
Dy	1.000E-06
Eu	2.100E-07
Fe	1.930E-04
Gd	1.000E-06
K	2.740E-05
La	1.200E-05
Li	7.300E-06
Mg	2.130E-05
Mn	3.500E-06
Mo	1.120E-05
N	1.330E-03
Na	9.140E-05
Nd	3.000E-06
Ni	6.990E-05
Rb	1.000E-08
Se	1.400E-07
Sm	3.800E-06
Sr	7.300E-05
Te	2.000E-05
Th	1.000E-06
Ti	4.800E-04
U	9.000E-06
V	9.900E-04
W	2.000E-05
Zn	1.290E-05
C	9.999E+01

FISPACT - AVE	
Element	**Conc. wt%**
Al	1.220E-04
B	1.300E-05
Ba	3.243E-04
Be	1.000E-08
Ca	3.546E-03
Ce	1.000E-05
Cl	1.640E-04
Co	1.917E-06
Cs	6.000E-06
Cu	1.355E-05
Dy	7.667E-07
Eu	1.867E-07
Fe	1.800E-04
Gd	1.000E-06
K	2.415E-05
La	1.200E-05
Li	6.700E-06
Mg	1.535E-05
Mn	1.833E-06
Mo	9.250E-06
N	1.220E-03
Na	5.180E-05
Nd	3.000E-06
Ni	6.490E-05
Rb	1.000E-08
Se	1.400E-07
Sm	2.575E-06
Sr	4.573E-05
Te	2.000E-05
Th	1.000E-06
Ti	4.800E-04
U	9.000E-06
V	8.700E-04
W	1.600E-05
Zn	9.400E-06
C	9.999E+01

Wylfa

FISPACT - MAX	
Element	**Conc. wt%**
Al	1.100E-03
B	1.230E-05
Ba	1.300E-03
Be	1.000E-08
Ca	4.500E-03
Ce	9.900E-06
Cl	5.700E-04
Co	3.800E-06
Cs	1.100E-05
Cu	2.950E-05
Dy	2.000E-06
Eu	1.300E-06
Fe	4.460E-04
Gd	1.200E-06
K	3.570E-05
La	2.000E-05
Li	4.320E-05
Mg	3.170E-05
Mn	1.100E-05
Mo	1.340E-05
N	1.300E-03
Na	2.400E-04
Nd	3.000E-06
Ni	3.090E-04
Rb	1.000E-08
Se	5.000E-08
Sm	4.000E-06
Sr	8.700E-05
Te	2.000E-05
Th	1.000E-06
Ti	8.500E-04
U	7.000E-06
V	8.800E-04
W	6.900E-06
Zn	2.150E-05
C	9.999E+01

FISPACT - AVE	
Element	**Conc. wt%**
Al	5.000E-04
B	1.020E-05
Ba	4.662E-04
Be	1.000E-08
Ca	3.278E-03
Ce	9.900E-06
Cl	3.688E-04
Co	1.880E-06
Cs	1.100E-05
Cu	1.340E-05
Dy	1.650E-06
Eu	9.200E-07
Fe	3.707E-04
Gd	1.100E-06
K	2.350E-05
La	1.850E-05
Li	2.387E-05
Mg	2.457E-05
Mn	5.147E-06
Mo	1.217E-05
N	1.113E-03
Na	9.618E-05
Nd	3.000E-06
Ni	1.757E-04
Rb	1.000E-08
Se	5.000E-08
Sm	4.000E-06
Sr	4.672E-05
Te	2.000E-05
Th	1.000E-06
Ti	5.667E-04
U	7.000E-06
V	7.433E-04
W	6.900E-06
Zn	1.233E-05
C	9.999E+01

Jowett

FISPACT - JOW			
Element	**Conc. wt%**	**Element**	**Conc. wt%**
Ag	3.40E-06	**Mn**	7.59E-06
Al	1.60E-04	**Mo**	2.30E-05
Ar	9.99E-03	**N**	2.50E-03
As	9.99E-03	**Na**	1.30E-04
Au	4.99E-05	**Nb**	1.60E-04
B	1.50E-05	**Nd**	1.50E-05
Ba	2.70E-04	**Ne**	1.30E-03
Be	2.70E-06	**Ni**	1.70E-04
Bi	1.10E-05	**O**	9.99E-03
Br	9.99E-03	**Os**	9.99E-06
C	9.99E+01	**P**	9.99E-03
Ca	4.39E-03	**Pb**	3.10E-05
Cd	4.39E-06	**Pd**	9.99E-05
Ce	2.00E-04	**Pr**	1.40E-04
Cl	6.99E-05	**Pt**	4.99E-05
Co	2.50E-06	**Rb**	9.99E-03
Cr	5.19E-05	**Re**	9.99E-06
Cs	1.40E-05	**Rh**	4.19E-06
Cu	3.20E-05	**Ru**	9.99E-06
Dy	9.39E-07	**S**	6.59E-03
Er	6.09E-06	**Sb**	7.79E-06
Eu	4.69E-07	**Sc**	9.99E-05
F	9.99E-03	**Se**	1.40E-04
Fe	9.99E-04	**Si**	4.39E-03
Ga	9.99E-03	**Sm**	4.69E-06
Gd	5.89E-07	**Sn**	5.39E-06
Ge	9.99E-03	**Sr**	5.99E-05
H	9.99E-03	**Ta**	4.89E-06
Hf	6.59E-06	**Tb**	9.49E-05
Hg	1.40E-04	**Te**	2.00E-05
Ho	5.79E-06	**Ti**	5.69E-04
I	3.00E-03	**Tl**	5.99E-03
In	6.99E-06	**Tm**	4.69E-06
Ir	9.99E-06	**V**	2.70E-03
K	3.10E-04	**W**	1.70E-05
Kr	3.30E-04	**Xe**	3.99E-05
La	1.70E-04	**Y**	1.70E-04
Li	7.39E-06	**Yb**	6.29E-05
Lu	4.19E-06	**Zn**	1.70E-05
Mg	2.10E-05	**Zr**	1.70E-04

APPENDIX 3 – HUNTERSTON A GRAPHITE PRECURSOR CONCENTRATIONS

	Hunterston A - Precursor Concentrations (PPB)		
	MIN - PPB	AVE - PPB	MAX - PPB
Ag	5.60E+02	1.13E+03	1.70E+03
Al	3.90E+02	4.91E+03	1.70E+04
As	5.40E+01	5.40E+01	5.40E+01
Au	2.50E+00	2.50E+00	2.50E+00
B	6.60E+01	1.54E+03	3.15E+03
Ba	2.80E+01	1.05E+03	5.50E+03
Be	4.10E-01	2.13E+00	3.84E+00
Br	2.40E+01	2.55E+01	2.70E+01
Ca	1.76E+03	4.78E+04	1.30E+05
Cd	1.00E+02	1.00E+02	1.00E+02
Ce	2.80E+02	2.80E+02	2.80E+02
Cl	2.30E+02	8.71E+02	1.80E+03
Co	1.45E+00	1.38E+02	5.80E+02
Cs	1.30E+02	1.30E+02	1.30E+02
Cu	4.20E+00	1.97E+01	3.74E+01
Dy	4.20E-01	1.38E+01	2.20E+01
Er	7.20E+01	7.20E+01	7.20E+01
Eu	3.60E-01	3.55E+00	7.00E+00
Fe	6.40E+02	6.78E+03	1.85E+04
Ga	2.80E+01	2.80E+01	2.80E+01
Gd	4.20E+00	4.70E+00	5.20E+00
Ge	1.80E+02	1.80E+02	1.80E+02
Hf	2.50E+02	2.50E+02	2.50E+02
Hg	5.90E+02	5.90E+02	5.90E+02
Ho	1.10E+01	1.10E+01	1.10E+01
I	6.40E+00	1.27E+01	1.90E+01
In	1.00E-01	1.00E-01	1.00E-01
Ir	5.70E+00	5.70E+00	5.70E+00
K	1.70E+02	1.01E+03	2.50E+03
La	9.30E+01	1.02E+02	1.10E+02
Li	1.40E+02	1.40E+02	1.40E+02
Lu	4.10E+00	4.10E+00	4.10E+00
Mg	2.10E+01	1.96E+02	6.00E+02
Mn	3.50E+00	1.05E+01	2.20E+01
Mo	6.40E+01	1.48E+02	3.10E+02
N	6.80E+03	8.70E+03	1.04E+04
Na	6.30E+01	1.17E+03	4.00E+03
Nb	1.30E+03	1.30E+03	1.30E+03
Nd	2.10E+00	1.73E+01	2.80E+01
Ni	2.91E+01	5.01E+03	1.00E+04
Pd	5.70E+01	5.70E+01	5.70E+01
Pr	1.10E+02	1.10E+02	1.10E+02
Pt	1.70E+02	1.70E+02	1.70E+02
Rb	1.60E+02	1.60E+02	1.60E+02
Re	6.50E+00	6.50E+00	6.50E+00
Rh	1.40E+00	1.40E+00	1.40E+00
Ru	2.80E+02	2.80E+02	2.80E+02

	Hunterston A - Precursor Concentrations (PPB)		
	MIN - PPB	AVE - PPB	MAX - PPB
S	3.00E+03	6.18E+03	1.15E+04
Sb	6.00E+01	6.00E+01	6.00E+01
Se	1.40E+00	1.40E+00	1.40E+00
Si	6.00E+04	6.00E+04	6.00E+04
Sm	1.70E+00	1.65E+01	3.60E+01
Sn	1.50E+02	1.50E+02	1.50E+02
Sr	2.10E+01	4.13E+02	1.70E+03
Ta	2.70E+02	2.70E+02	2.70E+02
Tb	4.20E+02	4.20E+02	4.20E+02
Te	2.80E+01	2.80E+01	2.80E+01
Th	2.10E+01	5.47E+03	2.18E+04
Ti	2.50E+02	5.82E+03	1.00E+04
Tm	1.50E+03	1.50E+03	1.50E+03
U	8.40E-01	8.40E-01	8.40E-01
V	6.30E+01	4.48E+03	1.60E+04
W	5.60E+01	5.60E+01	5.60E+01
Y	6.80E+00	6.80E+00	6.80E+00
Yb	1.20E+02	1.20E+02	1.20E+02
Zn	2.08E+01	9.62E+01	2.56E+02
C	9.999E+08	9.998E+08	9.997E+08

Table 5: Hunterston A VFT graphite precursors

FISPACT - MAX	
Element	Conc. wt%
Al	1.600E-04
B	1.470E-05
Ba	5.900E-04
Be	1.000E-08
Ca	5.400E-03
Ce	1.000E-05
Cl	2.260E-04
Co	4.400E-06
Cs	6.000E-06
Cu	1.700E-05
Dy	1.000E-06
Eu	2.100E-07
Fe	1.930E-04
Gd	1.000E-06
K	2.740E-05
La	1.200E-05
Li	7.300E-06
Mg	2.130E-05
Mn	3.500E-06
Mo	1.120E-05
N	1.330E-03
Na	9.140E-05
Nd	3.000E-06
Ni	6.990E-05
Rb	1.000E-08
Se	1.400E-07
Sm	3.800E-06
Sr	7.300E-05
Te	2.000E-05
Th	1.000E-06
Ti	4.800E-04
U	9.000E-06
V	9.900E-04
W	2.000E-05
Zn	1.290E-05
C	9.999E+01

FISPACT - AVE	
Element	Conc. wt%
Al	1.220E-04
B	1.300E-05
Ba	3.243E-04
Be	1.000E-08
Ca	3.546E-03
Ce	1.000E-05
Cl	1.640E-04
Co	1.917E-06
Cs	6.000E-06
Cu	1.355E-05
Dy	7.667E-07
Eu	1.867E-07
Fe	1.800E-04
Gd	1.000E-06
K	2.415E-05
La	1.200E-05
Li	6.700E-06
Mg	1.535E-05
Mn	1.833E-06
Mo	9.250E-06
N	1.220E-03
Na	5.180E-05
Nd	3.000E-06
Ni	6.490E-05
Rb	1.000E-08
Se	1.400E-07
Sm	2.575E-06
Sr	4.573E-05
Te	2.000E-05
Th	1.000E-06
Ti	4.800E-04
U	9.000E-06
V	8.700E-04
W	1.600E-05
Zn	9.400E-06
C	9.999E+01

Table 6: Hunterston A PGA graphite precursors

Note:

Since no precursor data was available for Hunterston core graphite, the maximum and average concentrations were taken as the average of the Sizewell and Wylfa precursor concentrations for the equivalent grade of graphite, since both reactors were constructed at a similar date.

APPENDIX 4 – FLUX MULTIPLICATION FACTOR CALCULATIONS FOR HUNTERSTON

To model a reactor, MCNP requires as an input the flux conversion factor for the reactor[2]. As this data was not available from historical records for Hunterston A it was estimated using the flux per unit of thermal fuel ratings calculated for Wylfa and Sizewell A [4],

		MCNP Base Fluence Probability Factor (n/cm2/neutrons in reactor)	Max Thermal Power MWh(th)	Flux at Full power (n/cm2/s)	Thermal Fuel Rating (MW/te)	Flux per MW/te
Centre	Sizewell	1.53E-06	800	9.18E+13	2.5	3.67E+13
	Wylfa	8.91E-07	1650	1.10E+14	2.8	3.93E+13
	Hunterston	***2.03E-06***	***525***	**7.98E+13**	***2.1***	***3.80E+13***
Halfway	Sizewell	1.15E-06	800	6.89E+13	2.5	2.76E+13
	Wylfa	6.13E-07	1650	7.56E+13	2.8	2.70E+13
	Hunterston	***1.46E-06***	***525***	**5.73E+13**	***2.1***	***2.73E+13***
Edge	Sizewell	3.51E-07	800	2.10E+13	2.5	8.40E+12
	Wylfa	1.55E-07	1650	1.91E+13	2.8	6.83E+12
	Hunterston	***4.07E-07***	***525***	**1.60E+13**	***2.1***	***7.61E+12***
Top	Sizewell	2.82E-07	800	1.69E+13	2.5	6.75E+12
	Wylfa	1.51E-07	1650	1.86E+13	2.8	6.66E+12
	Hunterston	***3.59E-07***	***525***	**1.41E+13**	***2.1***	***6.71E+12***
Bottom	Sizewell	3.18E-07	800	1.90E+13	2.5	7.60E+12
	Wylfa	1.59E-07	1650	1.96E+13	2.8	6.98E+12
	Hunterston	***3.90E-07***	***525***	**1.53E+13**	***2.1***	***7.29E+12***
Neutron Multiplier		7.48E+16	n/s/MWh(th)			

Table 7: Demonstration of calculations undertaken to generate Hunterston A flux

Table 7 outlines the information used to calculate the base fluence probability factor for five points within the Hunterston A reactor;

- Centre of the core;
- Halfway along the fueled region of the core radially;
- Edge of the fueled core region radially;
- Near top of the fueled core region;
- Near bottom of the fueled core region.

These positions were chosen as being representative of the positions for fuel elements in the reactor.

The calculations used the MCNP results (base fluence multiplication factor) for Wylfa and Sizewell and multiplied these values by the maximum thermal power output and neutron multiplication factor (the number of fission neutrons generated by 1 MW of thermal power) to give the flux at full power.

[2] The number that when multiplied by the thermal power output of the reactor and neutrons generated per unit thermal energy, gives the neutron flux at a certain position.

This result was then divided by the average thermal power rating for the fuel (reactor power divided by fuel mass) from technical literature [6](Appendix 5a) to generate a flux per unit of thermal fuel rating (last column of Table 7). An average of these results for Wylfa and Sizewell (which are very similar) was then taken, and the calculations reversed to find the base fluence probability factor for Hunterston A.

Considering Table 7, for each position, the calculations run from left to right for the Sizewell A and Hunterston lines, in order to determine the flux per unit of thermal fuel rating for these reactors. The average of these thermal fuel ratings was then used to perform the calculation in reverse (right to left in Table 7) for Hunterston.

Given that Magnox fuel is typically rated for a total burn-up of 5,000 MWd/te, it is possible to divide this number by the average burn-up recorded in the literature [6] to calculate the average irradiation duration, as shown in Table 8, below.

Average Fuel Burn-up	2.1	MW/te
Magnox Fuel Burn-up rating	5,000	MWd/te
Irradiation Duration (days)	2381	Days
Irradiation Duration (years)	6.52	Years

Table 8: Calculation of irradiation duration for Hunterston A

This results in approximately six and a half years of irradiation for the average fuel element.

Experience with Sizewell A and Wylfa reactors suggested that each ran at a lifetime average of 75% total thermal load and this corresponds to an average thermal load of 394 MW(th) on a single Hunterston A reactor.

This can be combined with the base fluence multiplication probability calculated previously (Table 7) to generate a total neutron flux at these positions within the reactor, as detailed in Table 9.

	Core Position	Base FMP (n/cm-2/neutrons in reactor)	Average Thermal Power (MWh(th))	Neutron Multiplication value (neutrons in reactor/s/MWh(th))	Neutron Flux (n/cm2/s)
Hunterston A	Centre	2.03E-06	393.75	7.48E+16	5.98E+13
	Halfway in fueled	1.46E-06	393.75	7.48E+16	4.30E+13
	Edge of fueled	4.07E-07	393.75	7.48E+16	1.20E+13
	Top (centre)	3.59E-07	393.75	7.48E+16	1.06E+13
	Bottom (centre)	3.90E-07	393.75	7.48E+16	1.15E+13

Table 9: Calculation of total flux for different positions within Hunterston A

APPENDIX 5 – AVERAGE ENERGY SPECTRA CALCULATIONS

To ensure a representative neutron energy spectra was utilised for the Hunterston calculations, an average was calculated using Sizewell A and Wylfa data.

Spectra were calculated at each of the five positions mentioned previously (Appendix 4) to ensure a representative set of samples were taken. The spectra are presented in Figure 6 to Figure 10.

It can be seen that the energy spectra at similar positions (e.g. the spectra at the centre of the reactor) are very similar between reactors in all cases, with the exception of the top of the reactor where Sizewell A has a much higher thermal neutron bias compared to Wylfa.

As a result, it is considered likely that Hunterston A spectra will be very similar to the spectra for Sizewell A and Wylfa, due to these reactors all having a similar power density and design.

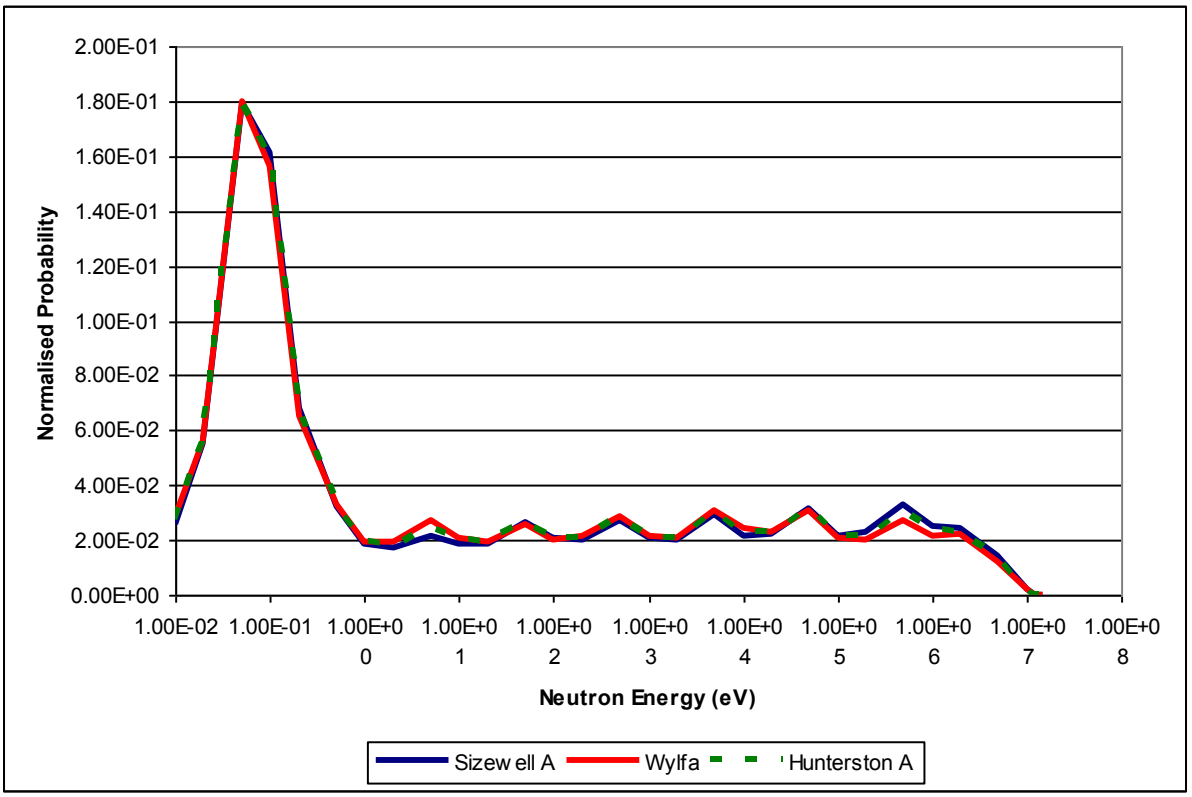

Figure 6: Neutron energy spectra at the centre of the reactor

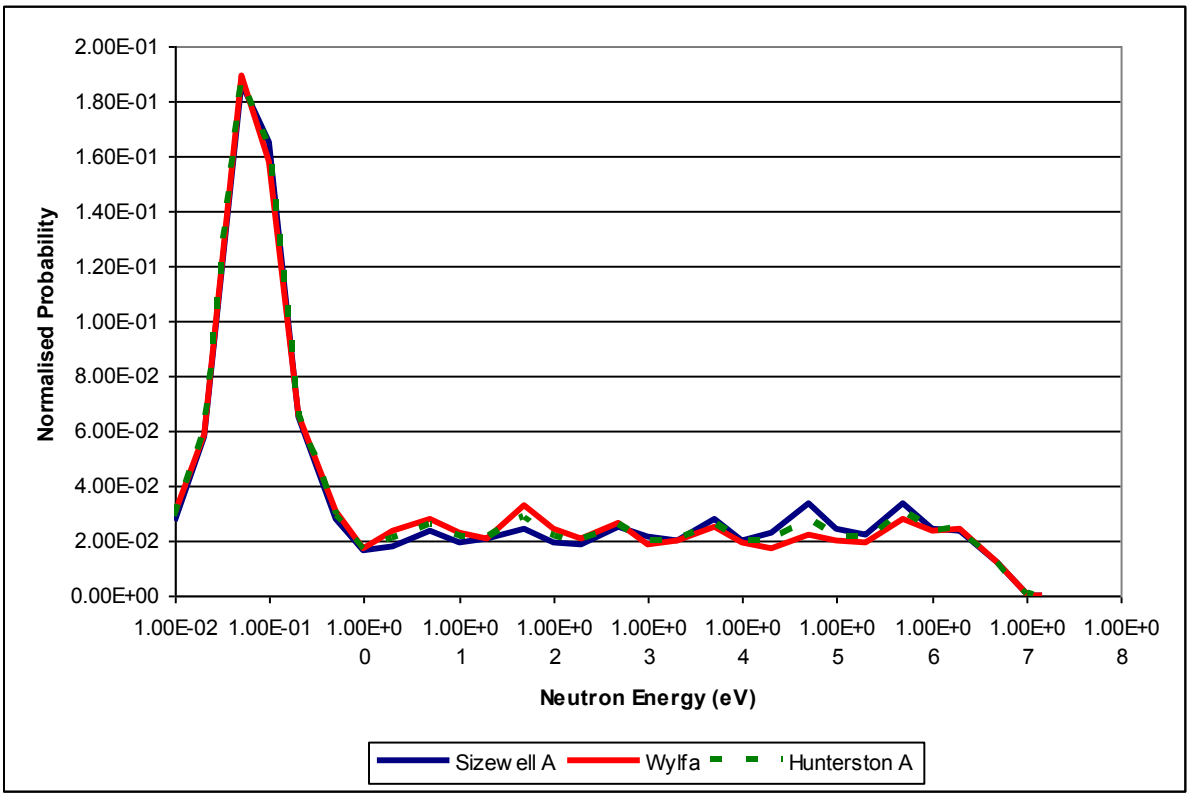

Figure 7: Neutron energy spectra at halfway along the fuelled region of the reactor

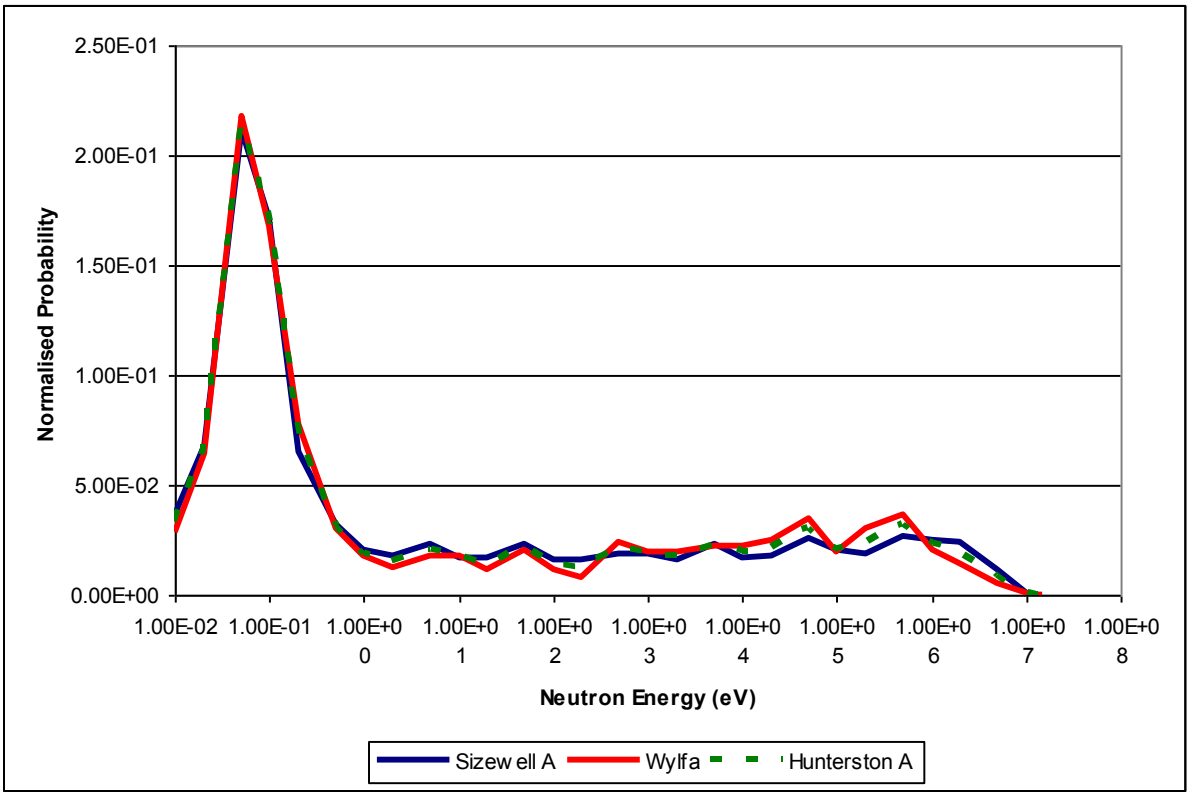

Figure 8: Neutron energy spectra at the edge of the fuelled region in the reactor

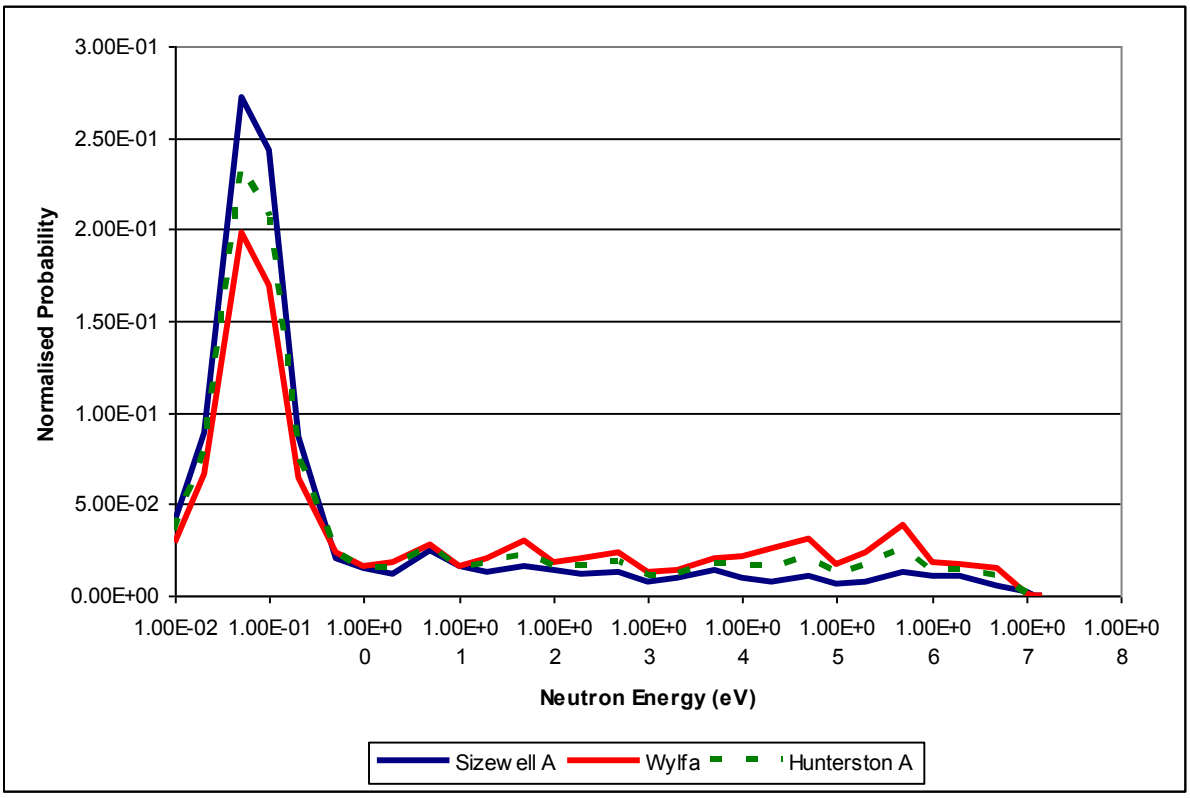

Figure 9: Neutron energy spectra at the top of the fuelled region in the reactor

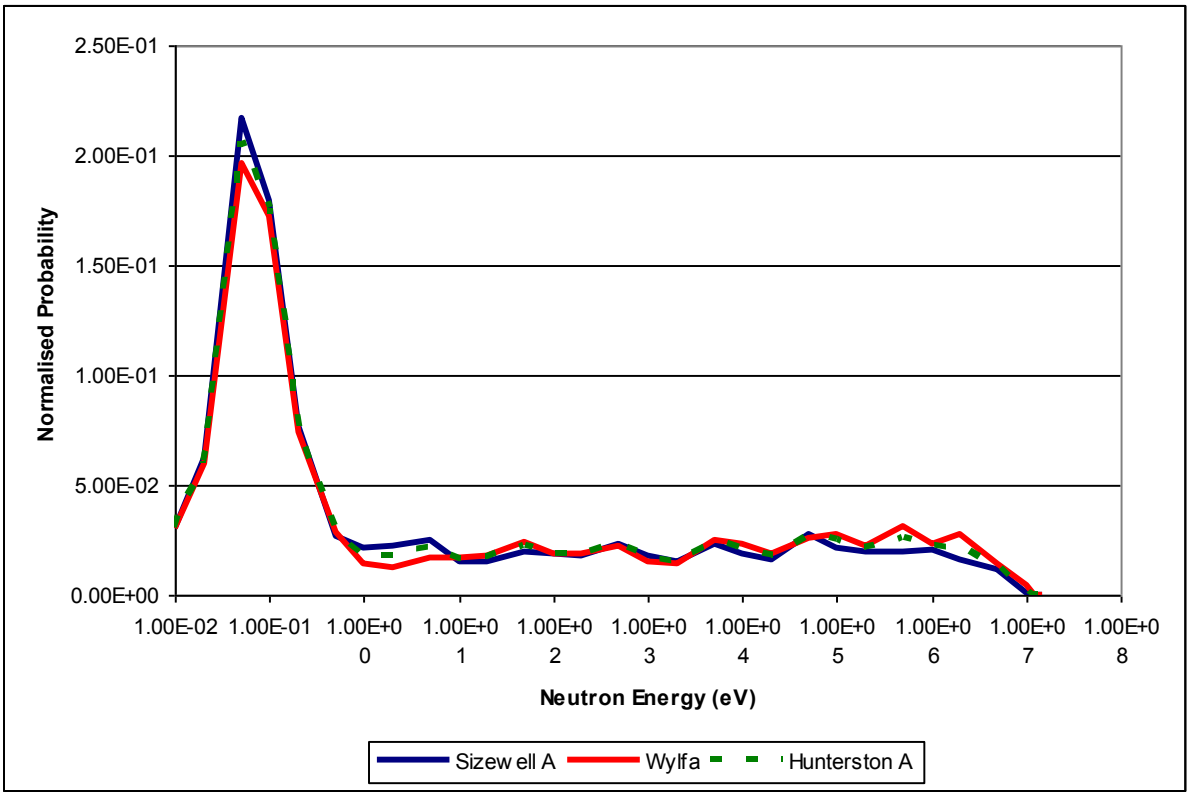

Figure 10: Neutron energy spectra at the bottom of the fuelled region in the reactor

APPENDIX 5A – COMPARATIVE MAGNOX THERMAL FUEL RATINGS

AVERAGE RATINGS AND OUTPUT

(Obtained from various reports or by calculations)

For the current reduced power levels corresponding to a bulk gas outlet temperature of approximately 360°C

NOMINAL REACTOR THERMAL FUEL RATINGS			NOMINAL THERMAL OUTPUTS			NOMINAL STATION OUTPUT		STATION
REACTOR MEAN MW/Te	MEAN CENTRE CHANNEL MW/Te	MAX IN CENTRE CHANNEL MW/Te	CENTRE CHANNEL FUEL KW	TOTAL CENTRE CHANNEL KW	REACTOR MW	THER-MAL MW	NET ELECTRICAL MW (SO)	
2.4	3.6	4.7	195	205	265	1060	200	Calder and Chapelcross (Pippa)
2.0	2.6	3.6	225	240	480	960	230	Bradwell
2.6	3.2	4.7	210	225	590	1180	265	Berkeley
2.1	2.3	3.7	165	175	525	1050	280	Hunterston
2.5	3.1	3.8	225	240	870	1740	425	Hinkley Pt
~~2.7~~ 3.1	3.3	5.0	240	255	860	1720	390	Trawsfynydd
~~2.3~~ 2.4	3.8	4.8	270	290	720	1440	410	Dungeness
2.5	3.0	4.1	240	255	800	1600	420	Sizewell
2.5	2.7	4.2	220	235	730	1460	415	Oldbury
2.8	2.9	3.9	255	270	1650	3300	900	Wylfa
2.4	2.7	4.2	230	245	635	635	160*	Latina
2.3	3.2	4.9	270	285	530	530	140*	Tokai-Mura

*Obtained from monthly reports.

Net electrical generation of 200 MW at Calder includes an export of approx 4MW to Windscale. In addition from 4-12 MW of steam is exported to Windscale.

Due to the complex operating conditions at Calder and Chapelcross one channel has been chosen to represent a typical centre channel.

APPENDIX 6 – STAGE 2 ACTIVE PHASE RESULTS - SIZEWELL A

Results are presented in tabular formats below in Table 10 to Table 24. Each table of results presents NPL active results (Bq/g), including an error (where the active analysis was higher than the LoD, presented as +/- xx Bq/g) and compares this value to FISPACT analysis and the RWI-2007 (which has been back decayed). Additionally, it compares this result to the specific activity trigger limits for LLWR and the proposed near surface repository limits for the vault and trench [4].

For comparative purposes, cells within the table are highlighted with a specific colour coding methodology described below.

123	Specific activity limit is greater than NPL active analysis
123	Specific activity limit is less than NPL active analysis (trigger breached)
123	Given activity is within one high accuracy level of NPL Active results
123	Given activity is within one low accuracy level of NPL Active results
123	Given activity is greater than one accuracy level of NPL Active results
123	Given activity is greater than LoD value for active analysis
123	Stated result is a LoD value or zero

Figure 11: Key to colour coded results tables

Figure 11 gives the key to the colour coded results tables displayed in Appendices 6, 7 and 8.

These tables describe how the NPL active results compare to repository trigger limits, the RWI 2007 (back decayed to present) and FISPACT.

- Green highlighted cells have a repository trigger limit greater than the NPL analysed specific activity (in Bq/g);
- Orange highlighted cells have a repository trigger limit that is less than the NPL analysed specific activity (Bq/g);
- Yellow highlighted cells have a modelled (FISPACT/RWI-2007) activity that is within 1 high accuracy level[3] of the NPL analysed specific activity (Bq/g);
- Pink highlighted cells have a modelled (FISPACT/RWI-2007) activity that is within 1 low accuracy level of the NPL analysed specific activity (Bq/g);
- Blue highlighted cells have a modelled (FISPACT/RWI-2007) activity that is greater than 1 low accuracy level of the NPL analysed specific activity (Bq/g);
- Purple highlighted cells indicate that the inventory predicted by modelling or the RWI2007 are greater (Noting previous comments about comparisons of sample results with RWI data.) than the active analysis LoD value (e.g. active analysis returns LoD of < 7 and FISPACT predicts 25 Bq/g);
- Non highlighted cells with greyed out text have either not reached their limit of detection (in the case of NPL results), or have no activity/trigger limit associated with that radionuclide.

[3] Accuracy levels are user defined in the results spreadsheets that are related to this report. In the case of this report, a “high” accuracy level is a factor of 2 (e.g. between half and twice the NPL activity) and a “low” accuracy is a factor of 10 (e.g. an order of magnitude).

In this case, the “high accuracy” level (yellow highlight) are those results within a factor of two of the NPL active analysis, and the “low accuracy” are those within an order of magnitude (factor of 10).

Results

ID	IMP100272									
Year Removed	1998	Core	8							
Channel	1644/10	Slice	Unknown (1)							
	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	PNSR - Trench	PNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	770 ± 260	408600	367500	400100	166883	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	150000 ± 8000	265900	170300	178500	80925	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	80 ± 60	384	883	1217	240	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 12	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	11800 ± 2600	21190	15010	33500	6408	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 1.4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 3	406	6.E-05	8.E-05	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 2.3	9	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 30	2	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 7	19	3	3	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 3	5.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 17	2.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1790 ± 380	1045	1255	2284	85	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	27 ± 8	1938	846	858	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	43 ± 12	403	2033	2033	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 7	2.E-02	9.E-03	1.E-02	1	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	250 ± 60	328	191	256	169	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	113 ± 28	162	94	129	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 2.1	14	9.E-02	1.E-01	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 7	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 50	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 2.4	0	16	16	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 16	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 15	0	7.E-02	7.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 3	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 50	0	7.E-04	7.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	18	18	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	6	6	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	457	457	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 10: Comparison data for NPL sample IM100272

ID	IMP100273		
Year Removed	1998	Core	8
Channel	1644/10	Slice	Unknown (2)

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	PNSR - Trench	PNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	4900 ± 1600	408500	367500	400100	166883	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	101800 ± 5000	265000	169700	177900	80925	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	70 ± 60	384	882	1215	240	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 8	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	6500 ± 1400	21160	15000	33480	6408	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 1.1	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 2.4	405	6.E-05	7.E-05	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 2.0	9	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 30	2	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 6	19	3	3	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 2.4	5.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 16	2.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1850 ± 380	1043	1253	2279	85	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	27 ± 8	1941	847	859	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	43 ± 12	402	2028	2028	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 6	2.E-02	9.E-03	1.E-02	1	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	270 ± 60	330	192	257	169	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	118 ± 28	163	94	129	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.9	14	9.E-02	1.E-01	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 5	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 40	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 2.3	0	16	16	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 14	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 14	0	7.E-02	7.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 2.4	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 40	0	7.E-04	7.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	18	18	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	6	6	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	457	457	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 11: Comparison data for NPL sample IM100273

ID	IMP100274		
Year Removed	1998	Core	4
Channel	1644/10	Slice	(1) or 2

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	PNSR - Trench	PNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	480 ± 160	401300	362500	394900	166883	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	68600 ± 4400	168000	107000	112300	80925	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	22 ± 16	305	706	973	240	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 3	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	5000 ± 1200	16380	12120	27480	6408	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 0.6	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 1.1	250	3.E-05	4.E-05	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 0.9	11	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 13	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 2.5	8	2	2	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 1.2	1.E-08	1.E-02	1.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 7	7.E-03	2.E-03	2.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1040 ± 220	699	840	1528	85	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	23 ± 6	2032	879	885	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	58 ± 14	254	1186	1186	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 3	4.E-02	2.E-02	3.E-02	1	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	228 ± 50	765	429	613	169	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	92 ± 22	337	189	271	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 0.9	7	2.E-01	3.E-01	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 2.4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 15	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 16	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1.4	0	17	17	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 0.7	0	2	2	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 6	0	2.E-02	2.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 1.1	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 17	0	9.E-04	9.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	24	24	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	447	447	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 12: Comparison data for NPL sample IM100274

ID	IMP100275		
Year Removed	1998	Core	14
Channel	1644/10	Slice	(1) or 2

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	PNSR - Trench	PNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	not required	408700	368300	400900	166883	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	not required	216900	138800	145500	80925	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	not required	350	808	1113	240	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 5	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	7100 ± 1600	19230	13940	31390	6408	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 5	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 7	336	6.E-05	8.E-05	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 5	9	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 60	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 14	17	3	3	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 6	4.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 40	1.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1080 ± 240	897	1077	1959	85	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	16 ± 6	2050	896	906	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	64 ± 16	327	1935	1935	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 14	2.E-02	1.E-02	2.E-02	1	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	440 ± 100	445	261	358	169	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	186 ± 44	206	120	167	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 4	13	1.E-01	2.E-01	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 13	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 70	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 90	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 4	0	20	20	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 4	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 25	0	7.E-02	7.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	< 0.13	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	< 0.13	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 5	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	< 0.19	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 80	0	7.E-04	7.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	< 2.2	0	25	25	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	< 0.97	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	< 0.97	0	6	6	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	32.7 ± 3.2	0	543	543	0	7.0E+03	7.0E+03	1.0E+17	9.0E+01	3.0E+11

Table 13: Comparison data for NPL sample IM100275

ID	IMP100276		
Year Removed	1998	Core	14
Channel	1644/10	Slice	1 or (2)

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	PNSR - Trench	PNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	not required	408600	368300	400900	166883	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	not required	216300	138400	145100	80925	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	not required	350	807	1112	240	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 16	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	14600 ± 3400	19200	13930	31350	6408	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 8	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 9	336	6.E-05	8.E-05	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 7	9	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 80	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	19 ± 12	17	3	3	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 9	4.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 40	1.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	990 ± 220	895	1075	1955	85	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	15 ± 6	2052	897	906	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	63 ± 18	326	1930	1930	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 19	2.E-02	1.E-02	2.E-02	1	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	400 ± 100	447	262	359	169	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	167 ± 46	207	120	167	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 5	13	1.E-01	2.E-01	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 18	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 90	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 110	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 7	0	20	20	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 4	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 40	0	7.E-02	7.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	< 0.079	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	< 0.079	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 6	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	< 0.096	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 100	0	7.E-04	7.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	3.25 ± 0.40	0	25	25	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	1.68 ± 0.24	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	1.68 ± 0.24	0	6	6	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	41.4 ± 3.8	0	543	543	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 14: Comparison data for NPL sample IM100276

ID	IMP100277		
Year Removed	1998	Core	4
Channel	1644/CR	Slice	(1) or 2

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	PNSR - Trench	PNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	64000 ± 22000	401100	362400	394700	166883	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	85000 ± 4200	165700	105600	110800	80925	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	3.8 ± 3.2	302	700	965	240	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 7	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	7500 ± 1600	16250	12030	27280	6408	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 1.5	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 3	247	3.E-05	4.E-05	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 2.1	12	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 30	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 6	8	2	2	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 3	1.E-08	1.E-02	1.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 16	7.E-03	2.E-03	2.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1140 ± 240	692	831	1511	85	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	21.2 ± 5.0	2028	877	883	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	32 ± 10	250	1171	1171	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 7	4.E-02	2.E-02	3.E-02	1	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	310 ± 80	784	439	628	169	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	129 ± 30	343	192	276	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.9	7	2.E-01	3.E-01	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 6	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 40	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1.9	0	17	17	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 1.5	0	2	2	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 13	0	2.E-02	2.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 2.4	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 40	0	9.E-04	9.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	24	24	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	447	447	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 15: Comparison data for NPL sample IM100277

ID	IMP100278		
Year Removed	1998	Core	4
Channel	1644/CR	Slice	1 or (2)

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	PNSR - Trench	PNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	16000 ± 6000	401200	362400	394800	166883	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	77600 ± 3800	166700	106300	111500	80925	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	2.5 ± 2.2	303	703	968	240	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 7	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	6500 ± 1400	16310	12070	27380	6408	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 1.4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 2.4	248	3.E-05	4.E-05	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 1.9	12	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 30	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 6	8	2	2	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 2.4	1.E-08	1.E-02	1.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 15	7.E-03	2.E-03	2.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1140 ± 240	695	835	1519	85	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	19 ± 6	2030	878	884	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	31 ± 10	252	1178	1178	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 6	4.E-02	2.E-02	3.E-02	1	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	320 ± 80	775	434	621	169	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	132 ± 32	340	191	274	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.8	7	2.E-01	3.E-01	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 6	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 40	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1.8	0	17	17	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 1.4	0	2	2	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 13	0	2.E-02	2.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 2.3	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 40	0	9.E-04	9.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	24	24	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	447	447	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 16: Comparison data for NPL sample IM100278

ID	IMP100279		
Year Removed	1998	Core	14
Channel	1644/CR	Slice	(1) or 2

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	PNSR - Trench	PNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	not required	405100	397800	365200	166883	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	not required	214900	144100	137500	80925	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	not required	349	1108	804	240	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 3	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	8600 ± 1800	19100	31210	13860	6408	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 2.0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 4	344	6.E-05	5.E-05	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 2.4	10	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 30	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 7	14	3	3	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 4	4.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 16	1.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	860 ± 180	894	1954	1074	85	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	16 ± 6	2057	904	895	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	49 ± 14	324	1692	1692	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 8	3.E-02	2.E-02	1.E-02	1	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	108 ± 26	478	379	274	169	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	44 ± 14	216	174	124	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 2.1	11	2.E-01	1.E-01	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 7	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 50	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 2.2	0	18	18	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 1.6	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 15	0	4.E-02	4.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	< 0.068	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	< 0.068	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 3	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	< 0.084	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 50	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	< 21	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	35 ± 6	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	35 ± 6	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	67 ± 8	0	487	487	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 17: Comparison data for NPL sample IM100279

ID	IMP100280		
Year Removed	1998	Core	14
Channel	1644/CR	Slice	1 or (2)

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	PNSR - Trench	PNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	not required	405200	365300	397800	166883	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	not required	216200	138400	145100	80925	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	not required	350	807	1112	240	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 3	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	8500 ± 1800	19160	13900	31290	6408	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 1.9	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 3	346	5.E-05	6.E-05	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 2.2	10	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 30	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 7	14	3	3	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 3	4.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 15	1.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	830 ± 180	899	1079	1964	85	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	16.0 ± 5.0	2055	894	903	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	50 ± 14	326	1701	1701	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 7	3.E-02	1.E-02	2.E-02	1	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	104 ± 24	472	271	375	169	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	43 ± 14	214	123	172	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.9	11	1.E-01	2.E-01	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 6	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 40	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1.6	0	18	18	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 1.4	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 14	0	4.E-02	4.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0.028 ± 0.005	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0.028 ± 0.005	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 2.5	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0.036 ± 0.006	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 40	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	< 6.3	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	7.6 ± 1.0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	7.6 ± 1.0	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	10.4 ± 1.2	0	486	486	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 18: Comparison data for NPL sample IM100280

ID	IMP100281									
Year Removed	1998	Core	18							
Channel	1644/CR	Slice	(1) or 2							
	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	PNSR - Trench	PNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	78000 ± 26000	392000	354900	386700	166883	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	53300 ± 2600	92030	58320	61220	80925	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	2.1 ± 2	201	468	645	240	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 12	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	2900 ± 800	10660	8057	18420	6408	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 1.1	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 2.2	125	1.E-05	1.E-05	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 1.7	10	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 40	2.E-01	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 5	2	1	1	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 2.4	2.E-09	5.E-03	5.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 70	2.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	227 ± 50	386	464	844	85	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	5.9 ± 1.6	1549	666	668	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	35 ± 8	139	487	487	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 6	2.E-01	9.E-02	1.E-01	1	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	590 ± 120	1829	990	1434	169	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	220 ± 60	699	379	549	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.5	3	3.E-01	3.E-01	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 5	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 30	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 40	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1.8	0	15	15	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 11	0	4.E-01	4.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 11	0	1.E-03	1.E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	5.E-02	5.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 2.0	0	7.E-07	7.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 30	0	1.E-03	1.E-03	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	4	4	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	329	329	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 19: Comparison data for NPL sample IM100281

ID	IMP100282									
Year Removed	1998	Core	18							
Channel	1644/CR	Slice	1 or (2)							
	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	PNSR - Trench	PNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	12900 ± 4400	392100	355000	386800	166883	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	42500 ± 2000	92630	58700	61620	80925	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	< 2.5	202	471	649	240	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 9	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	2800 ± 600	10710	8096	18500	6408	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 0.9	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 1.9	126	1.E-05	1.E-05	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 1.5	11	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 30	2.E-01	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 5	2	1	1	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 2.0	2.E-09	5.E-03	5.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 60	2.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	222 ± 46	388	467	849	85	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	6.0 ± 1.6	1555	669	671	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	33 ± 8	140	490	490	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 5	2.E-01	9.E-02	1.E-01	1	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	580 ± 120	1818	984	1426	169	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	217 ± 48	695	377	546	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.3	3	3.E-01	3.E-01	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 23	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 30	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1.4	0	15	15	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 1.1	0	4.E-01	4.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 10	0	1.E-03	1.E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	5.E-02	5.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 1.7	0	7.E-07	7.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 30	0	1.E-03	1.E-03	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	4	4	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	329	329	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 20: Comparison data for NPL sample IM100282

ID	IMP100283		
Year Removed	2002	Core	2
Channel	1215/10	Slice	2

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	PNSR - Trench	PNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	not required	464300	420800	458500	166883	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	not required	49960	31650	33220	80925	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	not required	121	282	389	240	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 15	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	10800 ± 2400	9637	7344	16830	6408	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 2.2	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 4	74	4.E-06	4.E-06	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 2.4	7	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 40	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 7	3	1	1	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 3	6.E-10	2.E-03	2.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 60	9.E-04	7.E-04	7.E-04	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	760 ± 160	263	316	574	85	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	42 ± 10	3591	1542	1544	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	38 ± 12	79	286	286	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 8	7.E-01	4.E-01	6.E-01	1	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	570 ± 120	3439	1807	2582	169	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	290 ± 80	1422	748	1070	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 2.1	3	2.E-01	3.E-01	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 7	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 50	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 3	0	14	14	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 1.6	0	8.E-02	8.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 14	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	5.E-02	5.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	7.E-03	7.E-03	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 3	0	2.E-06	2.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 50	0	1.E-03	1.E-03	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	20	20	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	4	4	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	345	345	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 21: Comparison data for NPL sample IM100283

ID	IMP100284		
Year Removed	2002	Core	10
Channel	1215/10	Slice	2

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	PNSR - Trench	PNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	350 ± 120	512500	460600	501400	166883	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	47700 ± 3000	280900	180000	188600	80925	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	4.4 ± 3.6	393	901	1241	240	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 13	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	7.E-06	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	8600 ± 1800	31800	22260	49430	6408	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 1.6	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 3	423	7.E-05	9.E-05	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 2.3	9	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 50	16	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 7	45	9	9	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 3	5.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 110	2.E-02	4.E-03	4.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	300 ± 80	1280	1537	2797	85	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	19 ± 6	6524	2854	2902	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	22 ± 8	447	2258	2258	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 7	2.E-02	1.E-02	2.E-02	1	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	890 ± 200	412	241	320	169	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	460 ± 120	270	156	214	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 2.0	14	8.E-02	1.E-01	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 7	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 50	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 2.0	0	13	13	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 14	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 14	0	7.E-02	7.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 2.5	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 40	0	7.E-04	7.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	19	19	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	545	545	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 22: Comparison data for NPL sample IM100284

ID	IMP100285		
Year Removed	2002	Core	7
Channel	1443/CR	Slice	1

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	PNSR - Trench	PNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	7000 ± 2400	508200	457600	498300	166883	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	123000 ± 8000	244300	156300	163800	80925	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	6.3 ± 5	371	854	1177	240	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 7	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	5.E-06	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	25000 ± 6000	29740	21250	47570	6408	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 7	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 12	359	5.E-05	6.E-05	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 9	9	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 90	12	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 25	38	8	8	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 11	3.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 50	1.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1140 ± 260	1137	1365	2484	85	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	65 ± 18	6834	2986	3026	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	64 ± 20	388	2051	2051	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 25	3.E-02	2.E-02	2.E-02	1	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	161 ± 44	501	295	400	169	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	90 ± 34	315	183	254	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 6	14	1.E-01	1.E-01	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 24	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 110	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 150	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 9	0	14	14	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 50	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 50	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 8	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 130	0	7.E-04	7.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	23	23	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	581	581	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 23: Comparison data for NPL sample IM100285

ID	IMP100286		
Year Removed	2002	Core	5
Channel	1702/CR	Slice	1

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	PNSR - Trench	PNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	2800 ± 1000	505800	456100	496700	166883	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	133000 ± 10000	215100	137200	143900	80925	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	5.3 ± 4.2	350	808	1113	240	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 4	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	7.E-06	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	12900 ± 3000	27770	20120	45280	6408	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 7	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 9	307	4.E-05	5.E-05	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 7	11	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 70	9	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 19	25	7	7	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 9	2.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 40	1.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	690 ± 160	1008	1211	2203	85	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	60 ± 16	7021	3047	3078	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	71 ± 20	342	1587	1587	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 19	4.E-02	2.E-02	3.E-02	1	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	260 ± 60	661	377	527	169	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	139 ± 34	410	233	329	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 5	11	2.E-01	2.E-01	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 18	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 90	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 120	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 5	0	13	13	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 4	0	2	2	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 40	0	3.E-02	3.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 6	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 100	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	519	519	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 24: Comparison data for NPL sample IM100286

Tritium			Activity (Bq/g)			
Sample ID	Year	Location	NPL Active	FISPACT - Average	FISPACT - Maximum	RWI 2007
IM100272	1998	1644/10/8/?	770 ± 260	367,500	400,100	166,883
IM100273	1998	1644/10/8/?	4900 ± 1600	367,500	400,100	166,883
IM100274	1998	1644/10/4/1 or 2	480 ± 160	362,500	394,900	166,883
IM100275	1998	1644/10/14/1 and 2	not required	368,300	400,900	166,883
IM100276	1998	1644/10/14/1 and 2	not required	368,300	400,900	166,883
IM100277	1998	1644/C/4/1 and 2	64000 ± 22000	362,400	394,700	166,883
IM100278	1998	1644/C/4/1 and 2	16000 ± 6000	362,400	394,800	166,883
IM100279	1998	1644/C/14/1 and 2	not required	365,200	397,800	166,883
IM100280	1998	1644/C/14/1 and 2	not required	365,300	397,800	166,883
IM100281	1998	1644/C/18/1 and 2	78000 ± 26000	354,900	386,700	166,883
IM100282	1998	1644/C/18/1 and 2	12900 ± 4400	355,000	386,800	166,883
IM100283	2002	1215/10/2/2	not required	420,800	458,500	166,883
IM100284	2002	1215/10/10/2	350 ± 120	460,600	501,400	166,883
IM100285	2002	1443C/7/1	7000 ± 2400	457,600	498,300	166,883
IM100286	2002	1702/C/5/1	2800 ± 1000	456,100	496,700	166,883

Table 25: Summary Table for Tritium – Sizewell A

Carbon-14			Activity (Bq/g)			
Sample ID	Year	Location	NPL Active	FISPACT - Average	FISPACT - Maximum	RWI 2007
IM100272	1998	1644/10/8/?	150000 ± 8000	170,300	178,500	80,925
IM100273	1998	1644/10/8/?	101800 ± 5000	169,700	177,900	80,925
IM100274	1998	1644/10/4/1 or 2	68600 ± 4400	107,000	112,300	80,925
IM100275	1998	1644/10/14/1 and 2	not required	138,800	145,500	80,925
IM100276	1998	1644/10/14/1 and 2	not required	138,400	145,100	80,925
IM100277	1998	1644/C/4/1 and 2	85000 ± 4200	105,600	110,800	80,925
IM100278	1998	1644/C/4/1 and 2	77600 ± 3800	106,300	111,500	80,925
IM100279	1998	1644/C/14/1 and 2	not required	137,500	144,100	80,925
IM100280	1998	1644/C/14/1 and 2	not required	138,400	145,100	80,925
IM100281	1998	1644/C/18/1 and 2	53300 ± 2600	58,320	61,220	80,925
IM100282	1998	1644/C/18/1 and 2	42500 ± 2000	58,700	61,620	80,925
IM100283	2002	1215/10/2/2	not required	31,650	33,220	80,925
IM100284	2002	1215/10/10/2	47700 ± 3000	180,000	188,600	80,925
IM100285	2002	1443C/7/1	123000 ± 8000	156,300	163,800	80,925
IM100286	2002	1702/C/5/1	133000 ± 10000	137,200	143,900	80,925

Table 26: Summary Table for Carbon-14 – Sizewell A

Chlorine-36			Activity (Bq/g)			
Sample ID	Year	Location	NPL Active	FISPACT - Average	FISPACT - Maximum	RWI 2007
IM100272	1998	1644/10/8/?	80 ± 60	883	1,217	240
IM100273	1998	1644/10/8/?	70 ± 60	882	1,215	240
IM100274	1998	1644/10/4/1 or 2	22 ± 16	706	973	240
IM100275	1998	1644/10/14/1 and 2	not required	808	1,113	240
IM100276	1998	1644/10/14/1 and 2	not required	807	1,112	240
IM100277	1998	1644/C/4/1 and 2	3.8 ± 3.2	700	965	240
IM100278	1998	1644/C/4/1 and 2	2.5 ± 2.2	703	968	240
IM100279	1998	1644/C/14/1 and 2	not required	804	1,108	240
IM100280	1998	1644/C/14/1 and 2	not required	807	1,112	240
IM100281	1998	1644/C/18/1 and 2	2.1 ± 2	468	645	240
IM100282	1998	1644/C/18/1 and 2	< 2.5	471	649	240
IM100283	2002	1215/10/2/2	not required	282	389	240
IM100284	2002	1215/10/10/2	4.4 ± 3.6	901	1,241	240
IM100285	2002	1443C/7/1	6.3 ± 5	854	1,177	240
IM100286	2002	1702/C/5/1	5.3 ± 4.2	808	1,113	240

Table 27: Summary Table for Chlorine-36 – Sizewell A

Cobalt-60			Activity (Bq/g)			
Sample ID	Year	Location	NPL Active	FISPACT - Average	FISPACT - Maximum	RWI 2007
IM100272	1998	1644/10/8/?	11800 ± 2600	15,010	33,500	6408
IM100273	1998	1644/10/8/?	6500 ± 1400	15,000	33,480	6408
IM100274	1998	1644/10/4/1 or 2	5000 ± 1200	12,120	27,480	6408
IM100275	1998	1644/10/14/1 and 2	7100 ± 1600	13,940	31,390	6408
IM100276	1998	1644/10/14/1 and 2	14600 ± 3400	13,930	31,350	6408
IM100277	1998	1644/C/4/1 and 2	7500 ± 1600	12,030	27,280	6408
IM100278	1998	1644/C/4/1 and 2	6500 ± 1400	12,070	27,380	6408
IM100279	1998	1644/C/14/1 and 2	8600 ± 1800	13,860	31,210	6408
IM100280	1998	1644/C/14/1 and 2	8500 ± 1800	13,900	31,290	6408
IM100281	1998	1644/C/18/1 and 2	2900 ± 800	8,057	18,420	6408
IM100282	1998	1644/C/18/1 and 2	2800 ± 600	8,096	18,500	6408
IM100283	2002	1215/10/2/2	10800 ± 2400	7,344	16,830	6408
IM100284	2002	1215/10/10/2	8600 ± 1800	22,260	49,430	6408
IM100285	2002	1443C/7/1	25000 ± 6000	21,250	47,570	6408
IM100286	2002	1702/C/5/1	12900 ± 3000	20,120	45,280	6408

Table 28: Summary Table for Cobalt-60 – Sizewell A

Explanation of Results

Trends for individual radionuclides across all the samples have been examined and some notes are presented below. For some nuclides, the amounts of material detected were very low and it was difficult to draw many conclusions, for example relationships between uranic and transuranic nuclides.

Tritium

There is a poor relationship between FISPACT and active analysis (typically greater than 1 order of magnitude, often closer to 2-3 orders). However, there is a good agreement between the RWI (2007) and FISPACT.

The over-predictions are likely due to limitations in the models, which do not account for mobility of tritium in the graphite, (or possibly during sample storage, although tritium generated in activated graphite tends to be tenacious compared to tritium due to contamination).

Carbon-14

There is generally very good agreement (within a factor of 2) between active analysis and FISPACT calculations utilising NPL precursor data, with the single exception of sample IMP100284 (factor of 3 higher than predicted).

There is typically good agreement to the RWI2007 value, although this is an average across the reactor.

Good C-14 results point towards a realistic flux profile (due to the relationship between activation rate, thermal flux and C-14's long half-life) and strong nitrogen and C-13 precursor data. This aids validation of the model.

Chlorine-36

Generally, comparison between FISPACT predicted and NPL analysed activities are poor. The RWI also over-predicts activity and typically yields similar results to FISPACT analysis utilising Jowett graphite precursors (~400 Bq/g).

The over-prediction is due to mobility and volatility of chlorine (as Cl-36 or its Cl-35 precursor) within graphite, which is not accounted for in FISPACT (and possibly loss from the samples during storage).

Sodium-22

Na-22 did not achieve limit of detection. All FISPACT calculations and the RWI2007 predict no Na-22 activity present.

Cobalt-57

Co-57 was not analysed for in Sizewell A.

FISPACT modelling predicted no Co-57 activity when utilising NPL inactive precursors and the RWI reported no Co-57 activity. Very small amounts of activity were predicted when using Jowett precursors for samples IM100284-286.

Cobalt-60

There is a good agreement with FISPACT results in most cases (factor of 2-3 agreement typically), though FISPACT tends to yield slightly over-estimate values. FISPACT also agrees well with RWI2007 (factor of 2 or less).

Niobium-94

Nb-94 did not achieve limit of detection. FISPACT predicted very small quantities of Nb-94 to be present when considering inactive precursors analysed by NPL. When using Jowett precursors, much higher activities (several orders of magnitude) were predicted. RWI2007 has a stated activity of 1 Bq/g, which is much higher than the FISPACT calculations using NPL inactive data, but much lower than when utilising Jowett precursors.

Nb-94 is an activation product of elemental niobium (Nb-93). Due to its long half-life (20,300 years) and strong dual gamma decay, any amount greater than trace impurities would be readily picked up in samples, unless it was completely burnt out during the reactors life (which would be highly improbable). In this event, Nb-95 would be generated, which would quickly decay into elemental molybdenum, and from there undergo further activation.

Silver-108(m)

Ag-108m did not achieve limit of detection. FISPACT calculations utilising the NPL inactive precursors and the RWI2007 predicted small amounts of Ag-108m activity, whilst those utilising Jowett precursors predicted small amounts of Ag-108m as being present. Ag-108m is an important nuclide in new LLWR acceptance criteria.

Ag-108m is highly likely to be an activation product of elemental silver (Ag-107). NPL inactive analysis of graphite did not detect elemental silver and as a result, reported no activity.

Cadmium-109

Cd-109 did not achieve limit of detection during active analysis. FISPACT calculations utilising the NPL inactive precursors and the RWI2007 predict no Cd-109 activity to be present. FISPACT calculations utilising Jowett precursors predict small amounts of Cd-109 to be present.

Cd-109 is highly likely to be an activation product of elemental cadmium (Cd-108 - ~1% of elemental cadmium). NPL inactive analysis did not detect elemental cadmium and as a result, reported no activity. Due to its short half-life (~1.25 years), any activity would decay away significantly after about 12 years.

Antimony-125

Generally, Sb-125 activity did not reach LoD, however, in one sample (IM100276) an activity was measured. This result was higher than predicted by FISPACT modelling using the NPL inactive precursor data by about a factor of 5. However, the level was quite close to the FISPACT calculations utilising Jowett precursors, which predicted higher activities than NPL inactive precursors. The RWI states no Sb-125 is present.

Sb-125 is likely to be an activation product of elemental antimony (Sb-123) or is generated from elemental tin (Sn-124 activated to Sn-125 and then beta decay to Sb-125). Since neither tin nor antimony was found in the NPL inactive data, it is thought that Sb-125 in FISPACT calculations utilising NPL inactive data is a fission product.

Given that Sb-125 was only found in a single sample, it is likely that this was due to a local deposit of the Sb-125 elemental precursor. It is also possible that Sb-125 exists as a fission

product; however, given that no other sample was found in Sizewell A with any noticeable amounts of Sb-125, this is an unlikely source for this local concentration of activity.

Tin-126

Sn-126 did not achieve limit of detection. FISPACT calculations predicted very low activities of Sn-126 to be present, and FISPACT models using NPL inactive data predict higher activities than those utilising Jowett precursors. The RWI states no Sn-126 is present.

Due to its long half-life (~100,000 years), any Sn-126 created will remain in the graphite for the duration of the reactors life, unless burnt off under neutron irradiation. It is thought that the precursor for Sn-126 is not elemental tin, as NPL precursor data does not include tin, yet still generates higher activities, but rather Sn-126 was generated as a fission product (Jowett data did not include uranium and thorium pre-cursors).

Iodine-129

I-129 did not achieve limit of detection. FISPACT calculations predict very low activities of I-129 to be present. The RWI states no I-129 is present.

Due to its long half-life (~15,700,000 years), any I-129 created will remain in the graphite for the duration of the reactors life, unless burnt off under neutron irradiation. I-129 is likely due to activation of elemental iodine (I-128), but a certain quantity could be generated by a fission route.

Barium-133

There is generally a very high degree (within a factor of 2) of agreement between active analysis undertaken by NPL and FISPACT modelling utilising Jowett and NPL inactive precursors. There is a noticeable exception in sample IM100284, where the predicted activity is somewhat lower than the active analysis (factor of 5). The RWI generally predicts much lower (~ an order of magnitude) activities than the active analysis.

Given the consistency of all the results other than IM100284, it is likely that for this sample there is a particularly low concentration of elemental barium (Ba-132) which is thought to be its parent.

Active analysis suggests that activities are typically higher closer to the core centre, however, samples from the bottom of the core (e.g. IM100274, 277 and 278) still have quite high activities, whilst samples from the top (IM100281 and 282) will have lower activities.

Caesium-134

There is poor agreement between active analysis of Cs-134 and modelled inventories (considering all precursors) with the FISPACT calculations typically predicting approximately two orders of magnitude greater than the analysed inventory. The RWI states no Cs-134 is present.

This poor agreement is likely due to two factors. Given that the primary precursor for Cs-134 is elemental caesium (Cs-133), and no NPL test achieved its LoD, part of the variance could be due to the default LoD precursor data used in the calculations. Additionally, it is thought that caesium radionuclides will be mobile in the graphite and potentially escape due to the high temperatures in the core.

Caesium-137

There is poor agreement between active analysis of Cs-137 and modelled inventories (considering all precursors) with the FISPACT calculations typically predicting approximately one to two orders of magnitude greater than the analysed inventory. The RWI states no Cs-137 is present.

This poor agreement is likely due to two factors. Given that the primary precursor for Cs-137 is as a fission product from uranium and thorium, and no NPL test achieved its LoD on either, part of the variance could be due to the poor precursor data. Additionally, it is possible that caesium radionuclides will be mobile in the graphite and potentially escape due to the high temperatures in the core.

Europium-152

Eu-152 did not achieve limit of detection. FISPACT calculations predict very low activities of Eu-152 to be present (<< 1 Bq/g). The RWI states 1 Bq/g of Eu-152 is present in the graphite.

Very low quantities of elemental europium (typically a few ppb), which is thought to be the primary precursor for Eu-152, is present within the inactive samples. Additionally, previous studies [4] have shown that europium radionuclides are readily burnt off, with areas of higher neutron flux having lower europium activities than areas of lower flux, whilst experiencing the same spectrum.

Europium-154 and 155

There is generally a very good level of agreement between active analysis and FISPACT models for Eu-154/155 activity, typically within a factor of two, and always within an order of magnitude.

Additionally, the trend exhibited between the two radionuclides is seen in both the modelled activity and active analysis, where Eu-154 activity is approximately twice that of Eu-155.

The RWI generally gives a good agreement also, being within an order of magnitude for most results.

There is no obvious pattern to why some samples give a much stronger agreement between the model and active analysis. As a result, it is thought that this is due to variations in local precursor concentrations, rather than changes in flux properties around the reactor. Because europium radionuclides are sensitive to neutron flux, the strong agreement between active and modelled activities suggests that the calculated reactor fluxes are reasonably accurate.

Holmium-166(m)

Ho-166m did not achieve limit of detection. FISPACT calculations utilising NPL inactive precursor data predict very low activities of Ho-166m to be present, however, Jowett precursor data predicts reasonable activities (5 - 20 Bq/g). The RWI states 4 Bq/g of Ho-166m is present.

Ho-166m is likely produced primarily due to activation of elemental holmium, which was not present in the NPL inactive graphite precursors, but was in the Jowett precursors. Small amounts are possibly created due to fission events, or from an activation chain starting with dysprosium, which exists in small concentrations in the NPL inactive data.

Bismuth-207

Bi-207 did not achieve limit of detection. All FISPACT calculations and the RWI2007 predict no Bi-207 activity present.

Trans-uranic radionuclides are likely to be present from activation and decay of any heavy or transuranic elements present in the graphite. Additionally, burst fuel cartridges may contribute a trace amount of fissile material onto the graphite.

Neptunium-236

Np-236 did not achieve limit of detection. All FISPACT calculations and the RWI2007 predict no Np-236 activity present.

Trans-uranic radionuclides are likely to be present from activation and decay of any heavy or transuranic elements present in the graphite. Additionally, burst fuel cartridges may contribute a small amount of fissile material onto the graphite.

Neptunium-237

As with Np-236, Np-237 did not achieve limit of detection. FISPACT calculations utilising NPL inactive data predict very low Np-237 activities. FISPACT calculations utilising the Jowett precursor data predicts no Np-237 activity, and the RWI states no activity.

Americium-241

Am-241 did not achieve limit of detection. FISPACT calculations utilising NPL inactive data predict low Am-241 activities (10 - 20 Bq/g). FISPACT calculations utilising the Jowett precursor data predicts no Am-241 activity, and the RWI states no activity.

Americium-243

Am-243 did not achieve limit of detection. FISPACT calculations utilising NPL inactive data predict very low Am-243 activities (0 - 5 Bq/g). FISPACT calculations utilising the Jowett precursor data predicts no Am-243, and the RWI states no activity.

Curium-245

Cm-245 did not achieve limit of detection. FISPACT calculations utilising NPL inactive data predict very low Cm-245 activities. FISPACT calculations utilising the Jowett precursor data predicts no Cm-245 activity, and the RWI states no activity.

Uranium-233 and 234

NPL active analysis grouped U-233 and 234 together for analysis, and only a few samples were measured. Where samples were measured, it was found that whilst FISPACT (utilising NPL inactive precursors) slightly over estimated the activity, it was generally a good match (within an order of magnitude) .

The over estimation is likely due to the inactive precursor analysis only returning a LoD figure for uranium and thorium.

Uranium-235

U-235 did not achieve limit of detection. FISPACT calculations utilising NPL inactive data predict extremely low U-235 activities (<< 1 Bq/g).

FISPACT calculations utilising the Jowett precursor data predicts no U-235 activity (this is most likely due to no uranium or thorium being included in the Jowett precursor data) and the RWI states no activity.

Uranium-236

NPL active analysis only measured a few samples for U-236. Where samples were measured, it was found that FISPACT (utilising NPL inactive precursors) over-estimated the activity to approximately two orders of magnitude.

The over-estimation is likely due to the inactive analysis only returning a LoD figure for uranium and thorium.

Uranium-238

U-238 did not achieve limit of detection. FISPACT calculations utilising NPL inactive data predict extremely low U-238 activities (<< 1 Bq/g). FISPACT calculations utilising the Jowett precursor data predicts no U-238 activity (this is most likely due to no uranium or thorium being included in the Jowett precursor data) and the RWI states no activity.

Plutonium-238

Pu-238 was only analysed in a few samples. Where samples were measured, it was found that whilst FISPACT (utilising NPL inactive precursors) slightly over estimated the activity, it was generally a good match (within an order of magnitude).

Plutonium-239 and 240

NPL active analysis grouped Pu-239 and 240 together for analysis, and only a few samples were measured. Where samples were measured, it was found that FISPACT (utilising NPL inactive precursors) gave good agreement with one sample (within a factor of two) but slightly under estimated the activity for two more samples (factor of 5).

Plutonium-241

NPL active analysis only measured a few samples for Pu-241. Where samples were measured, it was found that FISPACT (utilising NPL inactive precursors) overestimated the activity to approximately a factor of 20.

The over estimation is likely due to the inactive analysis only returning a LoD figure for uranium and thorium.

APPENDIX 7 – STAGE 2 ACTIVE PHASE RESULTS - WYLFA

Results are presented in tabular formats below in Table 29 to Table 54. For ease of comparison, results are presented in a colour coded format, as outlined above in Appendix 6.

In this case, the “high accuracy” level (yellow highlight) are those results within a factor of two of the NPL active analysis, and the “low accuracy” are those within an order of magnitude (factor of 10).

Results

ID	IM100246									
Year Removed	1997	Core	1							
Channel	1608/03	Slice	(1) or 3							
	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	142000 ± 48000	164900	532600	963900	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	22900 ± 1200	8493	5107	5564	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	< 34	23	120	185	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	1630 ± 360	1512	1137	2297	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 0.5	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 1.4	12	1.E-07	1.E-07	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 1.1	2	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 30	3.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 3	1.E-01	2.E-02	2.E-02	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 1.4	0	9.E-05	9.E-05	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 90	8.E-05	8.E-05	8.E-05	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	360 ± 80	44	76	212	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	3.3 ± 1.2	197	155	155	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	12.2 ± 3.8	14	18	18	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 4	12	21	28	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	1020 ± 220	1041	1639	2187	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	330 ± 80	211	321	425	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.0	4	2.E-01	3.E-01	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 3	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 19	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 20	0	6.E-06	6.E-06	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1.2	0	4.E-01	4.E-01	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 1.0	0	4.E-05	4.E-05	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 7	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	2.E-02	2.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	1.E-03	1.E-03	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 1.4	0	2.E-05	2.E-05	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	7.E-05	7.E-05	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 22	0	9.E-04	9.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	7.E-02	7.E-02	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	1	1	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	3.E-01	3.E-01	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	8	8	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 29: Comparison data for NPL sample IM100246

ID	IM100247		
Year Removed	1997	Core	1
Channel	1608/03	Slice	1 or (3)

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	12500 ± 4200	164500	531200	961300	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	35700 ± 1800	8465	5090	5545	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	< 900	23	120	185	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 16	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	3000 ± 800	1507	1133	2290	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 0.9	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 1.7	11	1.E-07	1.E-07	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	4.6 ± 1.6	2	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 30	3.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 4	1.E-01	2.E-02	2.E-02	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 1.7	0	9.E-05	9.E-05	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 90	8.E-05	8.E-05	8.E-05	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	320 ± 80	44	76	211	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	3.2 ± 1.2	196	154	154	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	9.3 ± 3.4	14	18	18	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 4	12	21	29	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	910 ± 200	1038	1635	2182	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	290 ± 80	210	320	423	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.2	4	2.E-01	3.E-01	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 21	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 24	0	6.E-06	6.E-06	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1.3	0	4.E-01	4.E-01	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 1.0	0	4.E-05	4.E-05	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 8	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	2.E-02	2.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	1.E-03	1.E-03	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 1.5	0	2.E-05	2.E-05	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	7.E-05	7.E-05	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 25	0	9.E-04	9.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	7.E-02	7.E-02	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	1	1	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	3.E-01	3.E-01	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	8	8	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 30: Comparison data for NPL sample IM100247

ID	IM100248		
Year Removed	1997	Core	11
Channel	1608/03	Slice	(1) or 3

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	not required	376400	1213000	2195000	417925	4.0E+02	1.0E+09	3.00E+03	3.0E+12	1.0E+13
C14	not required	107000	65200	70840	56675	1.0E+04	8.0E+06	1.50E+01	1.5E+10	5.0E+10
Cl36	not required	222	1164	1800	320	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Na22	< 11	0	0	0	0	4.0E+03	4.0E+08	4.50E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Co60	10300 ± 2200	15110	11340	22810	10845	3.0E+03	4.0E+08	6.00E+02	6.0E+11	2.0E+12
Sr85	< 2.0	0	0	0	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Nb94	< 4	170	2.E-05	2.E-05	2.E-01	4.0E+03	5.0E+08	4.50E+03	4.5E+12	1.5E+13
Ag108m	7.0 ± 1.8	11	7.E-07	7.E-07	2	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Cd109	< 40	3.E-01	0	0	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Sb125	< 7	5	1	1	0	2.0E+04	2.0E+09	4.50E+03	4.5E+12	1.5E+13
Sn126	< 3	4.E-09	5.E-03	5.E-03	0	2.0E+03	5.0E+08	4.50E+03	4.5E+12	1.5E+13
I129	< 40	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.50E+01	1.5E+10	5.0E+10
Ba133	240 ± 60	553	954	2660	55	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Cs134	5.4 ± 3.2	1846	1448	1455	0	4.0E+03	6.0E+08	4.50E+03	4.5E+12	1.5E+13
Cs137	30 ± 10	173	547	547	0	1.0E+04	2.0E+09	4.50E+03	4.5E+12	1.5E+13
Eu152	< 8	9.E-02	7.E-02	7.E-02	28	4.0E+03	8.0E+08	4.50E+03	4.5E+12	1.5E+13
Eu154	410 ± 100	1475	1339	1403	701	3.0E+03	7.0E+08	4.50E+03	4.5E+12	1.5E+13
Eu155	166 ± 40	533	483	506	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Ho166m	< 1.9	3	1	1	2	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Bi207	< 7	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 50	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 3	0	14	14	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 4	0	1	1	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 14	0	3.E-03	3.E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	< 1.6	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	< 1.6	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 2.5	0	7.E-07	7.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	< 1.9	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 40	0	7.E-04	7.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	5.1 ± 1.4	0	17	17	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	14.0 ± 3.2	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	14.0 ± 3.2	0	4	4	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	26.4 ± 3.2	0	329	329	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 31: Comparison data for NPL sample IM100248

ID	IM100249		
Year Removed	1997	Core	11
Channel	1608/03	Slice	1 or (3)

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	not required	376400	1213000	2195000	417925	4.0E+02	1.0E+09	3.00E+03	3.0E+12	1.0E+13
C14	not required	106700	65010	70630	56675	1.0E+04	8.0E+06	1.50E+01	1.5E+10	5.0E+10
Cl36	not required	222	1162	1796	320	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Na22	< 6	0	0	0	0	4.0E+03	4.0E+08	4.50E+03	4.5E+12	1.5E+13
Co57	2.0 ± 1.4	0	0	0	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Co60	9100 ± 2200	15070	11310	22750	10845	3.0E+03	4.0E+08	6.00E+02	6.0E+11	2.0E+12
Sr85	< 6	0	0	0	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Nb94	< 8	169	2.E-05	2.E-05	2.E-01	4.0E+03	5.0E+08	4.50E+03	4.5E+12	1.5E+13
Ag108m	< 6	11	7.E-07	7.E-07	2	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Cd109	< 70	3.E-01	0	0	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Sb125	< 17	5	1	1	0	2.0E+04	2.0E+09	4.50E+03	4.5E+12	1.5E+13
Sn126	< 8	4.E-09	5.E-03	5.E-03	0	2.0E+03	5.0E+08	4.50E+03	4.5E+12	1.5E+13
I129	< 40	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.50E+01	1.5E+10	5.0E+10
Ba133	270 ± 60	551	951	2652	55	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Cs134	6.9 ± 2.8	1843	1446	1453	0	4.0E+03	6.0E+08	4.50E+03	4.5E+12	1.5E+13
Cs137	30 ± 18	172	545	545	0	1.0E+04	2.0E+09	4.50E+03	4.5E+12	1.5E+13
Eu152	< 17	9.E-02	7.E-02	7.E-02	28	4.0E+03	8.0E+08	4.50E+03	4.5E+12	1.5E+13
Eu154	450 ± 100	1481	1345	1409	701	3.0E+03	7.0E+08	4.50E+03	4.5E+12	1.5E+13
Eu155	173 ± 50	535	485	508	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Ho166m	< 5	3	1	1	2	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Bi207	< 16	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 80	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 100	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 9	0	14	14	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 4	0	1	1	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 30	0	3.E-03	3.E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	< 0.21	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	< 0.21	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 6	0	7.E-07	7.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	< 0.15	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 90	0	7.E-04	7.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	< 3.4	0	17	17	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	< 6.6	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	< 6.6	0	4	4	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	17.5 ± 1.8	0	329	329	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 32: Comparison data for NPL sample IM100249

ID	IM100250		
Year Removed	1997	Core	22
Channel	1608/03	Slice	(1) or 3

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	48 ± 18	184500	595800	1078000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	20800 ± 1000	9811	5907	6433	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	2.1 ± 2	26	138	213	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 11	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	4600 ± 1000	1769	1329	2686	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 1.2	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 2.2	14	2.E-07	2.E-07	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	3.1 ± 1.0	2	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 30	4.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 5	2.E-01	4.E-02	4.E-02	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 2.1	0	2.E-04	2.E-04	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 14	1.E-04	1.E-04	1.E-04	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	197 ± 42	52	90	252	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	3.8 ± 1.8	281	221	221	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	7.6 ± 3.4	16	28	28	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 5	5	7	9	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	390 ± 100	1366	2026	2654	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	128 ± 30	293	427	557	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.4	4	3.E-01	4.E-01	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 5	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 25	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 30	0	1.E-05	1.E-05	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1.5	0	1	1	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 1.1	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 10	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	3.E-02	3.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	1.E-03	1.E-03	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 1.8	0	2.E-05	2.E-05	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	8.E-05	8.E-05	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 30	0	9.E-04	9.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	2.E-01	2.E-01	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	1	1	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	1	1	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	17	17	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 33: Comparison data for NPL sample IM100250

ID	IM100251		
Year Removed	1997	Core	22
Channel	1608/03	Slice	1 or (3)

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	340 ± 120	184000	594400	1076000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	17300 ± 800	9780	5888	6413	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	1.7 ± 1.6	26	137	212	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 6	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	3600 ± 800	1764	1326	2679	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 0.5	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 1.0	14	2.E-07	2.E-07	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 0.8	2	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 13	4.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 2.2	2.E-01	4.E-02	4.E-02	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 1.0	0	2.E-04	2.E-04	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 30	1.E-04	1.E-04	1.E-04	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	210 ± 44	52	90	251	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	4.0 ± 1.4	280	220	220	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	9.5 ± 2.8	16	28	28	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 2.3	5	7	9	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	390 ± 80	1363	2022	2650	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	129 ± 30	292	426	556	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 0.7	4	3.E-01	4.E-01	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 2.1	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 12	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 14	0	1.E-05	1.E-05	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 0.7	0	1	1	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 0.5	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 5	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	2.E-02	2.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	1.E-03	1.E-03	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 0.9	0	2.E-05	2.E-05	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	8.E-05	8.E-05	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 14	0	9.E-04	9.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	2.E-01	2.E-01	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	1	1	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	1	1	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	17	17	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 34: Comparison data for NPL sample IM100251

ID	IM100252		
Year Removed	1997	Core	9
Channel	1608/03	Slice	3

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	12800 ± 4400	374500	1208000	2185000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	59700 ± 2800	90520	55160	59930	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	< 3.1	196	1025	1585	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 1.3	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	4500 ± 1000	13270	9957	20050	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 1.1	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 2.0	145	1.E-05	1.E-05	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 1.6	10	6.E-07	6.E-07	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 23	2.E-01	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 5	4	1	1	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 2.0	3.E-09	4.E-03	4.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 13	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	480 ± 100	475	820	2285	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	7.0 ± 2.6	1709	1341	1346	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	21 ± 8	146	459	459	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 5	1.E-01	1.E-01	1.E-01	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	240 ± 60	1785	1660	1765	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	92 ± 22	629	584	620	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.4	3	1	1	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 5	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 25	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 30	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1.4	0	14	14	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 10	0	4.E-01	4.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 10	0	2.E-03	2.E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 1.8	0	7.E-07	7.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 30	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	17	17	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	4	4	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	328	328	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 35: Comparison data for NPL sample IM100252

ID	IM100253		
Year Removed	1997	Core	13
Channel	1608/03	Slice	3

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	12100 ± 4200	374600	1208000	2186000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	49400 ± 3200	91040	55470	60270	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	2.4 ± 2.2	197	1030	1592	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 18	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	12900 ± 2800	13320	9998	20140	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 2.0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 4	146	1.E-05	1.E-05	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 2.5	10	6.E-07	6.E-07	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 40	2.E-01	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 8	4	1	1	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 4	3.E-09	4.E-03	4.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 19	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	780 ± 160	477	824	2296	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	7.9 ± 3.4	1714	1345	1350	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	31 ± 10	147	461	461	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 8	1.E-01	1.E-01	1.E-01	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	670 ± 140	1774	1649	1752	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	270 ± 60	626	581	616	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 2.2	3	1	1	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 7	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 50	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 3	0	14	14	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 1.7	0	4.E-01	4.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 15	0	2.E-03	2.E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 3	0	7.E-07	7.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 50	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	2.E+01	2.E+01	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2.E+00	2.E+00	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	4.E+00	4.E+00	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	3.E+02	3.E+02	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 36: Comparison data for NPL sample IM100253

ID	IM100254		
Year Removed	1997	Core	18
Channel	1608/03	Slice	3

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	not required	366700	1183000	2142000	417925	4.0E+02	1.0E+09	3.00E+03	3.0E+12	1.0E+13
C14	not required	58980	35920	39030	56675	1.0E+04	8.0E+06	1.50E+01	1.5E+10	5.0E+10
Cl36	not required	137	721	1115	320	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Na22	< 10	0	0	0	0	4.0E+03	4.0E+08	4.50E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Co60	22000 ± 6000	9302	6983	14090	10845	3.0E+03	4.0E+08	6.00E+02	6.0E+11	2.0E+12
Sr85	< 9	0	0	0	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Nb94	< 13	97	8.E-06	9.E-06	2.E-01	4.0E+03	5.0E+08	4.50E+03	4.5E+12	1.5E+13
Ag108m	< 9	8	0	0	2	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Cd109	< 90	1.E-01	0	0	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Sb125	< 30	2	1	1	0	2.0E+04	2.0E+09	4.50E+03	4.5E+12	1.5E+13
Sn126	< 12	0	2.E-03	2.E-03	0	2.0E+03	5.0E+08	4.50E+03	4.5E+12	1.5E+13
I129	< 50	1.E-03	8.E-04	8.E-04	0	3.0E+02	2.0E+10	1.50E+01	1.5E+10	5.0E+10
Ba133	100 ± 30	318	550	1532	55	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Cs134	< 11	1324	1040	1042	0	4.0E+03	6.0E+08	4.50E+03	4.5E+12	1.5E+13
Cs137	37 ± 12	95	286	286	0	1.0E+04	2.0E+09	4.50E+03	4.5E+12	1.5E+13
Eu152	< 30	3.E-01	2.E-01	2.E-01	28	4.0E+03	8.0E+08	4.50E+03	4.5E+12	1.5E+13
Eu154	280 ± 80	2424	2423	2684	701	3.0E+03	7.0E+08	4.50E+03	4.5E+12	1.5E+13
Eu155	108 ± 38	802	801	887	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Ho166m	< 7	3	5.E-01	1	2	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Bi207	< 30	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 110	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 160	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 9	0	14	14	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 5	0	1.E-01	1.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 50	0	3.E-04	3.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	8.E-03	8.E-03	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 8	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 130	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	1.E+01	1.E+01	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2.E+00	2.E+00	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	4.E+00	4.E+00	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	3.E+02	3.E+02	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 37: Comparison data for NPL sample IM100254

ID	IM100255		
Year Removed	1997	Core	10
Channel	0818/15	Slice	(1) or 3

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	8300 ± 2800	387900	1234000	2230000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	84000 ± 6000	275800	168300	182800	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	10 ± 8	390	2013	3111	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 9	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	9600 ± 2000	28400	21370	42270	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 1.6	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 3	412	7.E-05	7.E-05	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 2.2	8	1.E-06	1.E-06	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 30	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 6	31	3	3	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 3	6.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 17	2.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1410 ± 300	1287	2223	6198	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	18 ± 6	1884	1465	1495	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	63 ± 16	454	1692	1692	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 7	1.E-02	8.E-03	8.E-03	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	380 ± 80	284	219	219	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	147 ± 36	135	108	108	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 2.0	15	2.E-01	2.E-01	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 6	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 40	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 2.0	0	12	12	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 15	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 14	0	7.E-02	7.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 2.5	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 40	0	5.E-04	5.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	10	10	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	341	341	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 38: Comparison data for NPL sample IM100255

ID	IM100256		
Year Removed	1997	Core	10
Channel	0818/15	Slice	1 or (3)

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	5700 ± 2000	387800	1234000	2230000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	98000 ± 8000	275000	167800	182200	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	10 ± 8	390	2011	3108	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 5	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	23000 ± 6000	28370	21350	42220	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 7	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 11	411	7.E-05	7.E-05	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	18 ± 8	8	1.E-06	1.E-06	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 80	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 22	31	3	3	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 10	6.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 50	2.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1420 ± 300	1285	2218	6185	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	20 ± 8	1888	1469	1499	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	62 ± 16	452	1687	1687	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 22	1.E-02	8.E-03	8.E-03	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	420 ± 100	286	220	221	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	149 ± 46	135	108	108	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 6	15	2.E-01	2.E-01	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 21	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 100	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 130	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 8	0	13	13	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 5	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 40	0	7.E-02	7.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 7	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 120	0	5.E-04	5.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	10	10	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	341	341	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 39: Comparison data for NPL sample IM100256

ID	IM100257		
Year Removed	1997	Core	10
Channel	0818/CR	Slice	(1) or 3

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	15000 ± 6000	387600	1233000	2230000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	83600 ± 4800	272000	166000	180300	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	4.9 ± 3.4	388	2003	3096	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 5	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	5500 ± 1200	28210	21230	42010	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 0.7	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 1.5	408	7.E-05	7.E-05	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 1.0	8	1.E-06	1.E-06	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 14	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 3	30	3	3	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 1.3	6.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 8	2.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1450 ± 300	1275	2201	6139	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	15.8 ± 3.8	1899	1478	1507	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	84 ± 18	447	1672	1673	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 3	1.E-02	8.E-03	8.E-03	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	214 ± 46	290	225	225	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	83 ± 20	137	110	110	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 0.9	15	2.E-01	2.E-01	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 2.5	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 17	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 17	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1.5	0	13	13	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 0.8	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 7	0	7.E-02	7.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 1.2	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 18	0	5.E-04	5.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	10	10	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	343	343	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 40: Comparison data for NPL sample IM100257

ID	IM100258		
Year Removed	1997	Core	10
Channel	0818/CR	Slice	1 or (3)

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	34000 ± 12000	387700	1233000	2230000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	86200 ± 4800	273800	167100	181500	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	5.8 ± 4.0	389	2008	3103	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 5	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	6200 ± 1400	28310	21300	42140	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 6	410	7.E-05	7.E-05	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 5	8	1.E-06	1.E-06	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 60	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 13	31	3	3	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 6	6.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 30	2.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1590 ± 340	1281	2212	6167	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	18 ± 6	1892	1472	1502	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	95 ± 24	450	1682	1682	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 14	1.E-02	8.E-03	8.E-03	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	230 ± 60	287	222	222	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	87 ± 24	136	109	109	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 4	15	2.E-01	2.E-01	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 12	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 70	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 80	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 4	0	13	13	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 4	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 30	0	7.E-02	7.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 5	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 80	0	5.E-04	5.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	10	10	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	342	342	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 41: Comparison data for NPL sample IM100258

ID	IM100259		
Year Removed	1997	Core	9
Channel	1517/CR	Slice	2

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	not required	386200	1232000	2228000	417925	4.0E+02	1.0E+09	3.00E+03	3.0E+12	1.0E+13
C14	not required	258400	157400	171000	56675	1.0E+04	8.0E+06	1.50E+01	1.5E+10	5.0E+10
Cl36	not required	380	1966	3039	320	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Na22	< 7	0	0	0	0	4.0E+03	4.0E+08	4.50E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Co60	3000 ± 800	27500	20690	41020	10845	3.0E+03	4.0E+08	6.00E+02	6.0E+11	2.0E+12
Sr85	< 1.2	0	0	0	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Nb94	< 1.7	371	6.E-05	6.E-05	2.E-01	4.0E+03	5.0E+08	4.50E+03	4.5E+12	1.5E+13
Ag108m	< 1.5	8	1.E-06	1.E-06	2	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Cd109	< 24	1	0	0	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Sb125	< 4	32	3	3	0	2.0E+04	2.0E+09	4.50E+03	4.5E+12	1.5E+13
Sn126	< 1.8	5.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.50E+03	4.5E+12	1.5E+13
I129	< 14	2.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.50E+01	1.5E+10	5.0E+10
Ba133	1400 ± 300	1202	2075	5787	55	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Cs134	22 ± 6	1916	1495	1524	0	4.0E+03	6.0E+08	4.50E+03	4.5E+12	1.5E+13
Cs137	61 ± 14	425	1751	1751	0	1.0E+04	2.0E+09	4.50E+03	4.5E+12	1.5E+13
Eu152	< 4	1.E-02	9.E-03	9.E-03	28	4.0E+03	8.0E+08	4.50E+03	4.5E+12	1.5E+13
Eu154	240 ± 60	303	241	241	701	3.0E+03	7.0E+08	4.50E+03	4.5E+12	1.5E+13
Eu155	94 ± 22	142	116	116	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Ho166m	< 1.5	15	2.E-01	2.E-01	2	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Bi207	< 4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 30	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 25	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 4	0	14	14	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 1.3	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	0	0	8.E-02	8.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 1.9	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 30	0	5.E-04	5.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	12	12	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	375	375	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 42: Comparison data for NPL sample IM100259

ID	IM100260		
Year Removed	1997	Core	9
Channel	1517/CR	Slice	(1) or 3

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	24000 ± 8000	386100	1232000	2228000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	77400 ± 4400	256800	156400	169900	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	6.4 ± 4.4	379	1961	3031	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 6	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	3500 ± 800	27420	20630	40900	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 1.1	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 1.9	369	5.E-05	6.E-05	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	1.05 ± 0.46	8	1.E-06	1.E-06	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 25	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 5	32	3	3	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 1.9	5.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 14	2.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1390 ± 280	1197	2066	5761	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	22 ± 6	1924	1501	1530	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	58 ± 14	422	1742	1742	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 5	1.E-02	9.E-03	9.E-03	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	250 ± 60	306	243	244	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	95 ± 24	143	117	117	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.6	15	2.E-01	2.E-01	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 30	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 30	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 5	0	14	14	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 1.3	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 11	0	8.E-02	8.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 2.0	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 30	0	5.E-04	5.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	12	12	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	376	376	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 43: Comparison data for NPL sample IM100260

ID	IM100261		
Year Removed	1997	Core	9
Channel	1517/CR	Slice	1 or (3)

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	2700 ± 1000	386200	1232000	2228000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	84100 ± 4600	258500	157400	171000	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	6.2 ± 4.2	380	1966	3039	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 5	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	2700 ± 600	27500	20700	41020	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 1.0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 1.7	371	6.E-05	6.E-05	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 1.5	8	1.E-06	1.E-06	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 24	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 4	32	3	3	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 1.8	5.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 15	2.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1420 ± 300	1202	2076	5788	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	23 ± 6	1916	1495	1524	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	61 ± 14	425	1751	1751	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 5	1.E-02	9.E-03	9.E-03	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	250 ± 60	303	241	241	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	96 ± 24	142	116	116	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.6	15	2.E-01	2.E-01	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 30	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 30	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 4	0	14	14	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 12	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 11	0	8.E-02	8.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 2.0	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 30	0	5.E-04	5.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	12	12	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	375	375	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 44: Comparison data for NPL sample IM100261

ID	IM100262		
Year Removed	1997	Core	13
Channel	1517/CR	Slice	(1) or 3

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	122000 ± 42000	386200	1232000	2228000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	82100 ± 4600	258200	157200	170800	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	7.0 ± 4.8	380	1965	3038	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 5	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	17800 ± 3800	27490	20680	41000	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 3	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 5	370	5.E-05	6.E-05	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 3	8	1.E-06	1.E-06	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 40	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 10	32	3	3	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 5	5.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 19	2.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	280 ± 60	1201	2074	5783	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	15.9 ± 4.2	1918	1496	1525	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	70 ± 18	425	1749	1750	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 10	1.E-02	9.E-03	9.E-03	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	193 ± 44	304	241	241	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	76 ± 22	142	116	116	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 3	15	2.E-01	2.E-01	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 9	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 50	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 60	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 2.1	0	14	14	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 24	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 18	0	8.E-02	8.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 4	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 60	0	5.E-04	5.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	12	12	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	375	375	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 45: Comparison data for NPL sample IM100262

ID	IM100263		
Year Removed	1997	Core	13
Channel	1517/CR	Slice	1 or (3)

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	8900 ± 3000	386300	1232000	2228000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	103000 ± 6000	259800	158200	171900	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	6.3 ± 4.2	381	1970	3045	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 8	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	17600 ± 4000	27570	20750	41120	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 7	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 11	372	6.E-05	6.E-05	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 8	8	1.E-06	1.E-06	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 80	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 22	32	3	3	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 10	5.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 50	2.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	320 ± 80	1206	2083	5809	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	19 ± 8	1911	1491	1520	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	69 ± 26	427	1759	1759	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 22	1.E-02	8.E-03	8.E-03	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	205 ± 48	300	238	239	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	76 ± 20	141	115	115	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 6	15	2.E-01	2.E-01	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 21	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 90	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 130	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 8	0	14	14	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 50	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 40	0	9.E-02	9.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 7	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 110	0	5.E-04	5.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	12	12	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	374	374	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 46: Comparison data for NPL sample IM100263

ID	IM100264		
Year Removed	1997	Core	18
Channel	1517/CR	Slice	1

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	14 ± 8	381700	1225000	2216000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	55600 ± 3200	167400	101900	110700	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	< 2.0	303	1579	2440	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 3	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	11.5 ± 3.0	21240	15950	31940	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 0.4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 0.5	257	4.E-05	4.E-05	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 0.5	10	1.E-06	1.E-06	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 15	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 1.3	14	2	2	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 0.4	2.E-08	1.E-02	1.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 9	7.E-03	2.E-03	2.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	310 ± 80	842	1454	4053	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 0.5	2155	1689	1704	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 0.5	273	1060	1060	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 1.5	3.E-02	3.E-02	3.E-02	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	79 ± 18	673	572	579	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	32 ± 10	263	225	227	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 0.8	8	4.E-01	5.E-01	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 0.7	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 15	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 10	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 2.0	0	15	15	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 0.8	0	2	2	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 6	0	3.E-02	3.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 1.0	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 15	0	6.E-04	6.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	16	16	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	4	4	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	389	389	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 47: Comparison data for NPL sample IM100264

ID	IM100265		
Year Removed	2003	Core	4
Channel	1112/02	Slice	1

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	2600 ± 1000	524000	1686000	3050000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	69800 ± 4400	96400	58480	63590	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	7 ± 6	206	1080	1670	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 20	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	2.E-05	2.E-05	3.E-05	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	36000 ± 8000	24760	18580	37390	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 9	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 15	166	3.E-05	3.E-05	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	20 ± 8	10	1.E-06	1.E-06	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 110	6	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 30	19	5	5	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 14	6.E-09	6.E-03	6.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 60	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1060 ± 240	682	1178	3284	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	101 ± 26	10320	8104	8147	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	85 ± 24	169	726	726	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 30	2.E-01	1.E-01	1.E-01	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	740 ± 160	2523	2301	2417	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	390 ± 100	1248	1137	1191	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 8	4	1	1	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 30	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 130	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 180	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 7	0	15	15	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 50	0	1	1	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 60	0	6.E-03	6.E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	7.E-02	7.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 10	0	9.E-07	9.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 160	0	7.E-04	7.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	30	30	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	4	4	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	565	565	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 48: Comparison data for NPL sample IM100265

ID	IM100266		
Year Removed	2003	Core	5
Channel	1112/02	Slice	3

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	370 ± 120	536400	1715000	3100000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	124000 ± 8000	173700	105500	114700	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	10 ± 8	310	1616	2497	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 7	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	3.E-05	3.E-05	6.E-05	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	17400 ± 4000	37050	27830	55650	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 6	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 10	278	6.E-05	6.E-05	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 7	10	2.E-06	2.E-06	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 80	15	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 20	45	8	8	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 9	2.E-08	1.E-02	1.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 50	8.E-03	2.E-03	2.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1940 ± 420	1129	1950	5438	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	168 ± 38	11870	9307	9419	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	52 ± 22	306	1280	1280	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 21	5.E-02	4.E-02	4.E-02	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	230 ± 60	1011	854	863	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	134 ± 32	577	490	495	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 6	9	4.E-01	4.E-01	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 20	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 100	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 130	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 8	0	12	12	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 5	0	2	2	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 40	0	3.E-02	3.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 7	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 110	0	6.E-04	6.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	21	21	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	4	4	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	533	533	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 49: Comparison data for NPL sample IM100266

ID	IM100267		
Year Removed	2003	Core	11
Channel	1112/02	Slice	1

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	86000 ± 30000	547500	1730000	3123000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	148000 ± 10000	268600	163500	177700	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	7 ± 6	387	1996	3085	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 6	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	4.E-05	5.E-05	8.E-05	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	54000 ± 12000	46800	35230	69630	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 10	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 17	394	9.E-05	1.E-04	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	16 ± 8	8	2.E-06	2.E-06	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 90	26	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 40	86	11	11	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 16	5.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 70	2.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1960 ± 440	1574	2717	7576	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	175 ± 40	10670	8315	8516	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	114 ± 28	477	1866	1866	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 40	2.E-02	1.E-02	1.E-02	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	370 ± 100	469	370	370	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	210 ± 60	315	256	256	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 9	14	2.E-01	2.E-01	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 40	2.E-05	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 150	0	6.E-11	6.E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 210	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 12	0	10	10	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 60	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 60	0	7.E-02	7.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 11	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 180	0	5.E-04	5.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	15	15	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	4	4	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	473	473	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 50: Comparison data for NPL sample IM100267

ID	IM100268		
Year Removed	2003	Core	17
Channel	1112/02	Slice	1

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	not required	536400	1715000	3100000	417925	4.0E+02	1.0E+09	3.00E+03	3.0E+12	1.0E+13
C14	not required	173800	105600	114800	56675	1.0E+04	8.0E+06	1.50E+01	1.5E+10	5.0E+10
Cl36	not required	310	1616	2498	320	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Na22	< 17	0	0	0	0	4.0E+03	4.0E+08	4.50E+03	4.5E+12	1.5E+13
Co57	0	3.E-05	3.E-05	6.E-05	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Co60	58000 ± 14000	37060	27850	55670	10845	3.0E+03	4.0E+08	6.00E+02	6.0E+11	2.0E+12
Sr85	< 12	0	0	0	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Nb94	< 19	278	6.E-05	6.E-05	2.E-01	4.0E+03	5.0E+08	4.50E+03	4.5E+12	1.5E+13
Ag108m	8.8 ± 4.2	10	2.E-06	2.E-06	2	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Cd109	< 130	15	0	0	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Sb125	< 40	45	8	8	0	2.0E+04	2.0E+09	4.50E+03	4.5E+12	1.5E+13
Sn126	< 17	2.E-08	1.E-02	1.E-02	0	2.0E+03	5.0E+08	4.50E+03	4.5E+12	1.5E+13
I129	< 80	8.E-03	2.E-03	2.E-03	0	3.0E+02	2.0E+10	1.50E+01	1.5E+10	5.0E+10
Ba133	1460 ± 320	1130	1951	5440	55	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Cs134	133 ± 30	11870	9308	9420	0	4.0E+03	6.0E+08	4.50E+03	4.5E+12	1.5E+13
Cs137	49 ± 28	306	1281	1281	0	1.0E+04	2.0E+09	4.50E+03	4.5E+12	1.5E+13
Eu152	< 40	5.E-02	4.E-02	4.E-02	28	4.0E+03	8.0E+08	4.50E+03	4.5E+12	1.5E+13
Eu154	230 ± 60	1010	854	862	701	3.0E+03	7.0E+08	4.50E+03	4.5E+12	1.5E+13
Eu155	136 ± 34	577	490	494	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Ho166m	< 10	9	4.E-01	4.E-01	2	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Bi207	< 40	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 160	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 230	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 13	0	12	12	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 90	0	2	2	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 70	0	3.E-02	3.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	< 1.3	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	< 1.3	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 12	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	< 1.7	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 190	0	6.E-04	6.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	< 4.9	0	21	21	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	< 0.53	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	< 0.53	0	4	4	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	69 ± 8	0	532	532	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 51: Comparison data for NPL sample IM100268

ID	IM100269		
Year Removed	2003	Core	12
Channel	1224/CR	Slice	1

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	30000 ± 10000	543300	1725000	3117000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	186000 ± 10000	241800	147500	160200	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	16 ± 12	369	1910	2953	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 9	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	3.E-05	4.E-05	6.E-05	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	50000 ± 12000	44270	33300	66070	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 6	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 9	354	7.E-05	8.E-05	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 6	9	2.E-06	2.E-06	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 60	23	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 18	78	11	11	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 9	3.E-08	2.E-02	2.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 40	1.E-02	3.E-03	3.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1730 ± 380	1458	2517	7018	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	109 ± 28	11120	8683	8863	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	91 ± 28	426	1803	1803	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 19	2.E-02	2.E-02	2.E-02	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	280 ± 80	540	436	437	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	167 ± 50	355	292	293	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 5	15	2.E-01	3.E-01	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 18	1.E-05	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 80	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 110	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 7	0	11	11	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 40	0	3	3	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 40	0	7.E-02	7.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 6	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 100	0	5.E-04	5.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	17	17	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	4	4	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	514	514	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 52: Comparison data for NPL sample IM100269

ID	IM100270		
Year Removed	2003	Core	17
Channel	1224/CR	Slice	1

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	not required	532100	1707000	3087000	417925	4.0E+02	1.0E+09	3.00E+03	3.0E+12	1.0E+13
C14	not required	143300	87230	94790	56675	1.0E+04	8.0E+06	1.50E+01	1.5E+10	5.0E+10
Cl36	not required	274	1430	2211	320	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Na22	< 5	0	0	0	0	4.0E+03	4.0E+08	4.50E+03	4.5E+12	1.5E+13
Co57	0	2.E-05	2.E-05	4.E-05	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Co60	20300 ± 4400	32560	24450	49030	10845	3.0E+03	4.0E+08	6.00E+02	6.0E+11	2.0E+12
Sr85	< 3	0	0	0	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Nb94	< 5	232	4.E-05	5.E-05	2.E-01	4.0E+03	5.0E+08	4.50E+03	4.5E+12	1.5E+13
Ag108m	< 5	11	1.E-06	1.E-06	2	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Cd109	< 50	12	0	0	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Sb125	< 11	35	8	8	0	2.0E+04	2.0E+09	4.50E+03	4.5E+12	1.5E+13
Sn126	< 5	1.E-08	1.E-02	1.E-02	0	2.0E+03	5.0E+08	4.50E+03	4.5E+12	1.5E+13
I129	< 21	6.E-03	2.E-03	2.E-03	0	3.0E+02	2.0E+10	1.50E+01	1.5E+10	5.0E+10
Ba133	320 ± 80	959	1656	4619	55	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Cs134	57 ± 14	11840	9290	9376	0	4.0E+03	6.0E+08	4.50E+03	4.5E+12	1.5E+13
Cs137	100 ± 24	251	1136	1136	0	1.0E+04	2.0E+09	4.50E+03	4.5E+12	1.5E+13
Eu152	< 11	7.E-02	6.E-02	6.E-02	28	4.0E+03	8.0E+08	4.50E+03	4.5E+12	1.5E+13
Eu154	222 ± 50	1374	1190	1214	701	3.0E+03	7.0E+08	4.50E+03	4.5E+12	1.5E+13
Eu155	129 ± 30	755	656	667	0	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Ho166m	< 3	7	5.E-01	1	2	0.0E+00	0.0E+00	4.50E+03	4.5E+12	1.5E+13
Bi207	< 10	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 50	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 70	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 2.5	0	14	14	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 7	0	2	2	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 20	0	2.E-02	2.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	< 0.064	0	7.E-02	7.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	< 0.064	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 4	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	< 0.050	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 60	0	6.E-04	6.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	< 3.8	0	26	26	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	< 0.97	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	< 0.97	0	4	4	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	37.6 ± 3.6	0	583	583	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 53: Comparison data for NPL sample IM100270

ID	IM100271		
Year Removed	2003	Core	21
Channel	1224/CR	Slice	3

	01/06/2011 Activity (Bq/g)					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	26000 ± 10000	496700	1604000	2902000	417925	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	39900 ± 2200	49180	29680	32310	56675	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	8 ± 6	119	624	964	320	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 23	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	14200 ± 3000	13790	10350	20890	10845	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 2.4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 4	72	4.E-06	4.E-06	2.E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 3	7	0	0	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 50	1	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 9	5	2	2	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 4	0	2.E-03	2.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 100	8.E-04	6.E-04	6.E-04	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	1050 ± 220	331	572	1595	55	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	59 ± 14	6127	4812	4823	0	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	38 ± 12	86	234	234	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 9	1	1	1	28	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	910 ± 200	4041	4161	4685	701	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	490 ± 120	1926	1984	2233	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 2.5	4	1	1	2	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 8	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 50	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 60	0	1.E-04	1.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 4	0	9	9	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 7	0	8.E-02	8.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 17	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	0	0	5.E-02	5.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	0	0	6.E-03	6.E-03	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 4	0	2.E-06	2.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	0	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 50	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	0	0	12	12	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	0	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	0	0	3	3	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	0	0	289	289	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 54: Comparison data for NPL sample IM100271

Tritium			Activity (Bq/g)			
Sample ID	Year	Location	NPL Active	FISPACT - Average	FISPACT - Maximum	RWI 2007
IM100246	1997	1608/03/1/1 or 3	142000 ± 48000	532,600	963,900	417,925
IM100247	1997	1608/03/1/1 or 3	12500 ± 4200	531,200	961,300	417,925
IM100248	1997	1608/03/11/1 or 3	not required	1,213,000	2,195,000	417,925
IM100249	1997	1608/03/11/1 or 3	not required	1,213,000	2,195,000	417,925
IM100250	1997	1608/03/22/1 or 3	48 ± 18	595,800	1,078,000	417,925
IM100251	1997	1608/03/22/1 or 3	340 ± 120	594,400	1,076,000	417,925
IM100252	1997	1608/03/9/3	12800 ± 4400	1,208,000	2,185,000	417,925
IM100253	1997	1608/03/13/3	12100 ± 4200	1,208,000	2,186,000	417,925
IM100254	1997	1608/03/18/3	not required	1,183,000	2,142,000	417,925
IM100255	1997	0818/15/10/1 or 3	8300 ± 2800	1,234,000	2,230,000	417,925
IM100256	1997	0818/15/10/1 or 3	5700 ± 2000	1,234,000	2,230,000	417,925
IM100257	1997	0818/CR/10/1 or 3	15000 ± 6000	1,233,000	2,230,000	417,925
IM100258	1997	0818/CR/10/1 or 3	34000 ± 12000	1,233,000	2,230,000	417,925
IM100259	1997	1517/CR/9/2	not required	1,232,000	2,228,000	417,925
IM100260	1997	1517/CR/9/1 or 3	24000 ± 8000	1,232,000	2,228,000	417,925
IM100261	1997	1517/CR/9/1 or 3	2700 ± 1000	1,232,000	2,228,000	417,925
IM100262	1997	1517/CR/13/1 or 3	122000 ± 42000	1,232,000	2,228,000	417,925
IM100263	1997	1517/CR/13/1 or 3	8900 ± 3000	1,232,000	2,228,000	417,925
IM100264	1997	1517/CR/18/1	14 ± 8	1,225,000	2,216,000	417,925
IM100265	2003	1112/02/4/1	2600 ± 1000	1,686,000	3,050,000	417,925
IM100266	2003	1112/02/5/1	370 ± 120	1,715,000	3,100,000	417,925
IM100267	2003	1112/02/11/1	86000 ± 30000	1,730,000	3,123,000	417,925
IM100268	2003	1112/02/17/1	not required	1,715,000	3,100,000	417,925
IM100269	2003	1224/CR/12/1	30000 ± 10000	1,725,000	3,117,000	417,925
IM100270	2003	1224/CR/17/1	not required	1,707,000	3,087,000	417,925
IM100271	2003	1224/CR/21/3	26000 ± 10000	1,604,000	2,902,000	417,925

Table 55: Summary Table for Tritium - Wylfa

Carbon-14			Activity (Bq/g)			
Sample ID	Year	Location	NPL Active	FISPACT - Average	FISPACT - Maximum	RWI 2007
IM100246	1997	1608/03/1/1 or 3	22900 ± 1200	5,107	5,564	56,675
IM100247	1997	1608/03/1/1 or 3	35700 ± 1800	5,090	5,545	56,675
IM100248	1997	1608/03/11/1 or 3	not required	65,200	70,840	56,675
IM100249	1997	1608/03/11/1 or 3	not required	65,010	70,630	56,675
IM100250	1997	1608/03/22/1 or 3	20800 ± 1000	5,907	6,433	56,675
IM100251	1997	1608/03/22/1 or 3	17300 ± 800	5,888	6,413	56,675
IM100252	1997	1608/03/9/3	59700 ± 2800	55,160	59,930	56,675
IM100253	1997	1608/03/13/3	49400 ± 3200	55,470	60,270	56,675
IM100254	1997	1608/03/18/3	not required	35,920	39,030	56,675
IM100255	1997	0818/15/10/1 or 3	84000 ± 6000	168,300	182,800	56,675
IM100256	1997	0818/15/10/1 or 3	98000 ± 8000	167,800	182,200	56,675
IM100257	1997	0818/CR/10/1 or 3	83600 ± 4800	166,000	180,300	56,675
IM100258	1997	0818/CR/10/1 or 3	86200 ± 4800	167,100	181,500	56,675
IM100259	1997	1517/CR/9/2	not required	157,400	171,000	56,675
IM100260	1997	1517/CR/9/1 or 3	77400 ± 4400	156,400	169,900	56,675
IM100261	1997	1517/CR/9/1 or 3	84100 ± 4600	157,400	171,000	56,675
IM100262	1997	1517/CR/13/1 or 3	82100 ± 4600	157,200	170,800	56,675
IM100263	1997	1517/CR/13/1 or 3	103000 ± 6000	158,200	171,900	56,675
IM100264	1997	1517/CR/18/1	55600 ± 3200	101,900	110,700	56,675
IM100265	2003	1112/02/4/1	69800 ± 4400	58,480	63,590	56,675
IM100266	2003	1112/02/5/1	124000 ± 8000	105,500	114,700	56,675
IM100267	2003	1112/02/11/1	148000 ± 10000	163,500	177,700	56,675
IM100268	2003	1112/02/17/1	not required	105,600	114,800	56,675
IM100269	2003	1224/CR/12/1	186000 ± 10000	147,500	160,200	56,675
IM100270	2003	1224/CR/17/1	not required	87,230	94,790	56,675
IM100271	2003	1224/CR/21/3	39900 ± 2200	29,680	32,310	56,675

Table 56: Summary Table for Carbon-14 - Wylfa

Chlorine-36			Activity (Bq/g)			
Sample ID	Year	Location	NPL Active	FISPACT - Average	FISPACT - Maximum	RWI 2007
IM100246	1997	1608/03/1/1 or 3	< 34	120	185	320
IM100247	1997	1608/03/1/1 or 3	< 900	120	185	320
IM100248	1997	1608/03/11/1 or 3	not required	1,164	1,800	320
IM100249	1997	1608/03/11/1 or 3	not required	1,162	1,796	320
IM100250	1997	1608/03/22/1 or 3	2.1 ± 2	138	213	320
IM100251	1997	1608/03/22/1 or 3	1.7 ± 1.6	137	212	320
IM100252	1997	1608/03/9/3	< 3.1	1,025	1,585	320
IM100253	1997	1608/03/13/3	2.4 ± 2.2	1,030	1,592	320
IM100254	1997	1608/03/18/3	not required	721	1,115	320
IM100255	1997	0818/15/10/1 or 3	10 ± 8	2,013	3,111	320
IM100256	1997	0818/15/10/1 or 3	10 ± 8	2,011	3,108	320
IM100257	1997	0818/CR/10/1 or 3	4.9 ± 3.4	2,003	3,096	320
IM100258	1997	0818/CR/10/1 or 3	5.8 ± 4.0	2,008	3,103	320
IM100259	1997	1517/CR/9/2	not required	1,966	3,039	320
IM100260	1997	1517/CR/9/1 or 3	6.4 ± 4.4	1,961	3,031	320
IM100261	1997	1517/CR/9/1 or 3	6.2 ± 4.2	1,966	3,039	320
IM100262	1997	1517/CR/13/1 or 3	7.0 ± 4.8	1,965	3,038	320
IM100263	1997	1517/CR/13/1 or 3	6.3 ± 4.2	1,970	3,045	320
IM100264	1997	1517/CR/18/1	< 2.0	1,579	2,440	320
IM100265	2003	1112/02/4/1	7 ± 6	1,080	1,670	320
IM100266	2003	1112/02/5/1	10 ± 8	1,616	2,497	320
IM100267	2003	1112/02/11/1	7 ± 6	1,996	3,085	320
IM100268	2003	1112/02/17/1	not required	1,616	2,498	320
IM100269	2003	1224/CR/12/1	16 ± 12	1,910	2,953	320
IM100270	2003	1224/CR/17/1	not required	1,430	2,211	320
IM100271	2003	1224/CR/21/3	8 ± 6	624	964	320

Table 57: Summary Table for Chlorine-36 - Wylfa

Cobalt-60			Activity (Bq/g)			
Sample ID	Year	Location	NPL Active	FISPACT - Average	FISPACT - Maximum	RWI 2007
IM100246	1997	1608/03/1/1 or 3	1630 ± 360	1,137	2,297	10,845
IM100247	1997	1608/03/1/1 or 3	3000 ± 800	1,133	2,290	10,845
IM100248	1997	1608/03/11/1 or 3	10300 ± 2200	11,340	22,810	10,845
IM100249	1997	1608/03/11/1 or 3	9100 ± 2200	11,310	22,750	10,845
IM100250	1997	1608/03/22/1 or 3	4600 ± 1000	1,329	2,686	10,845
IM100251	1997	1608/03/22/1 or 3	3600 ± 800	1,326	2,679	10,845
IM100252	1997	1608/03/9/3	4500 ± 1000	9,957	20,050	10,845
IM100253	1997	1608/03/13/3	12900 ± 2800	9,998	20,140	10,845
IM100254	1997	1608/03/18/3	22000 ± 6000	6,983	14,090	10,845
IM100255	1997	0818/15/10/1 or 3	9600 ± 2000	21,370	42,270	10,845
IM100256	1997	0818/15/10/1 or 3	23000 ± 6000	21,350	42,220	10,845
IM100257	1997	0818/CR/10/1 or 3	5500 ± 1200	21,230	42,010	10,845
IM100258	1997	0818/CR/10/1 or 3	6200 ± 1400	21,300	42,140	10,845
IM100259	1997	1517/CR/9/2	3000 ± 800	20,690	41,020	10,845
IM100260	1997	1517/CR/9/1 or 3	3500 ± 800	20,630	40,900	10,845
IM100261	1997	1517/CR/9/1 or 3	2700 ± 600	20,700	41,020	10,845
IM100262	1997	1517/CR/13/1 or 3	17800 ± 3800	20,680	41,000	10,845
IM100263	1997	1517/CR/13/1 or 3	17600 ± 4000	20,750	41,120	10,845
IM100264	1997	1517/CR/18/1	11.5 ± 3.0	15,950	31,940	10,845
IM100265	2003	1112/02/4/1	36000 ± 8000	18,580	37,390	10,845
IM100266	2003	1112/02/5/1	17400 ± 4000	27,830	55,650	10,845
IM100267	2003	1112/02/11/1	54000 ± 12000	35,230	69,630	10,845
IM100268	2003	1112/02/17/1	58000 ± 14000	27,850	55,670	10,845
IM100269	2003	1224/CR/12/1	50000 ± 12000	33,300	66,070	10,845
IM100270	2003	1224/CR/17/1	20300 ± 4400	24,450	49,030	10,845
IM100271	2003	1224/CR/21/3	14200 ± 3000	10,350	20,890	10,845

Table 58: Summary Table for Cobalt-60 - Wylfa

Explanation of Results

As for Sizewell A, individual radionuclide trends have been highlighted and discussed in this section.

Where no further comment is made about a trend, equivalent comment has already been made regarding the Sizewell A data.

Additionally, unlike Sizewell A, Wylfa had a greater degree of axial variation within the same fuel channel for different samples. This has allowed graphs to be created showing how the modelled activities and activities determined from the active samples compare for certain key radionuclides.

Tritium

There is a poor relationship between active analysis of the graphite and predicted inventories generated by FISPACT. FISPACT generated tritium inventories that were much higher (several orders of magnitude). Additionally, some samples show large variations for samples taken from different slices of the same core (e.g. IM100246 and 247, IM100260 and 261).

As for Sizewell, FISPACT has generated inventories significantly in excess of the active sampling, however, this is likely due to the same reason whereby FISPACT will not account for mobility of tritium in the graphite, or possible loss during sample storage (although tritium generated in activated graphite tends to be tenacious compared to tritium due to contamination).

Carbon-14

There is a very good degree of agreement between active analysis and FISPACT calculations using the NPL inactive precursor data, as can be seen in Figure 12[4] and Figure 13. The predicted activities are typically within a factor of 2. However, at the extreme top (core 22) and bottom (core 1) this drops to a factor of 3 or 4, with FISPACT under estimating the activity. This suggests that in the extremes of the reactor, FISPACT under-estimates the flux.

The RWI also shows a good level of agreement to the active data, achieving agreement within a factor of 2for results towards the centre of the core (e.g. not extreme top or bottom. Also note previous comments about direct comparisons with RWI data).

Due to the strong relationship to thermal flux in the case of C-14, the under-estimation by FISPACT in the extreme top and bottom suggests that it has underestimated flux in these regions. This is potentially due to neutrons being reflected from components not included in the model.

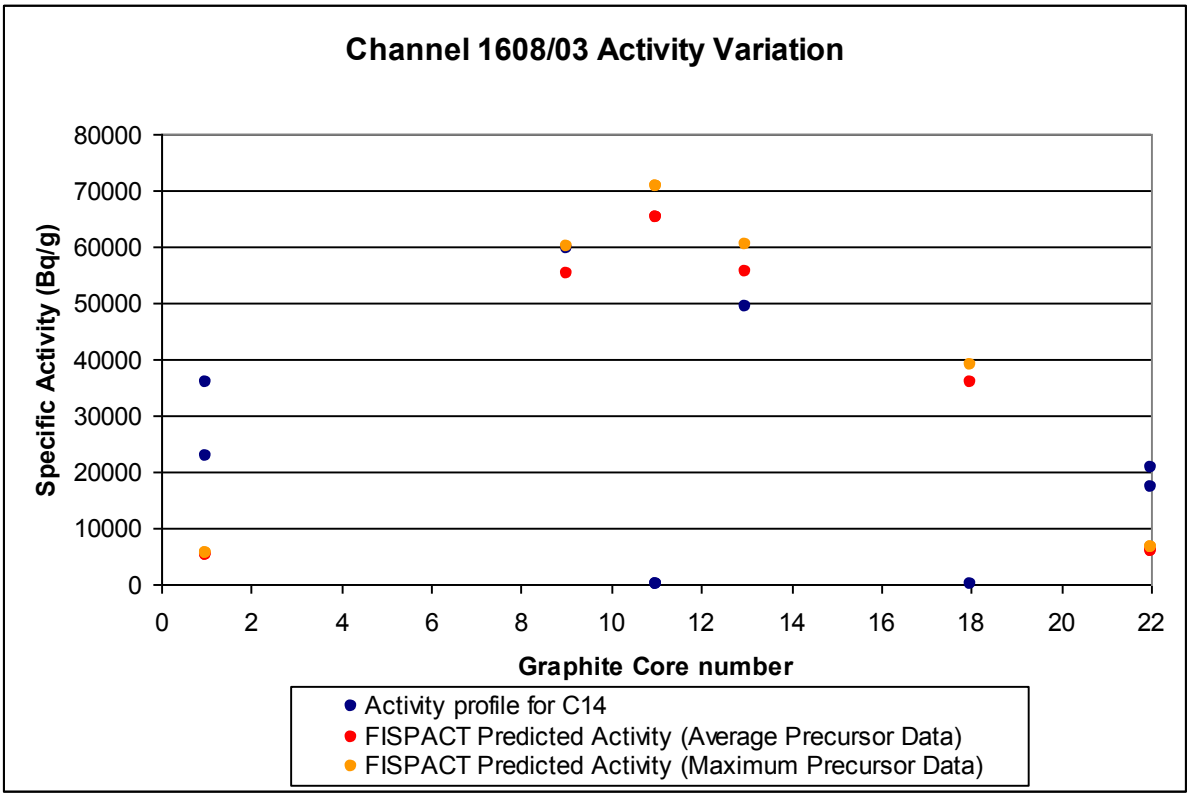

Figure 12: Graph depicting the relationship between active analysis and predicted activity for Channel 1608/03 for C14

[4] Note: Those points with an activity of zero are due to no active analysis being undertaken on these samples.

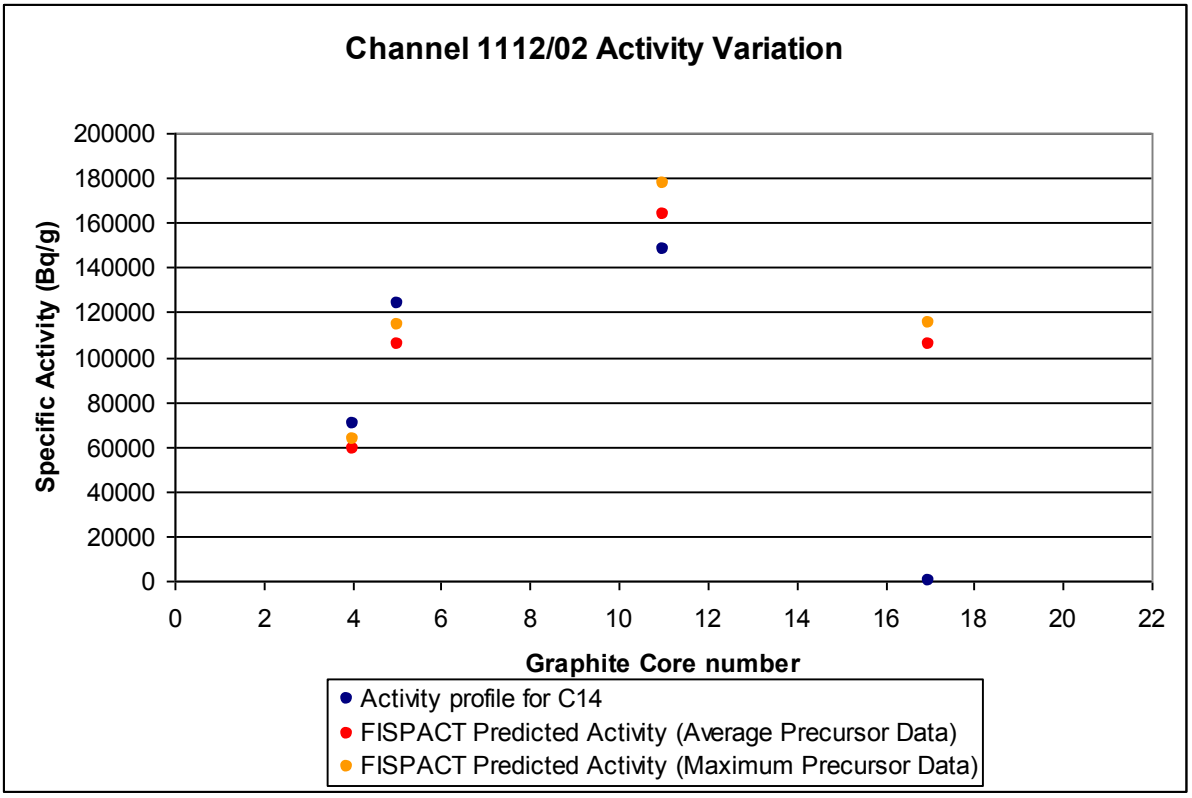

Figure 13: Graph depicting the relationship between active analysis and predicted activity for Channel 1112/02 for C14

Chlorine-36

There was generally a poor relationship between active analysis and FISPACT modelling. FISPACT calculations, when considering all precursors, typically predicted results at least an order of magnitude greater than the NPL active analysis. The RWI2007 value was more in agreement with FISPACT calculations when considering the Jowett precursor data.

The over-prediction is due to mobility and volatility of chlorine nuclides and precursors within graphite, which is not accounted for in FISPACT (and possibly loss from the samples during storage).

Sodium-22

Na-22 did not achieve limit of detection. All FISPACT calculations and the RWI2007 predict no Na-22 activity present.

Cobalt-57

One sample was analysed for Co-57 activity in Wylfa (sample IM100249). The analysed activity was 2 Bq/g. Whilst FISPACT predicted that there would be no Co-57 activity at all in samples removed in 1997 (of which IM100249 forms part), it did predict very small (<< 1 Bq/g) activities in samples removed in 2003.

Given that Co-57 has a half-life of ~250 days, it will have undergone almost 20 half-lives since 1997. Given an activity in 2011 of 2 Bq/g, it would relate to an activity in excess of 1 MBq/g of Co-57 when the sample was removed.

Cobalt-60

There is a good degree (typically within a factor of 2) of agreement between active analysis and FISPACT modelling for Co-60, as can be seen in Figure 14 and Figure 15. There is also a large variation in activities throughout the reactor. RWI gives a good degree of agreement (typically within an order of magnitude, noting previous comments about direct comparisons with RWI data, particularly short half-life nuclides).

The large variation in activity is not just a result of changes in flux. For example, IM100254 has an activity of 22,000 Bq/g of Co-60 and is very close to the top (blocks 18) where flux will be lower than towards the centre of the core. In the same channel, samples IM100252 and 253, which are at the centre of the core (blocks 9 and 13) have a much lower activity (~4,000 Bq/g). This is either due to local variations in precursor data, or metallic contamination (e.g. steel corrosion products) of the graphite sample.

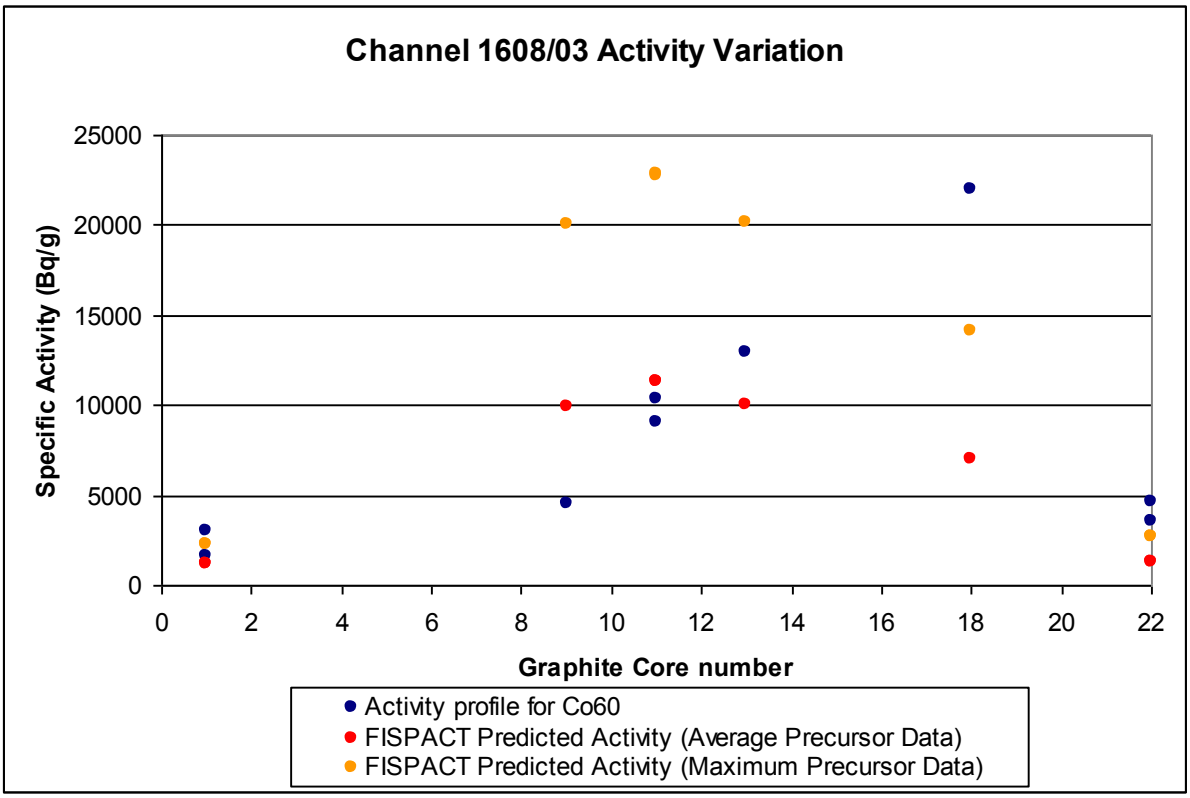

Figure 14: Graph depicting the relationship between active analysis and predicted activity for Channel 1608/03 for Co60

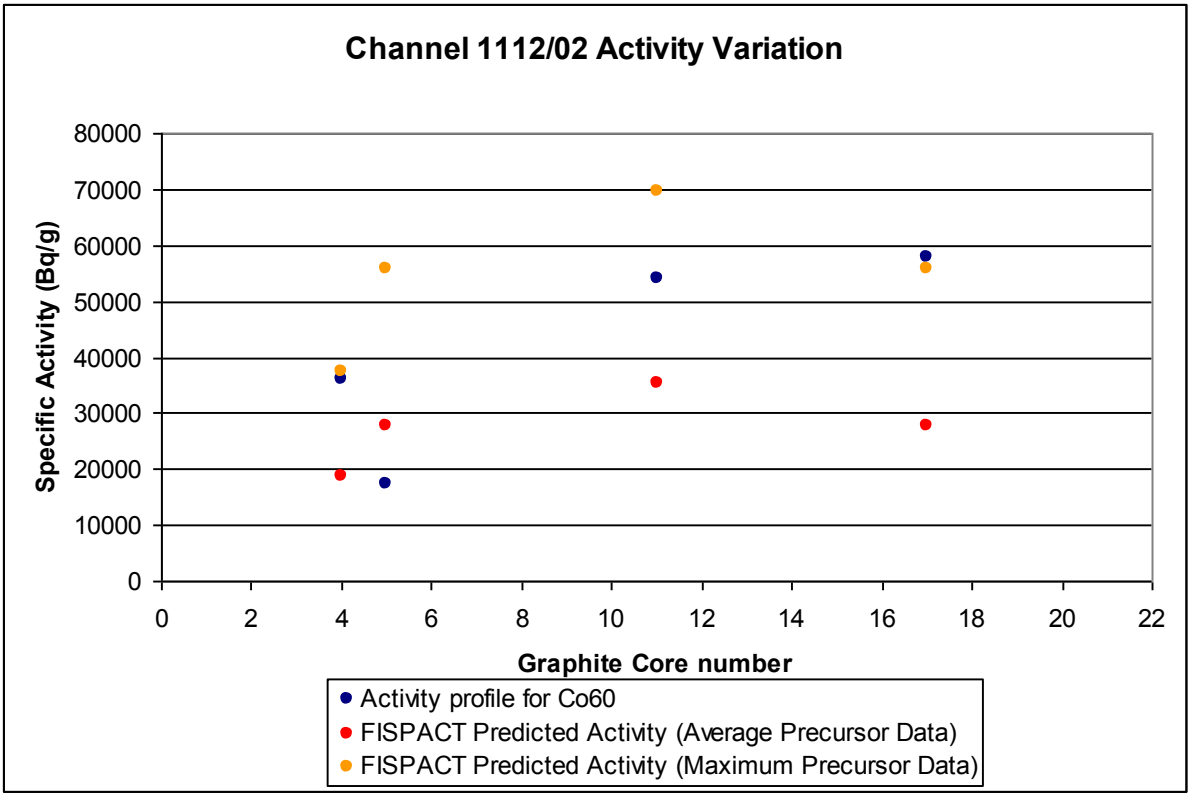

Figure 15: Graph depicting the relationship between active analysis and predicted activity for Channel 1102/02 for Co60

Strontium-85

Sr-85did not achieve limit of detection. All FISPACT calculations and the RWI2007 predict no Sr-85 activity present.

Niobium-94

Nb-94 did not achieve limit of detection. FISPACT predicted very small quantities of Nb-94 to be present when using inactive precursors analysed by NPL. When using Jowett precursors, much higher activities (several orders of magnitude) were predicted. RWI2007 has a stated activity of 0.25 Bq/g, which is much higher than the FISPACT calculations using NPL inactive data, but much lower than when utilising Jowett precursors.

Silver-108(m)

Many samples sent for active analysis did not reach LoD, those that did were typically within a factor of three of the FISPACT calculations utilising Jowett precursors, but many orders of magnitude higher than those utilising NPL inactive data. There is no noticeable trend in activity and variance across the samples of approximately an order of magnitude.

Silver has a half-life of 418 years and is a nuclide noted in LLWR acceptance assessments.

Cadmium-109

Cd-109 did not achieve limit of detection. FISPACT calculations utilising the NPL inactive precursors and the RWI2007 predict no Cd-109 activity present. FISPACT calculations utilising Jowett precursors predict small amounts of Cd-109 as being present.

Antimony-125

Sb-125 did not achieve limit of detection. FISPACT calculations utilising the NPL inactive precursors predicted small activities to be present (~1-10 Bq/g) and the RWI2007 predicted no Sb-125 activity present. FISPACT calculations utilising Jowett precursors predict slightly higher activities than those utilising NPL inactive data of Sb-125 as being present.

Tin-126

Sn-126 did not achieve limit of detection. FISPACT calculations predict very low activities of Sn-126 to be present, and FISPACT models using NPL inactive data predict higher activities than those utilising Jowett precursors. The RWI states no Sn-126 is present.

Iodine-129

I-129 did not achieve limit of detection. FISPACT calculations predict very low activities of I-129 to be present. The RWI states no I-129 is present.

Barium-133

Generally, Ba-133 displayed a good degree of agreement between NPL active results and calculations undertaken using FISPACT (generally within a factor of 2-5).

Active analysis however shows no clear trends in data, with samples taken from within the same fuel channel, 1608/03, having very little variance (~200-350 Bq/g) at the extreme bottom, dead centre and extreme top of the core (Samples IM100246-251), but then having larger just off centre, with one sample, IM100253 having an activity of ~800 Bq/g and another, IM100254 with an activity of 100 Bq/g. It is not clear what causes these variations.

Ba-133 activities in Wylfa show a much lower degree of agreement to Wylfa than Sizewell A. This may be due to other effects within the core. Figure 16 and Figure 17 show how Ba-133 activity varies axially upwards in channels 1608/03 (samples removed in 1997) and 1112/02 (removed 2003), and compares FISPACT calculations to active analysis. It can be seen that there is typically very little variation in activity and certainly much less than FISPACT predicts. However, it can also be seen that there is generally a good degree of agreement between the FISPACT and active analysis.

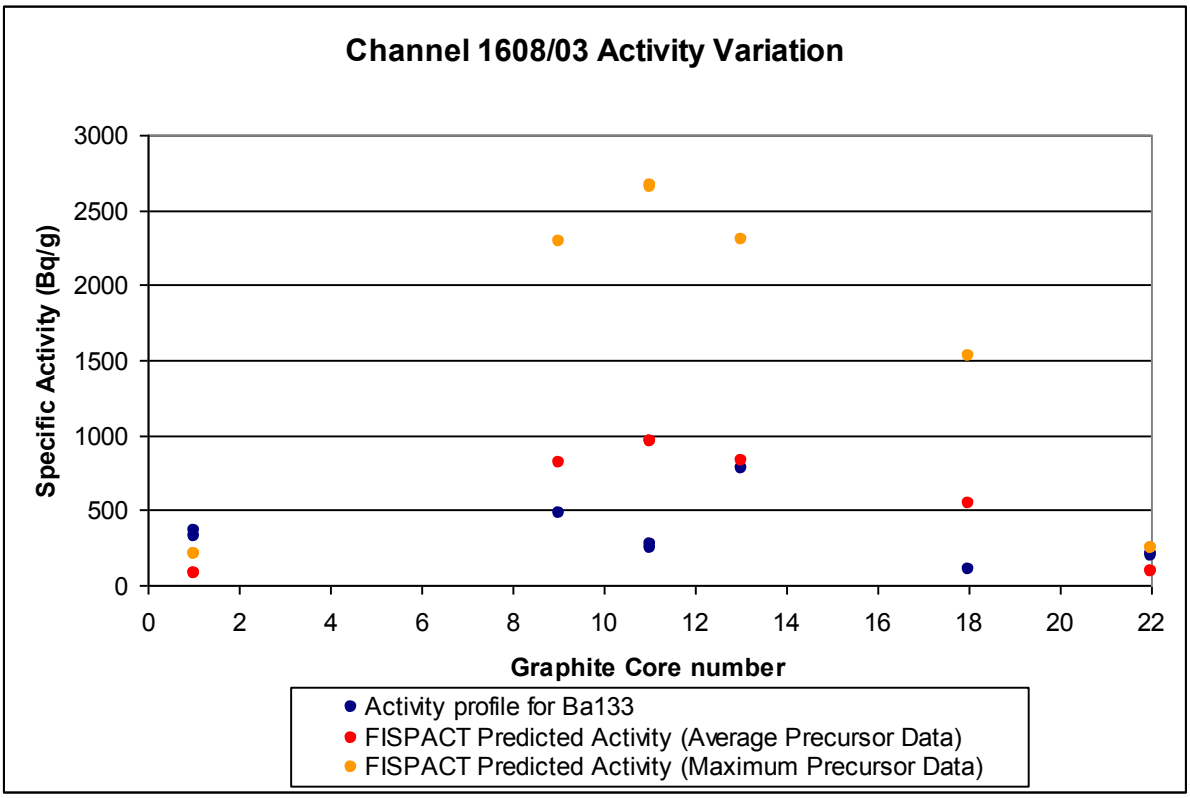

Figure 16: Graph depicting the relationship between active analysis and predicted activity for Channel 1608/03 for Ba-133

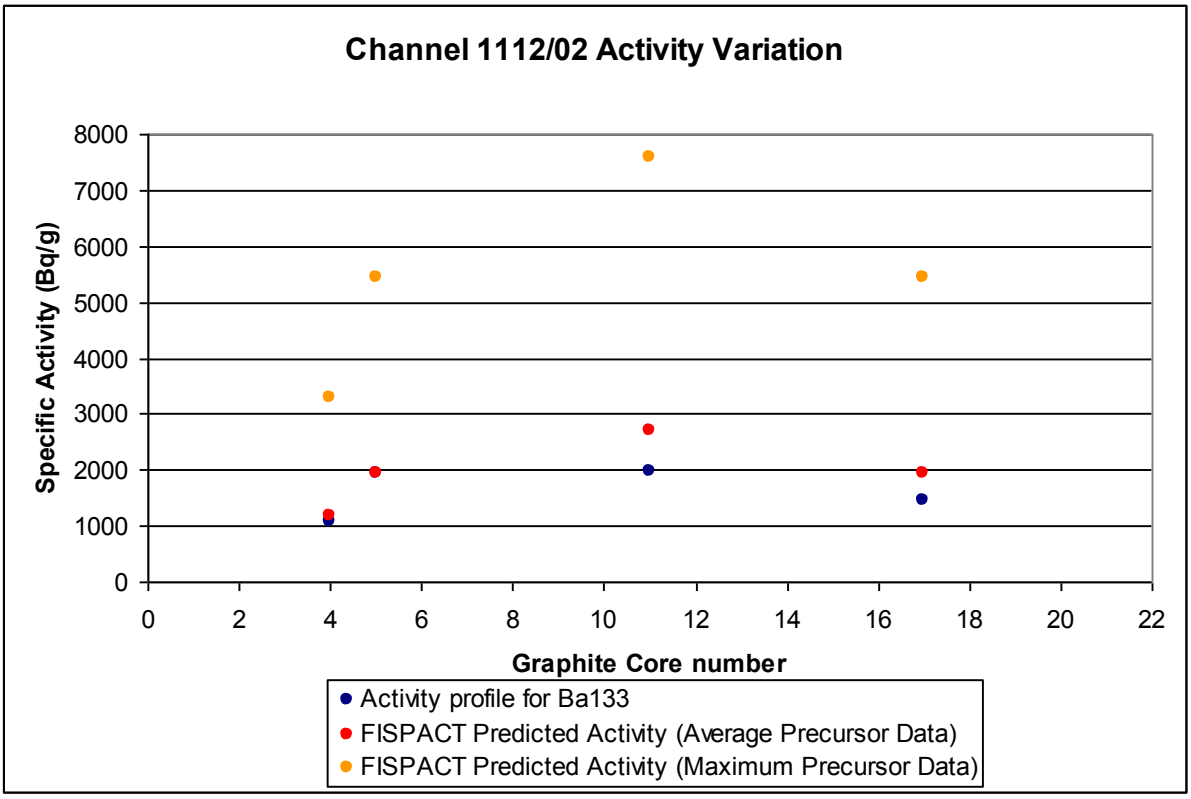

Figure 17: Graph depicting the relationship between active analysis and predicted activity for Channel 1112/02 for Ba-133

Caesium-134

There is poor agreement between active analysis of Cs-134 and modelled inventories (considering all precursors) with the FISPACT calculations typically predicting approximately two to three orders of magnitude greater than the analysed inventory. This is maybe a consequence of default LoD precursor concentrations used in the calculations. The RWI states no Cs-134 is present.

Caesium-137

There is generally poor agreement between active analysis of Cs-137 and modelled inventories (considering all precursors) with the FISPACT calculations typically predicting approximately a factor of 10-30 greater than the analysed inventory. The RWI states no Cs-137 is present.

Europium-152

Eu-152 did not achieve limit of detection. FISPACT calculations predict very low activities of Eu-152 to be present, except in the extreme top and bottom where higher activities (~10 Bq/g are predicted). The RWI states ~40 Bq/g of Eu-152 is present.

Europium-154 and 155

There is generally a good level of agreement between active analysis and FISPACT models for Eu-154/155 activity, typically within a factor of two, and always within an order of magnitude. FISPACT, however, tends to overestimate the measured activities. Additionally, the trend exhibited between the two radionuclides is seen in both the modelled activity and active analysis, where Eu-154 activity is approximately 2-3 times that of Eu-155. The RWI generally gives a good agreement also, being within an order of magnitude for most results.

This over-estimation is likely due to potential precursors (neodymium, gadolinium and samarium) having LoD values.

Figure 18 to Figure 21 shows how europium activities vary axially up channels 1608/03 (samples removed in 1997) and 1112/02 (removed 2003), and compare the results of the FISPACT calculations to the results of the active analysis. It can be seen here that whilst FISPACT typically over estimates activity, it is still generally within a factor of 2-3 of the active results. These graphs also show that there is no clear trend (e.g. higher activity in the centre) in the samples.

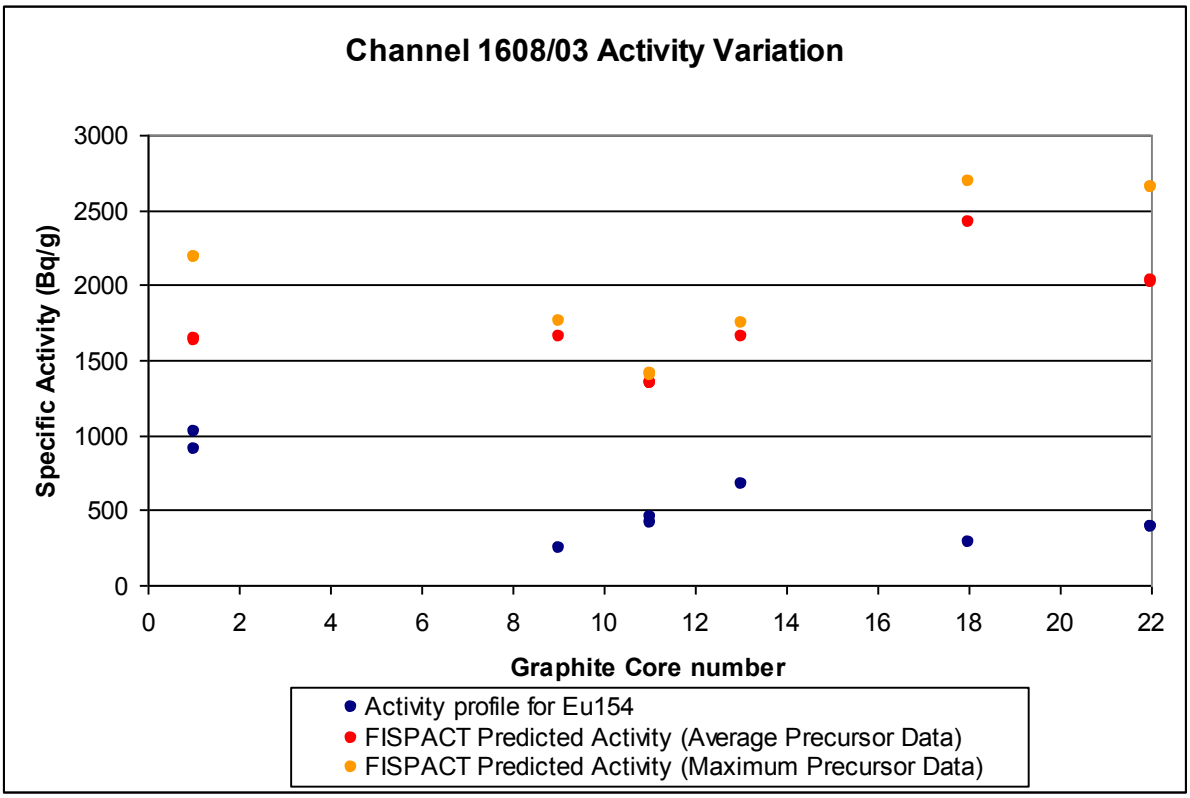

Figure 18: Graph depicting the relationship between active analysis and predicted activity for Channel 1608/03 for Eu-155

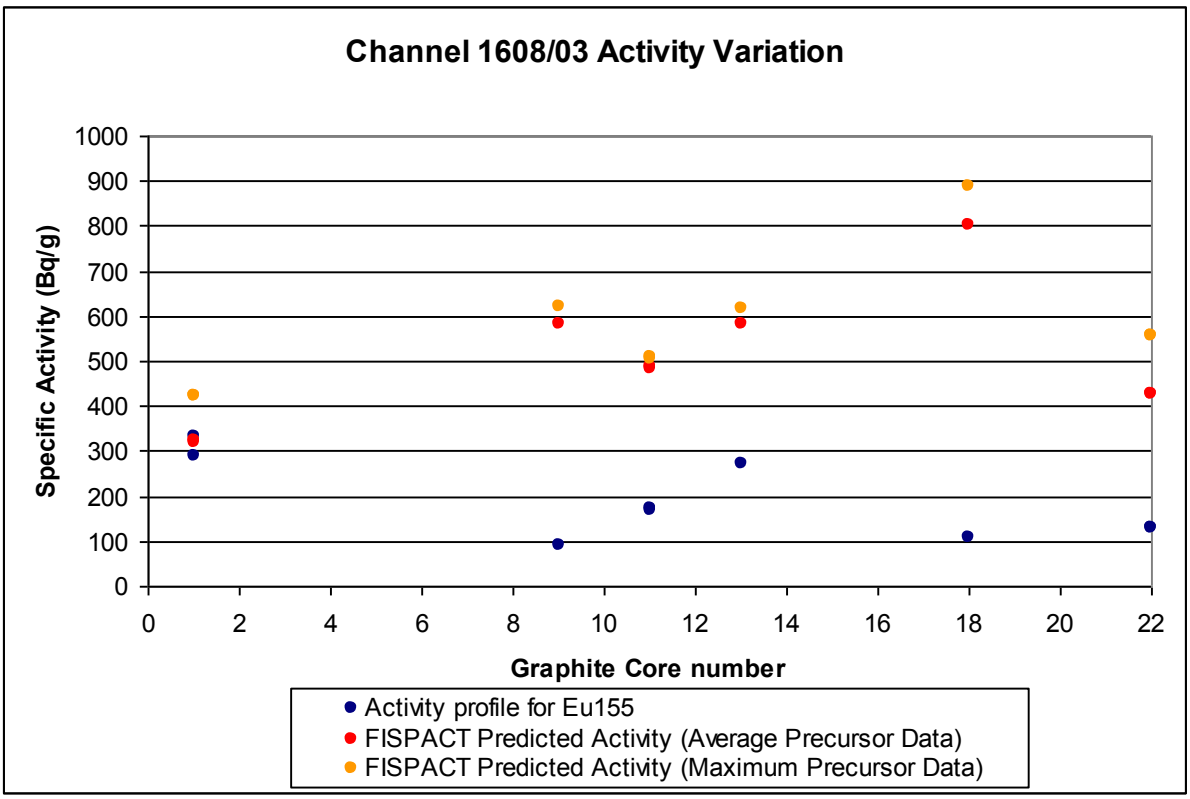

Figure 19: Graph depicting the relationship between active analysis and predicted activity for Channel 1608/03 for Eu155

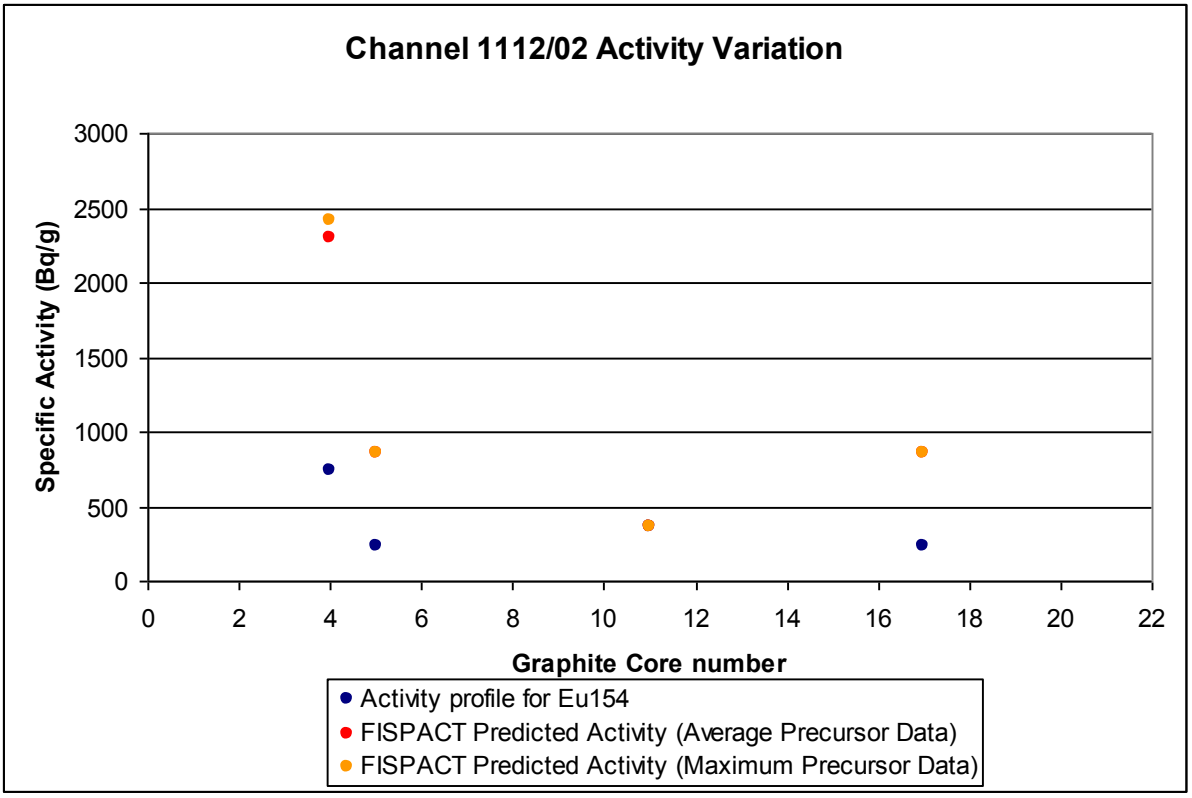

Figure 20: Graph depicting the relationship between active analysis and predicted activity for Channel 1112/02 for Eu-154

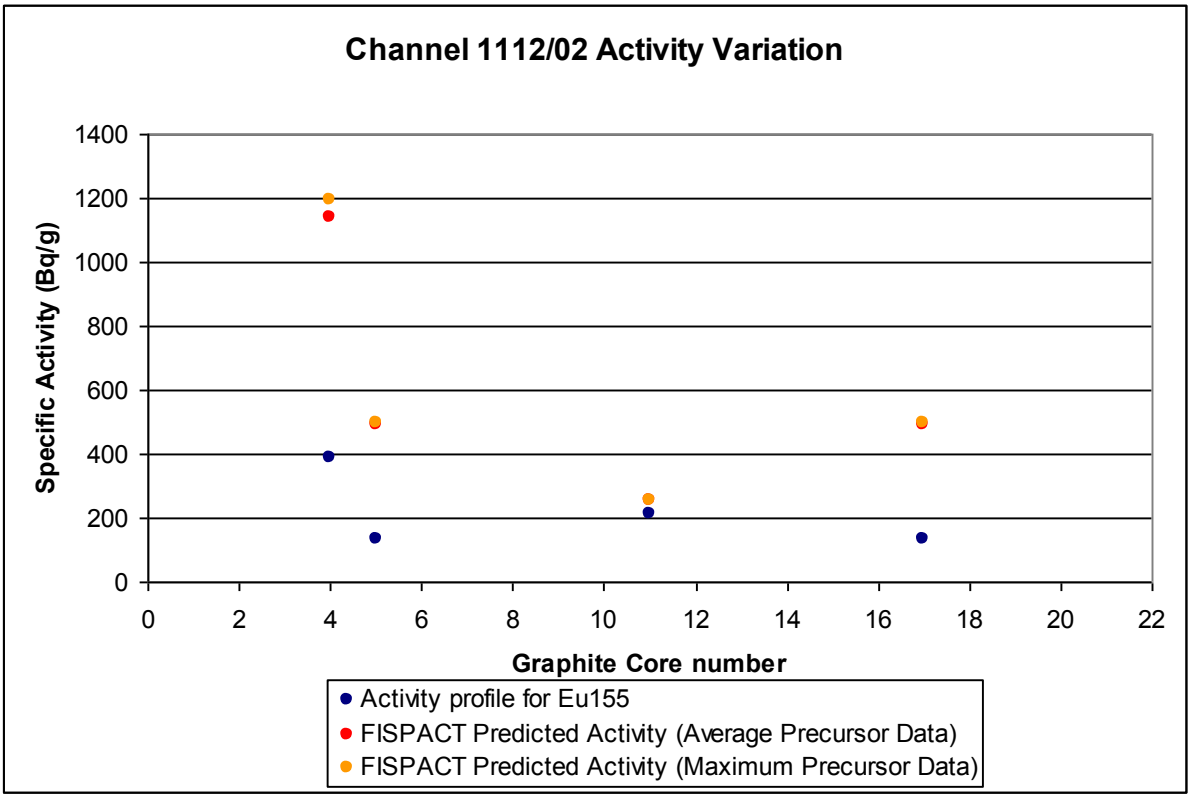

Figure 21: Graph depicting the relationship between active analysis and predicted activity for Channel 1112/02 for Eu-155

Holmium-166(m)

Ho-166m did not achieve limit of detection. FISPACT calculations utilising NPL inactive precursor data predict very low activities of Ho-166m to be present, however, Jowett precursor data predicts reasonable activities (5 - 20 Bq/g). The RWI states ~ 3 Bq/g of Ho-166m is present.

Bismuth-207

Bi-207 did not achieve limit of detection. All FISPACT calculations and the RWI2007 predict no Bi-207 activity present, except the Jowett precursor data which predicts very small (<<< 1 Bq/g) activities are present in samples IM10026 and 269.

Neptunium-236

Np-236 did not achieve limit of detection. All FISPACT calculations and the RWI2007 predict no Np-236 activity present.

Neptunium-237

Np-237 did not achieve limit of detection. FISPACT calculations utilising NPL inactive data predict very low Np-237 activities. FISPACT calculations utilising the Jowett precursor data predicts no Np-237 activity, and the RWI states no activity.

Americium-241

Am-241 did not achieve limit of detection. FISPACT calculations utilising NPL inactive data predict low Am-241 activities (10 - 20 Bq/g). FISPACT calculations utilising the Jowett precursor data predicts no Am-241 activity, and the RWI states no activity.

Americium-243

Am-243 did not achieve limit of detection. FISPACT calculations utilising NPL inactive data predict very low Am-243 activities (0 - 5 Bq/g). FISPACT calculations utilising the Jowett precursor data predicts no Am-243 activity, and the RWI states no activity.

Curium-245

Cm-245 did not achieve limit of detection. FISPACT calculations utilising NPL inactive data predict very low Cm-245 activities. FISPACT calculations utilising the Jowett precursor data predicts no Cm-245 activity, and the RWI states no activity.

Uranium-233 and 234

NPL active analysis grouped U-233 and 234 together for analysis, and only a few samples were measured and of these, none achieved LoD.

Uranium-235

U-235 did not achieve limit of detection. FISPACT calculations utilising NPL inactive data predict extremely low U-235 activities (<< 1 Bq/g). FISPACT calculations utilising the Jowett precursor data predicts no U-235 activity, and the RWI states no activity.

Uranium-236

NPL active analysis only measured a few samples for U-236 and never achieved LoD. FISPACT predicts extremely low activities of U-236.

Uranium-238

U-238 did not achieve limit of detection. FISPACT calculations utilising NPL inactive data predict extremely low U-238 activities (<< 1 Bq/g). FISPACT calculations utilising the Jowett precursor data predicts no U-238 activity, and the RWI states no activity.

Plutonium-238

NPL active analysis for Pu-238 only analysed a few samples and only one achieved LoD. In the case of this sample, it was found that whilst FISPACT (utilising NPL inactive precursors) slightly over estimated the activity, it was generally a good match (within an order of magnitude).

Plutonium-239 and 240

NPL active analysis grouped Pu-239 and 240 together for analysis, and only a few samples were measured. Of these, only one achieved LoD. Where samples were measured, it was found that FISPACT (utilising NPL inactive precursors) displayed good agreement with one sample (within a factor of three when combining activities for Pu-239 and 240).

Plutonium-241

NPL active analysis only measured a few samples for Pu-241. Where samples were measured, it was found that FISPACT (utilising NPL inactive precursors) over-estimated the activity to approximately an order of magnitude.

APPENDIX 8 – STAGE 2 ACTIVE PHASE RESULTS - HUNTERSTON A

Results are presented in tabular formats below in Table 59 to Table 86.

Since active samples for Hunterston A were retrieved from fuel sleeves, it is impossible to know precisely the location in the reactor core without a full history of the fuel element. Unfortunately, this information was not available and as a result, the active analysis undertaken by NPL has been compared to FISPACT modelling for fuel approximately halfway between the centre and edge of the fuelled region. This is thought to be representative of the average flux and spectra that a fuel sleeve would be exposed to. In addition, RWI data for the sleeves only provides information on silo stored inventories and not specific fuel elements and therefore direct comparison with sample results can only be approximate.

Appendix 8a covers the variation in activity for samples from different locations within the core (as mentioned previously in Appendix 5), as well as comparing minimum, average and maximum elemental precursor concentration for non-carbon elements. It should be noted that all results are presented at the 1st of July 2011.

Explanation of Results

As for Sizewell A and Wylfa, individual radionuclide trends have been highlighted and discussed in this section.

Tritium

Only those samples retrieved in 1991 were analysed for tritium. As has been seen in the Wylfa and Sizewell A results comparisons, there is both a very high variation in tritium activity as well as a poor comparison between FISPACT and active analysis. FISPACT typically over-predicts activity by a few orders of magnitude.

Carbon-14

Only those samples retrieved in 1991 were analysed for C-14. As with Sizewell A and Wylfa, FISPACT predicts C-14 activities that are typically within a factor of 2 of the active samples.

Considering the graph below (Figure 22), it can be seen that FISPACT, when considering all precursor concentrations on average, slightly over-predicts C-14 activity. This is probably due to assumptions made with regard to the duration and position of the fuel sleeves in the core, as the precursors show only a small degree of variation.

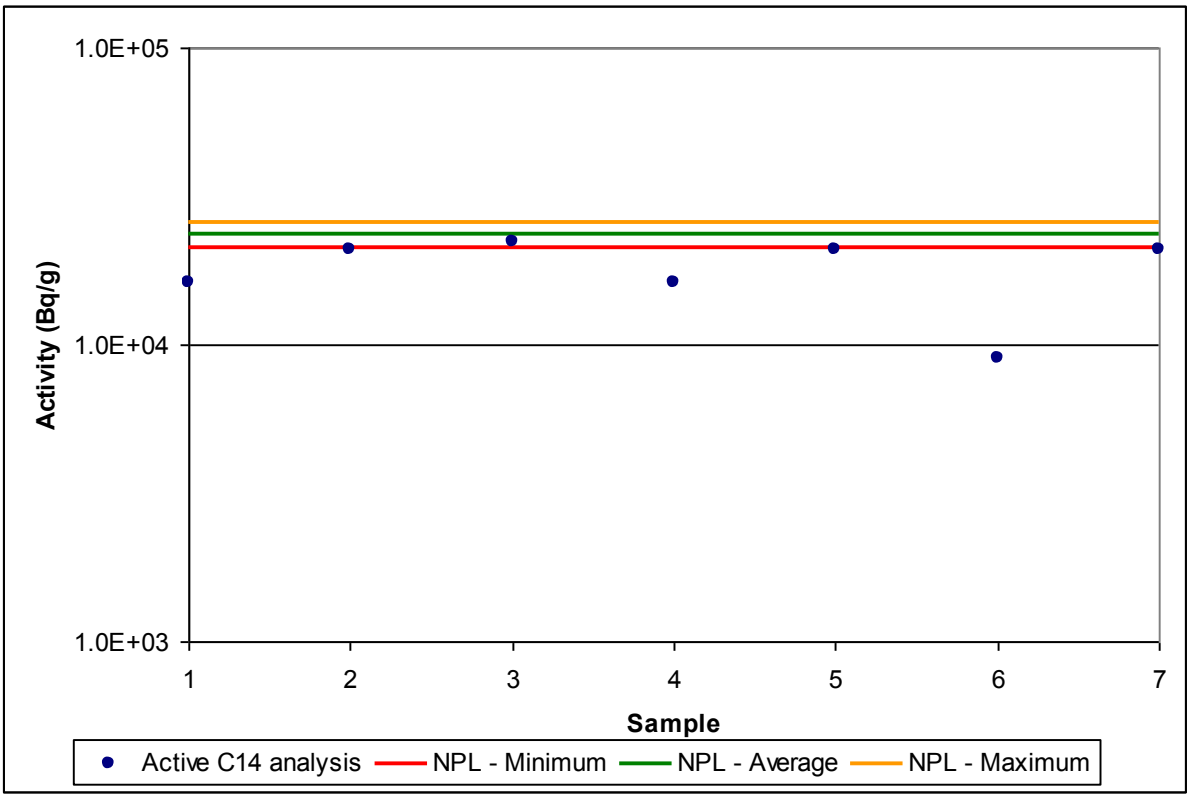

Figure 22: Activity profile for C-14 comparing active sleeve results to FISPACT

Chlorine-36

Cl-36 achieved LoD in sample IM100306. As with Sizewell and Wylfa, FISPACT over predicted the activity. The over-prediction is probably due to mobility and volatility of chlorine nuclides within graphite (or sample deterioration in storage), which is not accounted for in FISPACT.

Sodium-22

Na-22 did not achieve limit of detection. All FISPACT calculations and the RWI2007 predict no Na-22 activity present.

Cobalt-57

Co-57 was not analysed for in the Hunterston samples.

Cobalt-60

Co-60 activity (Figure 23) was somewhat similar for VFT graphite, suggesting that, together with similar results for C-14, the samples experienced a similar lifetime flux. However, modelling of the VFT graphite predicted activities that were higher than were actually found. This is possibly due to the predicted flux being slightly higher than reality.

For PGA core graphite, predicted activity was very close to the activity measured in the active samples in all cases, with the exception of samples IM100316-318, where the measured activity was much lower than the predicted by the modelling. This may be due to a local low precursor concentration.

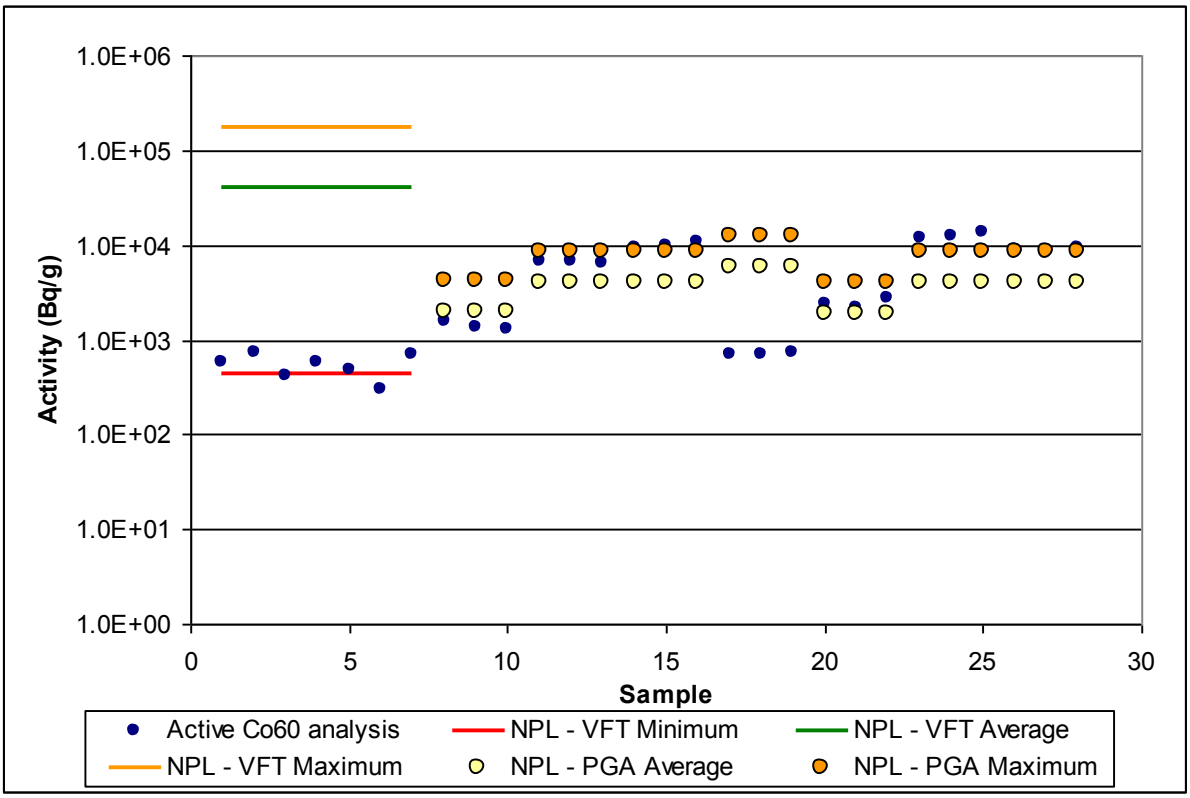

Figure 23: Activity profile for Co-60 comparing active sleeve and core results to FISPACT

Strontium-85

Sr-85 did not achieve limit of detection. All FISPACT calculations and the RWI2007 predict no Sr-85 activity present.

Niobium-94

Only 4 samples achieved LoD for Nb-94. Nb-94 activity was typically much less (> 1 order of magnitude) than FISPACT calculations predicted for sleeve graphite. Core graphite calculations predicted very low activities which are more in line with the analysed activities. RWI2007 activities are very close to the Nb-94 activity.

FISPACT calculations likely over-predicted the VFT sleeve activity due to inactive precursors never achieving LoD for niobium.

Silver-108(m)

Only one sample gave a non-LoD value for Ag-108m. This was very low and showed poor comparison to sleeve FISPACT calculations. Core graphite predicted low activities of Ag-108m, in line with the analysed results.

Cadmium-109

Cd-109 did not achieve LoD. FISPACT predicted activities were consistently below the LoD figure with activities of < 1Bq/g. The RWI predicts no Cd-109 is present.

Antimony-125

Sb-125 only achieved LoD for two active samples which reports a very low activity. These showed a good degree of agreement (within an order of magnitude) to FISPACT calculations using minimum and average precursor concentrations. The RWI2007 predicts much lower activities then active analysis revealed.

Tin-126

Sn-126 did not achieve LoD. FISPACT predicted activities were consistently below the LoD figure with activities of < 1Bq/g. The RWI predicts no Sn-126 is present.

Iodine-129

I-129 did not achieve LoD. FISPACT predicted activities were consistently below the LoD figure with activities of << 1Bq/g. The RWI predicts no I-129 is present.

Barium-133

Ba-133 analysed activity showed reasonable agreement with predicted activities, as shown in Figure 24. However, FISPACT typically predicted higher in all but the minimum concentration cases for sleeve graphite.

The RWI2007 typically under predicted Ba-133 activity.

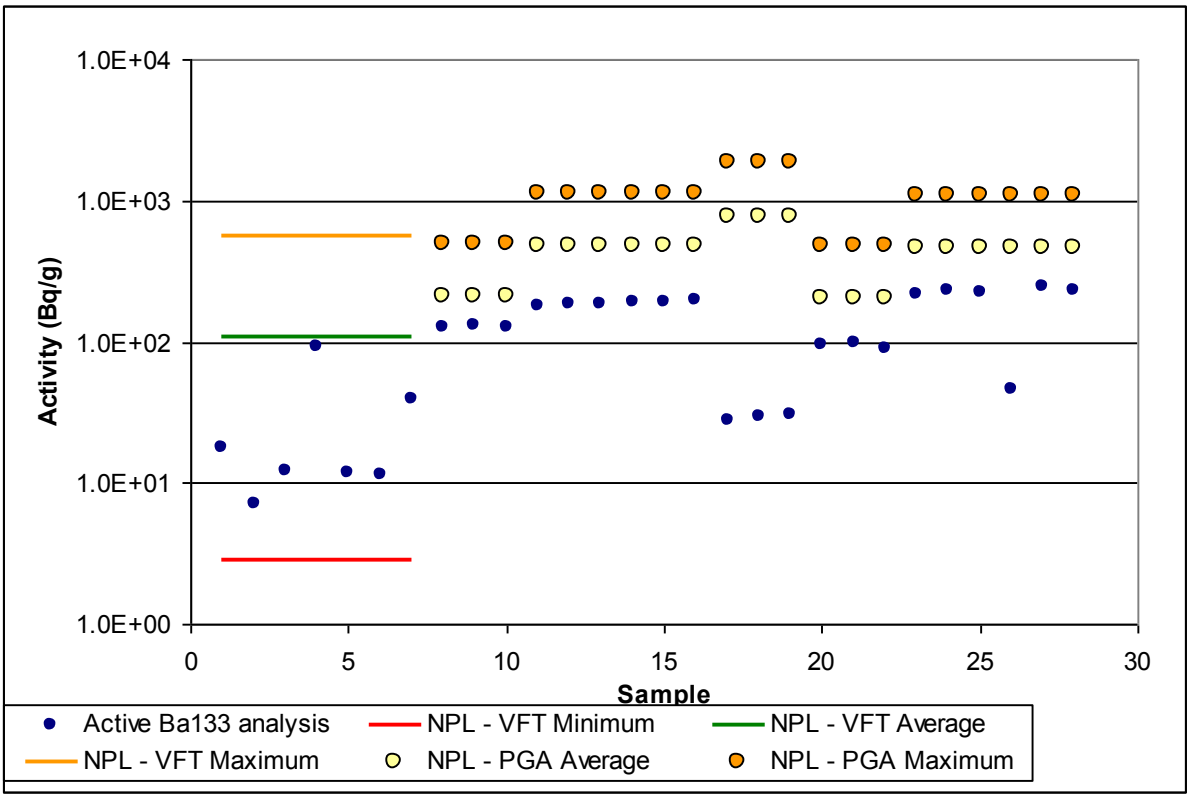

Figure 24: Activity profile for Ba-133 comparing active sleeve and core results to FISPACT

Caesium-134

Only those samples removed in 1991 have achieved LoD for Cs-134. These activities are much lower than those predicted in FISPACT calculations.

See also comments in Sizewell A and Wylfa comparisons.

Caesium-137

Whilst no sample achieved LoD for Cs-137, FISPACT calculations predict activities much greater than these LoD figures.

See also comments in Sizewell A and Wylfa comparisons.

Europium-152

Only two samples broke LoD during active analysis and these were from samples removed in 1991. Noticeably, these exhibited higher activities than the LoD values for the other samples (~5 Bq/g against LoD values of ~< 4 Bq/g for samples removed in 1991 also). FISPACT under predicted the Eu-152 activities for these two samples.

It is thought that the two samples had a much greater level of precursor concentration for elemental europium than has been used in the calculations.

Europium-154 and 155

As shown in Figure 25 and Figure 26, Eu-154 and Eu-155 activity was typically over-predicted for sleeve graphite, with a few notable exceptions. However, for core graphite, predicted activity was much greater than was actually experienced, typically by an order of magnitude. This suggests that the predicted precursor data was too high and / or that flux was too low.

The RWI typically over predicts sleeve graphite, but under predicts core graphite.

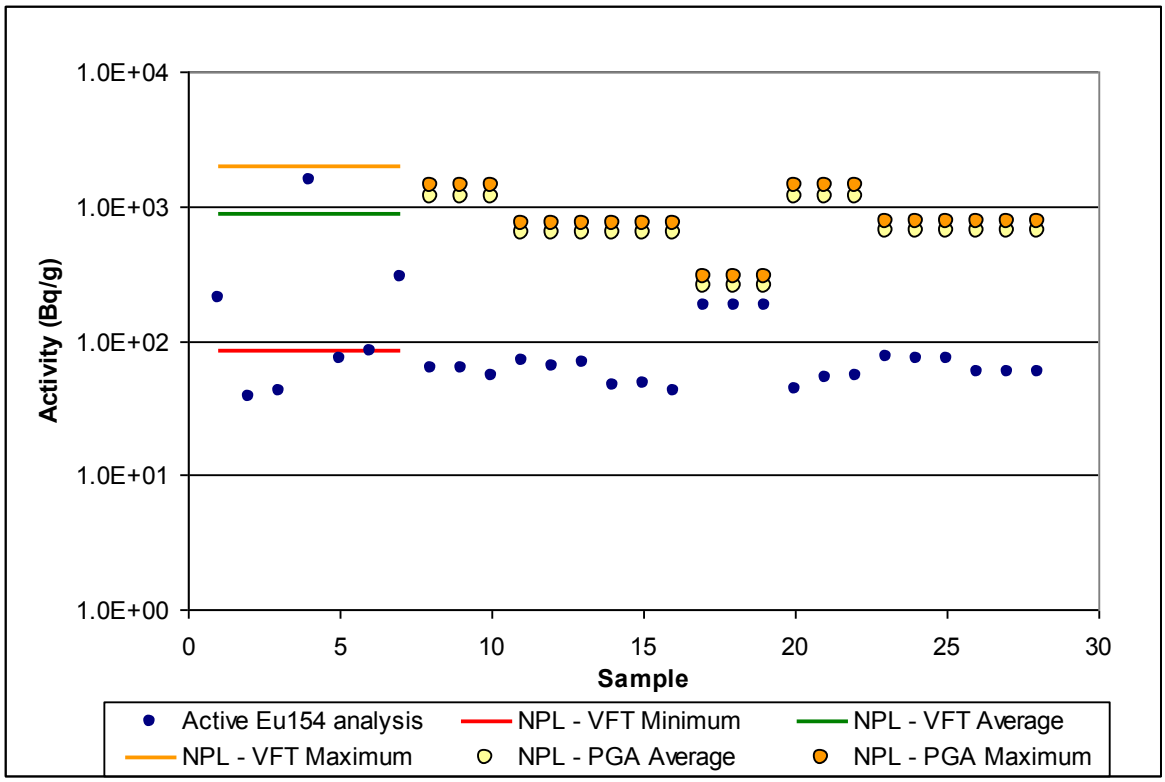

Figure 25: Activity profile for Eu-154 comparing active sleeve and core results to FISPACT

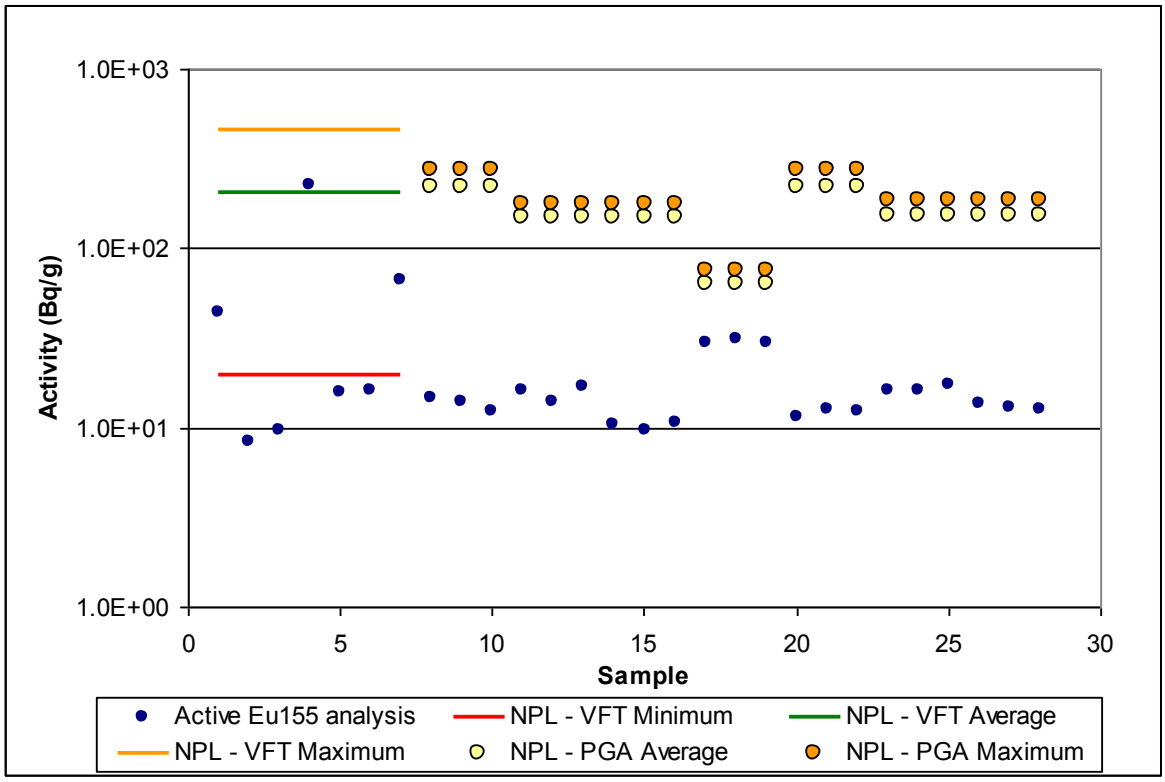

Figure 26: Activity profile for Eu-155 comparing active sleeve and core results to FISPACT

Holmium-166(m)

Ho-166m did not achieve LoD. FISPACT predicted activities were similar, if slightly higher than the LoD values for sleeve graphite, and lower for core graphite. The RWI predicts much higher Ho-166m activities (~1 order of magnitude).

Bismuth-207

Bi-207 did not achieve limit of detection. All FISPACT calculations and the RWI2007 predict no Bi-207 activity present.

Neptunium-236

Np-236 did not achieve limit of detection. All FISPACT calculations and the RWI2007 predict no, or negligible Np-236 activity present.

Neptunium-237

Np-237 did not achieve limit of detection. All FISPACT calculations predict trace amounts of Np-237 activity (<<< 1 Bq/g). The RWI2007 predicts no Np-237.

Americium-241

Am-241 did not achieve limit of detection. FISPACT sleeve graphite calculations predict values which are very similar to the LoD value of Am-241, and core graphite that is slightly higher, whilst the RWI2007 predicts activities slightly higher than the LoD value.

Americium-243

Am-243 did not achieve limit of detection. All FISPACT calculations predict trace amounts of Am-243 activity (< 1 Bq/g). The RWI2007 predicts no Am-243.

Curium-245

Cm-245 did not achieve limit of detection. All FISPACT calculations predict trace amounts of Cm-245 activity (<<< 1 Bq/g). The RWI2007 predicts no Cm-245.

Uranium-233 and 234

U-233 and U-234 were not analysed for in the Hunterston samples.

Uranium-235

U-235 did not achieve limit of detection. All FISPACT calculations predict trace amounts of U-235 activity (<<< 1 Bq/g). The RWI2007 predicts no U-235.

Uranium-236

U-236 was not analysed.

Uranium-238

U-238 did not achieve limit of detection. All FISPACT calculations predict trace amounts of U-238 activity (<<< 1 Bq/g). The RWI2007 predicts no U-238.

Plutonium-238, 239, 240 and 241

Pu-238, 239, 240 and 241 were not analysed.

Comparison to active analysis

ID	IM100287, 288 & 289		
Year Removed	1991	Core	N/A
Channel	Unknown/Various	Slice	N/A

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g) Halfway across fuelled region					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Min	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	33300 ± 3000	264200	500200	500300	500500	68665	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	16200 ± 800	44060	21320	23700	25820	2499	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	< 1.7	107	35	132	274	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	570 +/- 100	7453	432	40980	172100	1264	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 0.4	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 0.22	78	64	64	64	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	0.45 +/- 0.14	7	110	222	335	2.8E-02	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 5	7.2E-03	1.0E-01	2.1E-01	3.1E-01	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	1.54 +/- 0.44	2	4	16	54	1.4E-02	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 0.22	4.8E-09	3.3E-04	7.9E-02	3.1E-01	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 0.25	1.0E-03	1.0E-04	8.3E-03	3.3E-02	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	17.8 +/- 3.2	275	3	107	561	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	11.7 +/- 2.0	465	431	442	475	4.1E-02	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 0.19	75	43	10360	41290	53	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 0.6	9.E-02	3.E-03	5.E-02	2.E-01	130	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	207 +/- 34	1951	84	873	1954	204	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	44 +/- 8	460	20	206	460	12	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 0.16	3	1	1	1	8	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 0.5	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 3	0	0	0	4.1E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 4	0	2.9E-06	1.5E-04	6.1E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 0.22	0	2.3E-01	2.3E-01	2.3E-01	4.7E-01	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 1.3	0	1.4E-03	1.4E-03	1.4E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 1.1	0	3.5E-06	3.5E-06	3.5E-06	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	1.4E-01	37	149	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.2E-02	3	13	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 0.2	0	5.7E-07	1.4E-04	5.6E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	4.2E-06	5.8E-04	2.3E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 60	0	9.5E-06	9.5E-06	9.5E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	7.5E-02	4.6E-01	2	1.6E-01	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2.9E-02	3.0E-02	3.1E-02	1.7E-01	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	4.6E-02	4.7E-02	4.7E-02	2.5E-01	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	4	4	4	7	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 59: Activity comparison for combined samples IM100287, 288 and 289 (sleeve)

ID	IM100290, 291 & 292		
Year Removed	1991	Core	N/A
Channel	Unknown/Various	Slice	N/A

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g) Halfway across fuelled region					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Min	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	30900 ± 2800	264200	500200	500300	500500	68665	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	20800 ± 1200	44060	21320	23700	25820	2499	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	< 1.8	107	35	132	274	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	730 +/- 140	7453	432	40980	172100	1264	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 0.8	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	2.16 +/- 0.44	78	64	64	64	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 0.4	7	110	222	335	3.E-02	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 6	7.2E-03	1.0E-01	2.1E-01	3.1E-01	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 1.1	2	4	16	54	1.E-02	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 0.5	4.8E-09	3.3E-04	7.9E-02	3.1E-01	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 3	1.0E-03	1.0E-04	8.3E-03	3.3E-02	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	7.2 +/- 1.6	275	3	107	561	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	4 +/- 1	465	431	442	475	4.1E-02	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 0.4	75	43	10360	41290	53	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 1.2	9.E-02	3.E-03	5.E-02	2.E-01	130	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	38 +/- 8	1951	84	873	1954	204	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	8.3 +/- 2	460	20	206	460	12	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 0.3	3	1	1	1	8	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 1	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 5	0	0	0	4.1E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 7	0	2.9E-06	1.5E-04	6.1E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 0.4	0	2.3E-01	2.3E-01	2.3E-01	4.7E-01	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 2.6	0	1.4E-03	1.4E-03	1.4E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 2.1	0	3.5E-06	3.5E-06	3.5E-06	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	1.4E-01	37	149	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.2E-02	3	13	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 0.4	0	5.7E-07	1.4E-04	5.6E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	4.2E-06	5.8E-04	2.3E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 100	0	9.5E-06	9.5E-06	9.5E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	7.5E-02	4.6E-01	2	1.6E-01	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2.9E-02	3.0E-02	3.1E-02	1.7E-01	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	4.6E-02	4.7E-02	4.7E-02	2.5E-01	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	4	4	4	7	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 60: Activity comparison for combined samples IM100290, 291 and 292 (sleeve)

ID	IM100293, 294 & 295		
Year Removed	1991	Core	N/A
Channel	Unknown/Various	Slice	N/A

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g) Halfway across fuelled region					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Min	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	2520 ± 240	264200	500200	500300	500500	68665	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	22100 ± 1200	44060	21320	23700	25820	2499	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	< 1.3	107	35	132	274	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	410 +/- 80	7453	432	40980	172100	1264	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 0.6	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	2.1 +/- 0.6	78	64	64	64	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 0.3	7	110	222	335	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 5	7.2E-03	1.0E-01	2.1E-01	3.1E-01	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 0.9	2	4	16	54	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 0.4	4.8E-09	3.3E-04	7.9E-02	3.1E-01	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 3	1.0E-03	1.0E-04	8.3E-03	3.3E-02	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	12 +/- 2.2	275	3	107	561	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	6.5 +/- 1.4	465	431	442	475	4.1E-02	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 0.3	75	43	10360	41290	53	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 0.9	9.E-02	3.E-03	5.E-02	2.E-01	130	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	42 +/- 8	1951	84	873	1954	204	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	9.6 +/- 2	460	20	206	460	12	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 0.24	3	1	1	1	8	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 0.8	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 4	0	0	0	4.1E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 5	0	2.9E-06	1.5E-04	6.1E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 0.22	0	2.3E-01	2.3E-01	2.3E-01	4.7E-01	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 2	0	1.4E-03	1.4E-03	1.4E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 1.7	0	3.5E-06	3.5E-06	3.5E-06	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	1.4E-01	37	149	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.2E-02	3	13	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 0.3	0	5.7E-07	1.4E-04	5.6E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	4.2E-06	5.8E-04	2.3E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 80	0	9.5E-06	9.5E-06	9.5E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	7.5E-02	4.6E-01	2	1.6E-01	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2.9E-02	3.0E-02	3.1E-02	1.7E-01	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	4.6E-02	4.7E-02	4.7E-02	2.5E-01	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	4	4	4	7	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 61: Activity comparison for combined samples IM100293, 294 and 295 (sleeve)

ID	IM100296, 297 & 298		
Year Removed	1991	Core	N/A
Channel	Unknown/Various	Slice	N/A

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g) Halfway across fuelled region					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Min	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	315 ± 30	264200	500200	500300	500500	68665	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	16100 ± 800	44060	21320	23700	25820	2499	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	< 1.5	107	35	132	274	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 60	0	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	580 +/- 100	7453	432	40980	172100	1264	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 1.4	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 0.7	78	64	64	64	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 0.6	7	110	222	335	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 22	7.2E-03	1.0E-01	2.1E-01	3.1E-01	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 1.8	2	4	16	54	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 0.7	4.8E-09	3.3E-04	7.9E-02	3.1E-01	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 7	1.0E-03	1.0E-04	8.3E-03	3.3E-02	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	92 +/- 16	275	3	107	561	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	8.5 +/- 1.8	465	431	442	475	4.1E-02	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 0.6	75	43	10360	41290	53	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	5.3 +/- 1.6	9.E-02	3.E-03	5.E-02	2.E-01	130	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	1560 +/- 260	1951	84	873	1954	204	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	224 +/- 46	460	20	206	460	12	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 0.6	3	1	1	1	8	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 1.2	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 9	0	0	0	4.1E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 11	0	2.9E-06	1.5E-04	6.1E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 0.9	0	2.3E-01	2.3E-01	2.3E-01	4.7E-01	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 4	0	1.4E-03	1.4E-03	1.4E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 4	0	3.5E-06	3.5E-06	3.5E-06	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	1.4E-01	37	149	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.2E-02	3	13	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 0.7	0	5.7E-07	1.4E-04	5.6E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	4.2E-06	5.8E-04	2.3E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 300	0	9.5E-06	9.5E-06	9.5E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	7.5E-02	4.6E-01	2	1.6E-01	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2.9E-02	3.0E-02	3.1E-02	1.7E-01	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	4.6E-02	4.7E-02	4.7E-02	2.5E-01	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	4	4	4	7	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 62: Activity comparison for combined samples IM100296, 297 and 298 (sleeve)

ID	IM100299, 300, 301& 302		
Year Removed	1991	Core	N/A
Channel	Unknown/Various	Slice	N/A

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g) Halfway across fuelled region					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Min	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	4730 ± 440	264200	500200	500300	500500	68665	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	20800 ± 1200	44060	21320	23700	25820	2499	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	< 3.2	107	35	132	274	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	480 +/- 100	7453	432	40980	172100	1264	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 0.23	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	0.15 +/- 0.1	78	64	64	64	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 0.1	7	110	222	335	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 1.8	7.2E-03	1.0E-01	2.1E-01	3.1E-01	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	0.84 +/- 0.22	2	4	16	54	1.4E-02	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 0.12	4.8E-09	3.3E-04	7.9E-02	3.1E-01	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 1.1	1.0E-03	1.0E-04	8.3E-03	3.3E-02	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	11.9 +/- 2.2	275	3	107	561	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	4.5 +/- 0.8	465	431	442	475	4.1E-02	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 0.1	75	43	10360	41290	53	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 0.3	9.E-02	3.E-03	5.E-02	2.E-01	130	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	74 +/- 12	1951	84	873	1954	204	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	15.9 +/- 3	460	20	206	460	12	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 0.08	3	1	1	1	8	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 0.25	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 1.4	0	0	0	4.1E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 1.8	0	2.9E-06	1.5E-04	6.1E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 0.11	0	2.3E-01	2.3E-01	2.3E-01	4.7E-01	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 0.7	0	1.4E-03	1.4E-03	1.4E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 0.6	0	3.5E-06	3.5E-06	3.5E-06	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	1.4E-01	37	149	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.2E-02	3	13	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 0.11	0	5.7E-07	1.4E-04	5.6E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	4.2E-06	5.8E-04	2.3E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 30	0	9.5E-06	9.5E-06	9.5E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	7.5E-02	4.6E-01	2	1.6E-01	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2.9E-02	3.0E-02	3.1E-02	1.7E-01	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	4.6E-02	4.7E-02	4.7E-02	2.5E-01	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	4	4	4	7	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 63: Activity comparison for sample IM100299, 300, 301 and 302 (sleeve)

ID	IM100303, 304 & 305		
Year Removed	1991	Core	N/A
Channel	Unknown/Various	Slice	N/A

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g) Halfway across fuelled region					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Min	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	10900 ± 1000	264200	500200	500300	500500	68665	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	9010 ± 460	44060	21320	23700	25820	2499	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	< 1.6	107	35	132	274	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	300 +/- 60	7453	432	40980	172100	1264	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 0.7	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	0.73 +/- 0.18	78	64	64	64	8.3E-01	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 0.3	7	110	222	335	3.E-02	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 7	7.2E-03	1.0E-01	2.1E-01	3.1E-01	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 0.9	2	4	16	54	1.E-02	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 0.4	4.8E-09	3.3E-04	7.9E-02	3.1E-01	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 1.9	1.0E-03	1.0E-04	8.3E-03	3.3E-02	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	11.6 +/- 2.2	275	3	107	561	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	3.2 +/- 0.8	465	431	442	475	4.1E-02	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 0.3	75	43	10360	41290	53	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	4.4 +/- 1	9.E-02	3.E-03	5.E-02	2.E-01	130	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	83 +/- 14	1951	84	873	1954	204	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	16 +/- 3.4	460	20	206	460	12	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 0.25	3	1	1	1	8	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 0.7	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 5	0	0	0	4.1E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 6	0	2.9E-06	1.5E-04	6.1E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 0.4	0	2.3E-01	2.3E-01	2.3E-01	4.7E-01	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 2	0	1.4E-03	1.4E-03	1.4E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 1.7	0	3.5E-06	3.5E-06	3.5E-06	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	1.4E-01	37	149	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.2E-02	3	13	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 0.4	0	5.7E-07	1.4E-04	5.6E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	4.2E-06	5.8E-04	2.3E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 90	0	9.5E-06	9.5E-06	9.5E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	7.5E-02	4.6E-01	2	1.6E-01	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2.9E-02	3.0E-02	3.1E-02	1.7E-01	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	4.6E-02	4.7E-02	4.7E-02	2.5E-01	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	4	4	4	7	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 64: Activity comparison for sample IM100303, 304 and 305 (sleeve)

ID	IM100306		
Year Removed	1991	Core	N/A
Channel	Unknown/Various	Slice	N/A

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g) Halfway across fuelled region					Acceptance Criteria (Bq/g)		Drigg Trigger Limits		
RN	Active	FIS-Jow	FIS-Min	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	13800 ± 1400	264200	500200	500300	500500	68665	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	20800 ± 1200	44060	21320	23700	25820	2499	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	3.7 +/- 3	107	35	132	274	3	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	690 +/- 120	7453	432	40980	172100	1264	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 0.8	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 0.4	78	64	64	64	1	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 0.3	7	110	222	335	3.E-02	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 8	7.2E-03	1.0E-01	2.1E-01	3.1E-01	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 1	2	4	16	54	1.E-02	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 0.4	4.8E-09	3.3E-04	7.9E-02	3.1E-01	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	18 +/- 16	1.0E-03	1.0E-04	8.3E-03	3.3E-02	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	39 +/- 8	275	3	107	561	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	11.7 +/- 2.2	465	431	442	475	4.1E-02	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 0.4	75	43	10360	41290	53	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 1	9.E-02	3.E-03	5.E-02	2.E-01	130	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	299 +/- 50	1951	84	873	1954	204	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	66 +/- 12	460	20	206	460	12	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 0.3	3	1	1	1	8	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 0.8	0	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 5	0	0	0	4.1E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 6	0	2.9E-06	1.5E-04	6.1E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 0.4	0	2.3E-01	2.3E-01	2.3E-01	4.7E-01	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 2.2	0	1.4E-03	1.4E-03	1.4E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 1.9	0	3.5E-06	3.5E-06	3.5E-06	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	1.4E-01	37	149	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.2E-02	3	13	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 0.4	0	5.7E-07	1.4E-04	5.6E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	4.2E-06	5.8E-04	2.3E-03	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 110	0	9.5E-06	9.5E-06	9.5E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	7.5E-02	4.6E-01	2	1.6E-01	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2.9E-02	3.0E-02	3.1E-02	1.7E-01	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	4.6E-02	4.7E-02	4.7E-02	2.5E-01	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	4	4	4	7	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 65: Activity comparison for sample IM10306 (sleeve)

ID	IM100307		
Year Removed	1998	Core	3
Channel	1028	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	237300	490300	810200	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	42590	26460	28250	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	104	394	589	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	1550 +/- 280	2584	1956	4219	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 3	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 1.4	71	6.E-06	7.E-06	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 1.1	6	4.E-07	4.E-07	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 17	1.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 3.4	2.E-01	8.E-02	8.E-02	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 1.7	8.E-10	2.E-03	2.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 10	8.E-04	6.E-04	6.E-04	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	128 +/- 22	142	208	498	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 1.4	87	53	53	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 1.2	57	195	195	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 3.4	3.E-01	2.E-01	3.E-01	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	63 +/- 12	1465	1158	1431	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	14.5 +/- 4.6	281	222	275	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1	3	3.E-01	4.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 3	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 17	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 20	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1	0	19	19	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 8	0	8.E-02	8.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 7	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	7.E-03	7.E-03	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 1.3	0	3.E-06	3.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 300	0	9.E-04	9.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	14	14	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	3	3	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	219	219	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 66: Activity comparison for sample IM100307 (core)

ID	IM100308		
Year Removed	1998	Core	3
Channel	1028	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	237300	490300	810200	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	42590	26460	28250	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	104	394	589	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	1330 +/- 240	2584	1956	4219	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 2.1	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 1.2	71	6.E-06	7.E-06	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 0.9	6	4.E-07	4.E-07	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 14	1.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 3	2.E-01	8.E-02	8.E-02	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 1.4	8.E-10	2.E-03	2.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 8	8.E-04	6.E-04	6.E-04	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	130 +/- 22	142	208	498	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 1.1	87	53	53	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 1	57	195	195	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 3	3.E-01	2.E-01	3.E-01	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	62 +/- 12	1465	1158	1431	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	14 +/- 3.4	281	222	275	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 0.8	3	3.E-01	4.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 2.4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 14	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 16	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1.2	0	19	19	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 7	0	8.E-02	8.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 6	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	7.E-03	7.E-03	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 1	0	3.E-06	3.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 230	0	9.E-04	9.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	14	14	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	3	3	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	219	219	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 67: Activity comparison for sample IM100308 (core)

ID	IM1000309									
Year Removed	1998	Core	3							
Channel	1028	Slice	1							
	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	237300	490300	810200	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	42590	26460	28250	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	104	394	589	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	1310 +/- 240	2584	1956	4219	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 3	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 1.4	71	6.E-06	7.E-06	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 1.1	6	4.E-07	4.E-07	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 17	1.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 4	2.E-01	8.E-02	8.E-02	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 1.7	8.E-10	2.E-03	2.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 10	8.E-04	6.E-04	6.E-04	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	125 +/- 22	142	208	498	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 1.3	87	53	53	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 1.2	57	195	195	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 4	3.E-01	2.E-01	3.E-01	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	55 +/- 12	1465	1158	1431	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	12.4 +/- 4.2	281	222	275	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1	3	3.E-01	4.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 3	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 18	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 20	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1.5	0	19	19	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 8	0	8.E-02	8.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 7	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	7.E-03	7.E-03	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 1.3	0	3.E-06	3.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 300	0	9.E-04	9.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	14	14	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	3	3	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	219	219	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 68: Activity comparison for sample IM100309 (core)

ID	IM100310		
Year Removed	1998	Core	4
Channel	1028	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	252800	521300	861200	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	103700	64470	68830	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	219	827	1236	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	6600 +/- 1200	5371	4042	8685	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 2.3	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 1.1	164	2.E-05	2.E-05	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 0.9	11	1.E-06	1.E-06	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 11	6.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 3	7.E-01	2.E-01	2.E-01	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 1.1	4.E-09	6.E-03	6.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 6	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	179 +/- 30	324	475	1135	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 1.1	154	94	94	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 1	140	549	549	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 3	8.E-02	5.E-02	6.E-02	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	70 +/- 14	857	623	746	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	16.2 +/- 3.6	204	148	178	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 0.7	4	4.E-01	5.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 2.4	8.E-07	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 12	0	3.E-11	3.E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 16	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 0.7	0	21	21	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 7	0	7.E-01	7.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 5	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 0.9	0	8.E-07	8.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 220	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	284	284	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 69: Activity comparison for sample IM100310 (core)

ID	IM100311		
Year Removed	1998	Core	4
Channel	1028	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	252800	521300	861200	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	103700	64470	68830	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	219	827	1236	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	6600 +/- 1200	5371	4042	8685	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 7	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 3	164	2.E-05	2.E-05	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 2.1	11	1.E-06	1.E-06	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 30	6.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 7	7.E-01	2.E-01	2.E-01	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 3	4.E-09	6.E-03	6.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 14	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	187 +/- 34	324	475	1135	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 3	154	94	94	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 2.3	140	549	549	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 7	8.E-02	5.E-02	6.E-02	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	64 +/- 14	857	623	746	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	13.9 +/- 4.6	204	148	178	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.8	4	4.E-01	5.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 6	8.E-07	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 30	0	3.E-11	3.E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 40	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 2.3	0	21	21	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 16	0	7.E-01	7.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 13	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 2.2	0	8.E-07	8.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 600	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	284	284	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 70: Activity comparison for sample IM100311 (core)

ID	IM100312		
Year Removed	1998	Core	4
Channel	1028	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	252800	521300	861200	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	103700	64470	68830	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	219	827	1236	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	6500 +/- 1200	5371	4042	8685	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 6	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 3	164	2.E-05	2.E-05	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 2	11	1.E-06	1.E-06	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 30	6.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 7	7.E-01	2.E-01	2.E-01	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 3	4.E-09	6.E-03	6.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 9	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	188 +/- 34	324	475	1135	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 2.5	154	94	94	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 2.2	140	549	549	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 7	8.E-02	5.E-02	6.E-02	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	68 +/- 14	857	623	746	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	17 +/- 6	204	148	178	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.7	4	4.E-01	5.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 6	8.E-07	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 30	0	3.E-11	3.E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 40	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 2.2	0	21	21	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 15	0	7.E-01	7.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 12	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 2.1	0	8.E-07	8.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 500	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	284	284	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 71: Activity comparison for sample IM100312 (core)

ID	IM100313									
Year Removed	1998	Core	5							
Channel	1028	Slice	1							
	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	252800	521300	861200	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	103700	64470	68830	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	219	827	1236	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	9300 +/- 1600	5371	4042	8685	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 6	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 3	164	2.E-05	2.E-05	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 2.1	11	1.E-06	1.E-06	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 30	6.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 7	7.E-01	2.E-01	2.E-01	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 3	4.E-09	6.E-03	6.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 13	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	192 +/- 34	324	475	1135	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 3	154	94	94	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 2.4	140	549	549	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 7	8.E-02	5.E-02	6.E-02	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	46 +/- 10	857	623	746	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	10.5 +/- 4.2	204	148	178	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.8	4	4.E-01	5.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 6	8.E-07	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 30	0	3.E-11	3.E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 40	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 2.3	0	21	21	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 16	0	7.E-01	7.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 13	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 2.3	0	8.E-07	8.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 600	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	284	284	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 72: Activity comparison for sample IM100313 (core)

ID	IM100314		
Year Removed	1998	Core	5
Channel	1028	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	252800	521300	861200	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	103700	64470	68830	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	219	827	1236	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	9900 +/- 1800	5371	4042	8685	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 5	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 4	164	2.E-05	2.E-05	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 2.3	11	1.E-06	1.E-06	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 30	6.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 8	7.E-01	2.E-01	2.E-01	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 3	4.E-09	6.E-03	6.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 14	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	189 +/- 34	324	475	1135	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 3	154	94	94	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 3	140	549	549	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 8	8.E-02	5.E-02	6.E-02	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	48 +/- 10	857	623	746	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	9.6 +/- 2.6	204	148	178	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 2	4	4.E-01	5.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 7	8.E-07	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	3.E-11	3.E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 50	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 2.5	0	21	21	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 18	0	7.E-01	7.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 14	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 2.5	0	8.E-07	8.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 600	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	284	284	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 73: Activity comparison for sample IM100314 (core)

ID	IM100315									
Year Removed	1998	Core	5							
Channel	1028	Slice	1							
	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	252800	521300	861200	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	103700	64470	68830	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	219	827	1236	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	10600 +/- 1800	5371	4042	8685	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 9	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 4	164	2.E-05	2.E-05	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 3	11	1.E-06	1.E-06	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 40	6.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 9	7.E-01	2.E-01	2.E-01	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 4	4.E-09	6.E-03	6.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 17	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	199 +/- 36	324	475	1135	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 4	154	94	94	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 3	140	549	549	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 9	8.E-02	5.E-02	6.E-02	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	42 +/- 10	857	623	746	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	10.8 +/- 4.4	204	148	178	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 2.3	4	4.E-01	5.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 8	8.E-07	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	3.E-11	3.E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 50	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 3	0	21	21	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 21	0	7.E-01	7.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 17	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 2.9	0	8.E-07	8.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 700	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	284	284	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 74: Activity comparison for sample IM100315 (core)

ID	IM100316		
Year Removed	1998	Core	10
Channel	1028	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	257500	528400	872300	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	179300	111800	119300	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	316	1188	1775	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	700 +/- 120	7900	5885	12550	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 2.2	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 1.1	280	4.E-05	5.E-05	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 0.8	10	2.E-06	2.E-06	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 18	1.E-02	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 2.5	2	4.E-01	4.E-01	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 1	2.E-08	1.E-02	1.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 11	8.E-03	2.E-03	2.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	28 +/- 6	534	781	1868	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 1	181	110	111	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 0.8	242	1059	1059	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 3	3.E-02	2.E-02	2.E-02	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	180 +/- 32	361	254	298	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	30 +/- 8	91	64	75	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 0.7	9	3.E-01	3.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 2.1	3.E-06	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 13	0	4.E-11	4.E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 15	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 0.6	0	20	20	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 6	0	0.E+00	0.E+00	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 5	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 0.9	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 300	0	7.E-04	7.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	17	17	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	302	302	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 75: Activity comparison for sample IM100316 (core)

ID	IM100317		
Year Removed	1998	Core	10
Channel	1028	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	257500	528400	872300	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	179300	111800	119300	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	316	1188	1775	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	710 +/- 140	7900	5885	12550	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 1.5	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 1.1	280	4.E-05	5.E-05	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 0.8	10	2.E-06	2.E-06	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 18	1.E-02	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 2.5	2	4.E-01	4.E-01	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 1	2.E-08	1.E-02	1.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 11	8.E-03	2.E-03	2.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	30 +/- 6	534	781	1868	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 1	181	110	111	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 0.8	242	1059	1059	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 3	3.E-02	2.E-02	2.E-02	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	183 +/- 32	361	254	298	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	31 +/- 8	91	64	75	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 0.8	9	3.E-01	3.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 2.1	3.E-06	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 13	0	4.E-11	4.E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 15	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1	0	20	20	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 6	0	0.E+00	0.E+00	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 5	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 1	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 300	0	7.E-04	7.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	17	17	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	302	302	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 76: Activity comparison for sample IM100317 (core)

ID	IM100318		
Year Removed	1998	Core	10
Channel	1028	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	257500	528400	872300	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	179300	111800	119300	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	316	1188	1775	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	740 +/- 140	7900	5885	12550	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 1	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 0.5	280	4.E-05	5.E-05	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 0.4	10	2.E-06	2.E-06	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 8	1.E-02	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 1.2	2	4.E-01	4.E-01	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 0.5	2.E-08	1.E-02	1.E-02	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 5	8.E-03	2.E-03	2.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	31 +/- 6	534	781	1868	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 0.5	181	110	111	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 0.4	242	1059	1059	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 1.2	3.E-02	2.E-02	2.E-02	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	180 +/- 30	361	254	298	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	30 +/- 6	91	64	75	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 0.4	9	3.E-01	3.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 1	3.E-06	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 6	0	4.E-11	4.E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 7	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 0.5	0	20	20	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 3	0	0.E+00	0.E+00	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 2.3	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	2.E-02	2.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 0.4	0	1.E-06	1.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 120	0	7.E-04	7.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	17	17	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	302	302	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 77: Activity comparison for sample IM100318 (core)

ID	IM100319		
Year Removed	1998	Core	3
Channel	0729	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	236200	488100	806600	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	41370	25700	27440	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	101	384	574	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	2410 +/- 420	2518	1906	4112	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 1.7	69	6.E-06	7.E-06	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 1.3	6	4.E-07	4.E-07	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 18	1.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 4	2.E-01	8.E-02	8.E-02	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 1.8	8.E-10	2.E-03	2.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 10	8.E-04	6.E-04	6.E-04	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	94 +/- 18	138	203	484	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 1.6	85	52	52	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 1.4	56	188	188	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 4	3.E-01	2.E-01	3.E-01	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	44 +/- 10	1467	1164	1440	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	11.5 +/- 3	280	222	275	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.1	3	3.E-01	4.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 19	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 23	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1.5	0	18	18	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 10	0	7.E-02	7.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 8	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	6.E-03	6.E-03	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 1.4	0	4.E-06	4.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 400	0	9.E-04	9.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	14	14	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	3	3	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	215	215	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 78: Activity comparison for sample IM100319 (core)

ID	IM100320		
Year Removed	1998	Core	3
Channel	0729	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	236200	488100	806600	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	41370	25700	27440	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	101	384	574	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	2200 +/- 400	2518	1906	4112	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 1.8	69	6.E-06	7.E-06	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 1.3	6	4.E-07	4.E-07	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 20	1.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 5	2.E-01	8.E-02	8.E-02	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 1.9	8.E-10	2.E-03	2.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 10	8.E-04	6.E-04	6.E-04	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	99 +/- 18	138	203	484	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 1.7	85	52	52	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 1.5	56	188	188	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 5	3.E-01	2.E-01	3.E-01	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	53 +/- 10	1467	1164	1440	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	12.6 +/- 4.6	280	222	275	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.2	3	3.E-01	4.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 20	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 25	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1.6	0	18	18	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 10	0	7.E-02	7.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 8	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	6.E-03	6.E-03	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 1.5	0	4.E-06	4.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 400	0	9.E-04	9.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	14	14	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	3	3	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	215	215	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 79: Activity comparison for sample IM100320 (core)

ID	IM100321		
Year Removed	1998	Core	3
Channel	0729	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	236200	488100	806600	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	41370	25700	27440	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	101	384	574	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	2740 +/- 480	2518	1906	4112	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 5	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 2	69	6.E-06	7.E-06	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 1.5	6	4.E-07	4.E-07	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 21	1.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 5	2.E-01	8.E-02	8.E-02	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 2	8.E-10	2.E-03	2.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 11	8.E-04	6.E-04	6.E-04	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	89 +/- 18	138	203	484	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 1.9	85	52	52	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 1.7	56	188	188	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 5	3.E-01	2.E-01	3.E-01	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	55 +/- 12	1467	1164	1440	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	12.5 +/- 5	280	222	275	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.3	3	3.E-01	4.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 4	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 22	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 27	0	2.E-04	2.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 1.7	0	18	18	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 11	0	7.E-02	7.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 9	0	1.E-04	1.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	6.E-03	6.E-03	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 1.6	0	4.E-06	4.E-06	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 400	0	9.E-04	9.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	14	14	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	3	3	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	215	215	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 80: Activity comparison for sample IM100321 (core)

ID	IM100322		
Year Removed	1998	Core	4
Channel	0729	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	252500	520800	860400	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	100600	62500	66730	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	214	808	1208	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	11800 +/- 2000	5248	3950	8490	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 8	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 4	159	2.E-05	2.E-05	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 3	11	1.E-06	1.E-06	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 40	6.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 9	7.E-01	2.E-01	2.E-01	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 4	4.E-09	6.E-03	6.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 17	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	220 +/- 40	316	462	1104	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 4	152	92	93	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 3	136	532	532	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 9	8.E-02	6.E-02	7.E-02	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	76 +/- 14	890	648	777	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	16 +/- 8	211	153	184	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 2.2	4	4.E-01	5.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 8	8.E-07	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	3.E-11	3.E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 50	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 2.2	0	21	21	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 20	0	6.E-01	6.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 16	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 3	0	8.E-07	8.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 700	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	284	284	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 81: Activity comparison for sample IM100322 (core)

ID	IM100323		
Year Removed	1998	Core	4
Channel	0729	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	252500	520800	860400	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	100600	62500	66730	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	214	808	1208	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	12400 +/- 2200	5248	3950	8490	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 10	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 4	159	2.E-05	2.E-05	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 3	11	1.E-06	1.E-06	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 40	6.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 10	7.E-01	2.E-01	2.E-01	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 4	4.E-09	6.E-03	6.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 18	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	228 +/- 42	316	462	1104	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 4	152	92	93	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 4	136	532	532	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 10	8.E-02	6.E-02	7.E-02	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	73 +/- 16	890	648	777	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	16 +/- 6	211	153	184	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 2.4	4	4.E-01	5.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 9	8.E-07	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 50	0	3.E-11	3.E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 60	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 2.2	0	21	21	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 22	0	6.E-01	6.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 18	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 3	0	8.E-07	8.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 800	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	284	284	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 82: Activity comparison for sample IM100323 (core)

ID	IM100324		
Year Removed	1998	Core	4
Channel	0729	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	252500	520800	860400	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	100600	62500	66730	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	214	808	1208	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	13900 +/- 2400	5248	3950	8490	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 10	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 4	159	2.E-05	2.E-05	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 3	11	1.E-06	1.E-06	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 40	6.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 10	7.E-01	2.E-01	2.E-01	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 4	4.E-09	6.E-03	6.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 18	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	227 +/- 42	316	462	1104	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 4	152	92	93	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 4	136	532	532	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 10	8.E-02	6.E-02	7.E-02	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	74 +/- 16	890	648	777	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	17.6 +/- 4.2	211	153	184	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 2.5	4	4.E-01	5.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 9	8.E-07	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 50	0	3.E-11	3.E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 500	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 4	0	21	21	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 23	0	6.E-01	6.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 18	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 4	0	8.E-07	8.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 800	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	284	284	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 83: Activity comparison for sample IM100324 (core)

ID	IM100325		
Year Removed	1998	Core	5
Channel	0729	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	252500	520800	860400	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	100600	62500	66730	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	214	808	1208	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	9100 +/- 1600	5248	3950	8490	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 6	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 4	159	2.E-05	2.E-05	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 3	11	1.E-06	1.E-06	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 40	6.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 9	7.E-01	2.E-01	2.E-01	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 4	4.E-09	6.E-03	6.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 17	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	46 +/-	316	462	1104	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 4	152	92	93	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 3	136	532	532	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 9	8.E-02	6.E-02	7.E-02	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	58 +/- 12	890	648	777	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	13.5 +/- 4.6	211	153	184	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 2.3	4	4.E-01	5.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 8	8.E-07	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	3.E-11	3.E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 50	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 3	0	21	21	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 21	0	6.E-01	6.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 17	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 3	0	8.E-07	8.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 700	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	284	284	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 84: Activity comparison for sample IM100325 (core)

ID	IM100326		
Year Removed	1998	Core	5
Channel	0729	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	252500	520800	860400	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	100600	62500	66730	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	214	808	1208	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	8700 +/- 1600	5248	3950	8490	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 8	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 3	159	2.E-05	2.E-05	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 2.2	11	1.E-06	1.E-06	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 30	6.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 7	7.E-01	2.E-01	2.E-01	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 3	4.E-09	6.E-03	6.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 14	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	249 +/- 44	316	462	1104	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 3	152	92	93	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 2.5	136	532	532	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 7	8.E-02	6.E-02	7.E-02	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	58 +/- 12	890	648	777	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	13 +/- 6	211	153	184	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 1.9	4	4.E-01	5.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 7	8.E-07	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	3.E-11	3.E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 40	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 2.5	0	21	21	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 17	0	6.E-01	6.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 13	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 2.4	0	8.E-07	8.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 600	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	284	284	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 85: Activity comparison for sample IM100326 (core)

ID	IM100327		
Year Removed	1998	Core	5
Channel	0729	Slice	1

	01/06/2011 Activity (Bq/g)	01/06/2011 Activity (Bq/g)				Acceptance Criteria (Bq/g)			Drigg Trigger Limits	
RN	Active	FIS-Jow	FIS-Av	FIS-Max	RWI 2007	HNSR - Trench	HNSR - Vault	Specific (Bq/g)	Package (Bq)	Annual (Bq)
H3	Not Analysed	252500	520800	860400	195829	4.0E+02	1.0E+09	3.0E+03	3.0E+12	1.0E+13
C14	Not Analysed	100600	62500	66730	46597	1.0E+04	8.0E+06	1.5E+01	1.5E+10	5.0E+10
Cl36	Not Analysed	214	808	1208	154	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Na22	< 30	0	0	0	0	4.0E+03	4.0E+08	4.5E+03	4.5E+12	1.5E+13
Co57	Not Analysed	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Co60	9300 +/- 1600	5248	3950	8490	2.E+03	3.0E+03	4.0E+08	6.0E+02	6.0E+11	2.0E+12
Sr85	< 5	0	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Nb94	< 4	159	2.E-05	2.E-05	8.E-02	4.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
Ag108m	< 3	11	1.E-06	1.E-06	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cd109	< 40	6.E-03	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Sb125	< 9	7.E-01	2.E-01	2.E-01	0	2.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Sn126	< 4	4.E-09	6.E-03	6.E-03	0	2.0E+03	5.0E+08	4.5E+03	4.5E+12	1.5E+13
I129	< 17	3.E-03	1.E-03	1.E-03	0	3.0E+02	2.0E+10	1.5E+01	1.5E+10	5.0E+10
Ba133	235 +/- 42	316	462	1104	9909	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Cs134	< 4	152	92	93	5.E+10	4.0E+03	6.0E+08	4.5E+03	4.5E+12	1.5E+13
Cs137	< 3	136	532	532	0	1.0E+04	2.0E+09	4.5E+03	4.5E+12	1.5E+13
Eu152	< 9	8.E-02	6.E-02	7.E-02	94	4.0E+03	8.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu154	58 +/- 12	890	648	777	9.E+01	3.0E+03	7.0E+08	4.5E+03	4.5E+12	1.5E+13
Eu155	12.6 +/- 4.8	211	153	184	1.E+04	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Ho166m	< 2.2	4	4.E-01	5.E-01	1	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Bi207	< 8	8.E-07	0	0	0	0.0E+00	0.0E+00	4.5E+03	4.5E+12	1.5E+13
Np236	< 40	0	3.E-11	3.E-11	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Np237	< 50	0	3.E-04	3.E-04	0	1.0E+02	3.0E+09	9.0E+01	9.0E+10	3.0E+11
Am241	< 3	0	21	21	0	2.0E+02	2.0E+10	9.0E+01	9.0E+10	3.0E+11
Am243	< 20	0	6.E-01	6.E-01	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
Cm245	< 16	0	0	0	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U233	Not Analysed	0	6.E-02	6.E-02	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U234	Not Analysed	0	1.E-02	1.E-02	0	2.0E+03	3.0E+11	9.0E+01	9.0E+10	3.0E+11
U235	< 3	0	8.E-07	8.E-07	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
U236	Not Analysed	0	2.E-04	2.E-04	0	0.0E+00	0.0E+00	9.0E+01	9.0E+10	3.0E+11
U238	< 700	0	8.E-04	8.E-04	0	2.0E+03	3.0E+10	9.0E+01	9.0E+10	3.0E+11
Pu238	Not Analysed	0	22	22	0	2.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu239	Not Analysed	0	2	2	0	1.0E+02	7.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu240	Not Analysed	0	5	5	0	1.0E+02	3.0E+11	9.0E+01	9.0E+10	3.0E+11
Pu241	Not Analysed	0	284	284	0	7.0E+03	1.0E+17	9.0E+01	9.0E+10	3.0E+11

Table 86: Activity comparison for sample IM100327 (core)

Tritium			Activity (Bq/g)				
Sample ID	Year	Location	NPL Active	FISPACT - Minimum	FISPACT - Average	FISPACT - Maximum	RWI 2007
IM100287/288/289	1991	Sleeve	33300 +/- 3000	500,200	500,300	500,500	68,665
IM100290/291/292	1991	Sleeve	30900 +/- 2800	500,200	500,300	500,500	68,665
IM100293/294/295	1991	Sleeve	2520 +/- 240	500,200	500,300	500,500	68,665
IM100296/297/298	1991	Sleeve	315 +/- 30	500,200	500,300	500,500	68,665
IM100299/300/301/302	1991	Sleeve	4730 +/- 440	500,200	500,300	500,500	68,665
IM100303/304/305	1991	Sleeve	10900 +/- 1000	500,200	500,300	500,500	68,665
IM100306	1991	Sleeve	13800 +/- 1400	500,200	500,300	500,500	68,665
IM100307	1998	1028/5/1	N/A	N/A	490,300	810,200	195,829
IM100308	1998	1028/5/2	N/A	N/A	490,300	810,200	195,829
IM100309	1998	1028/5/3	N/A	N/A	490,300	810,200	195,829
IM100310	1998	1028/4/1	N/A	N/A	521,300	861,200	195,829
IM100311	1998	1028/4/2	N/A	N/A	521,300	861,200	195,829
IM100312	1998	1028/4/3	N/A	N/A	521,300	861,200	195,829
IM100313	1998	1028/10/1	N/A	N/A	521,300	861,200	195,829
IM100314	1998	1028/10/2	N/A	N/A	521,300	861,200	195,829
IM100315	1998	1028/10/3	N/A	N/A	521,300	861,200	195,829
IM100316	1998	1028/3/1	N/A	N/A	528,400	872,300	195,829
IM100317	1998	1028/3/2	N/A	N/A	528,400	872,300	195,829
IM100318	1998	1028/3/3	N/A	N/A	528,400	872,300	195,829
IM100319	1998	0729/3/1	N/A	N/A	488,100	806,600	195,829
IM100320	1998	0729/3/2	N/A	N/A	488,100	806,600	195,829
IM100321	1998	0729/3/3	N/A	N/A	488,100	806,600	195,829
IM100322	1998	0729/5/1	N/A	N/A	520,800	860,400	195,829
IM100323	1998	0729/5/2	N/A	N/A	520,800	860,400	195,829
IM100324	1998	0729/5/3	N/A	N/A	520,800	860,400	195,829
IM100325	1998	0729/4/1	N/A	N/A	520,800	860,400	195,829
IM100326	1998	0729/4/2	N/A	N/A	520,800	860,400	195,829
IM100327	1998	0729/4/3	N/A	N/A	520,800	860,400	195,829

Table 87: Summary Table for Tritium – Hunterston A

Carbon-14			Activity (Bq/g)				
Sample ID	Year	Location	NPL Active	FISPACT - Minimum	FISPACT - Average	FISPACT - Maximum	RWI 2007
IM100287/288/289	1991	Sleeve	16200 +/- 800	21,320	23,700	25,820	2,499
IM100290/291/292	1991	Sleeve	20800 +/- 1200	21,320	23,700	25,820	2,499
IM100293/294/295	1991	Sleeve	22100 +/- 1200	21,320	23,700	25,820	2,499
IM100296/297/298	1991	Sleeve	16100 +/- 800	21,320	23,700	25,820	2,499
IM100299/300/301/302	1991	Sleeve	20800 +/- 1200	21,320	23,700	25,820	2,499
IM100303/304/305	1991	Sleeve	9010 +/- 460	21,320	23,700	25,820	2,499
IM100306	1991	Sleeve	20800 +/- 1200	21,320	23,700	25,820	2,499
IM100307	1998	1028/5/1	N/A	N/A	26,460	28,250	46,597
IM100308	1998	1028/5/2	N/A	N/A	26,460	28,250	46,597
IM100309	1998	1028/5/3	N/A	N/A	26,460	28,250	46,597
IM100310	1998	1028/4/1	N/A	N/A	64,470	68,830	46,597
IM100311	1998	1028/4/2	N/A	N/A	64,470	68,830	46,597
IM100312	1998	1028/4/3	N/A	N/A	64,470	68,830	46,597
IM100313	1998	1028/10/1	N/A	N/A	64,470	68,830	46,597
IM100314	1998	1028/10/2	N/A	N/A	64,470	68,830	46,597
IM100315	1998	1028/10/3	N/A	N/A	64,470	68,830	46,597
IM100316	1998	1028/3/1	N/A	N/A	111,800	119,300	46,597
IM100317	1998	1028/3/2	N/A	N/A	111,800	119,300	46,597
IM100318	1998	1028/3/3	N/A	N/A	111,800	119,300	46,597
IM100319	1998	0729/3/1	N/A	N/A	25,700	27,440	46,597
IM100320	1998	0729/3/2	N/A	N/A	25,700	27,440	46,597
IM100321	1998	0729/3/3	N/A	N/A	25,700	27,440	46,597
IM100322	1998	0729/5/1	N/A	N/A	62,500	66,730	46,597
IM100323	1998	0729/5/2	N/A	N/A	62,500	66,730	46,597
IM100324	1998	0729/5/3	N/A	N/A	62,500	66,730	46,597
IM100325	1998	0729/4/1	N/A	N/A	62,500	66,730	46,597
IM100326	1998	0729/4/2	N/A	N/A	62,500	66,730	46,597
IM100327	1998	0729/4/3	N/A	N/A	62,500	66,730	46,597

Table 88: Summary Table for Carbon-14 – Hunterston A

Chlorine-36			Activity (Bq/g)				
Sample ID	Year	Location	NPL Active	FISPACT - Minimum	FISPACT - Average	FISPACT - Maximum	RWI 2007
IM100287/288/289	1991	Sleeve	< 1.7	35	132	274	3
IM100290/291/292	1991	Sleeve	< 1.8	35	132	274	3
IM100293/294/295	1991	Sleeve	< 1.3	35	132	274	3
IM100296/297/298	1991	Sleeve	< 1.5	35	132	274	3
IM100299/300/301/302	1991	Sleeve	< 3.2	35	132	274	3
IM100303/304/305	1991	Sleeve	< 1.6	35	132	274	3
IM100306	1991	Sleeve	3.7 +/- 3	35	132	274	3
IM100307	1998	1028/5/1	N/A	N/A	394	589	154
IM100308	1998	1028/5/2	N/A	N/A	394	589	154
IM100309	1998	1028/5/3	N/A	N/A	394	589	154
IM100310	1998	1028/4/1	N/A	N/A	827	1,236	154
IM100311	1998	1028/4/2	N/A	N/A	827	1,236	154
IM100312	1998	1028/4/3	N/A	N/A	827	1,236	154
IM100313	1998	1028/10/1	N/A	N/A	827	1,236	154
IM100314	1998	1028/10/2	N/A	N/A	827	1,236	154
IM100315	1998	1028/10/3	N/A	N/A	827	1,236	154
IM100316	1998	1028/3/1	N/A	N/A	1,188	1,775	154
IM100317	1998	1028/3/2	N/A	N/A	1,188	1,775	154
IM100318	1998	1028/3/3	N/A	N/A	1,188	1,775	154
IM100319	1998	0729/3/1	N/A	N/A	384	574	154
IM100320	1998	0729/3/2	N/A	N/A	384	574	154
IM100321	1998	0729/3/3	N/A	N/A	384	574	154
IM100322	1998	0729/5/1	N/A	N/A	808	1,208	154
IM100323	1998	0729/5/2	N/A	N/A	808	1,208	154
IM100324	1998	0729/5/3	N/A	N/A	808	1,208	154
IM100325	1998	0729/4/1	N/A	N/A	808	1,208	154
IM100326	1998	0729/4/2	N/A	N/A	808	1,208	154
IM100327	1998	0729/4/3	N/A	N/A	808	1,208	154

Table 89: Summary Table for Chlorine-36 – Hunterston A

Cobalt-60			Activity (Bq/g)				
Sample ID	Year	Location	NPL Active	FISPACT - Minimum	FISPACT - Average	FISPACT - Maximum	RWI 2007
IM100287/288/289	1991	Sleeve	570 +/- 100	432	40,980	172,100	1,264
IM100290/291/292	1991	Sleeve	730 +/- 140	432	40,980	172,100	1,264
IM100293/294/295	1991	Sleeve	410 +/- 80	432	40,980	172,100	1,264
IM100296/297/298	1991	Sleeve	580 +/- 100	432	40,980	172,100	1,264
IM100299/300/301/302	1991	Sleeve	480 +/- 100	432	40,980	172,100	1,264
IM100303/304/305	1991	Sleeve	300 +/- 60	432	40,980	172,100	1,264
IM100306	1991	Sleeve	690 +/- 120	432	40,980	172,100	1,264
IM100307	1998	1028/5/1	1550 +/- 280	N/A	1,956	4,219	1,502
IM100308	1998	1028/5/2	1330 +/- 240	N/A	1,956	4,219	1,502
IM100309	1998	1028/5/3	1310 +/- 240	N/A	1,956	4,219	1,502
IM100310	1998	1028/4/1	6600 +/- 1200	N/A	4,042	8,685	1,502
IM100311	1998	1028/4/2	6600 +/- 1200	N/A	4,042	8,685	1,502
IM100312	1998	1028/4/3	6500 +/- 1200	N/A	4,042	8,685	1,502
IM100313	1998	1028/10/1	9300 +/- 1600	N/A	4,042	8,685	1,502
IM100314	1998	1028/10/2	9900 +/- 1800	N/A	4,042	8,685	1,502
IM100315	1998	1028/10/3	10600 +/- 1800	N/A	4,042	8,685	1,502
IM100316	1998	1028/3/1	700 +/- 120	N/A	5,885	12,550	1,502
IM100317	1998	1028/3/2	710 +/- 140	N/A	5,885	12,550	1,502
IM100318	1998	1028/3/3	740 +/- 140	N/A	5,885	12,550	1,502
IM100319	1998	0729/3/1	2410 +/- 420	N/A	1,906	4,112	1,502
IM100320	1998	0729/3/2	2200 +/- 400	N/A	1,906	4,112	1,502
IM100321	1998	0729/3/3	2740 +/- 480	N/A	1,906	4,112	1,502
IM100322	1998	0729/5/1	11800 +/- 2000	N/A	3,950	8,490	1,502
IM100323	1998	0729/5/2	12400 +/- 2200	N/A	3,950	8,490	1,502
IM100324	1998	0729/5/3	13900 +/- 2400	N/A	3,950	8,490	1,502
IM100325	1998	0729/4/1	9100 +/- 1600	N/A	3,950	8,490	1,502
IM100326	1998	0729/4/2	8700 +/- 1600	N/A	3,950	8,490	1,502
IM100327	1998	0729/4/3	9300 +/- 1600	N/A	3,950	8,490	1,502

Table 90: Summary Table for Cobalt-60 – Hunterston A

APPENDIX 8A – COMPARISON OF GRAPHITE ACTIVATION DUE TO LOCATION AND PRECURSOR CONCENTRATIONS

FISPACT analysis was undertaken for samples placed at varying positions throughout the reactor in order to ascertain the scope of axial and radial variations in activity.

All samples were irradiated for 6.52 years and neutron flux and spectra were changed between these hypothetical positions based on Sizewell and Wylfa data.

All samples within the same precursor group (e.g. minimum, average, etc.) had the same pre-cursor concentration. John Jowett Precursor concentrations were not considered as this study is focused entirely on variation in activity for Hunterston A fuel sleeve graphite (Type VFT).

The variance in activity is calculated as maximum activity divided by minimum.

Table 91 shows how the activity at 1991 varies depending on the inactive data used – minimum, average or maximum precursor concentrations.

It can be seen that for some key precursors, namely H-3, C-14, Cs-134, there is little variance. However, the variance for radionuclides such as Cl-36, Co-60, Cs-137 and certain trans-uranics varies by many orders of magnitude, with Cs-137 and U-235 and Co-60 all varying by about three orders of magnitude.

This demonstrates the sensitivity of the calculations to the accuracy and precision of precursor data.

	1991 - Activities (Bq/kg)			
Radionuclide	**Minimum**	**Average**	**Maximum**	**Variance**
H3	500200000	500300000	500500000	1.00
C14	21320000	23700000	25820000	1.21
Cl36	34970	132400	273600	7.82
Na22	0	0	0	N/A
Co57	0	0	0	N/A
Co60	431900	40980000	172100000	398.47
Sr85	0	0	0	N/A
Nb94	63520	63520	63520	1.00
Ag108m	110200	222400	334600	3.04
Cd109	104.4	208.4	312.4	2.99
Sb125	3698	16280	53980	14.60
Sn126	0.3296	78.76	313.8	952.06
I129	0.1035	8.271	32.75	316.43
Ba133	2853	107000	560500	196.46
Cs134	430700	441700	474800	1.10
Cs137	43000	10360000	41290000	960.23
Eu152	3.271	53.25	156.6	47.88
Eu154	84090	873100	1954000	23.24
Eu155	19860	205800	459600	23.14
Ho166m	637	1056	1313	2.06
Bi207	0	0	0	N/A
Np236	0	0	4.131E-08	N/A
Np237	0.00287	0.1541	0.6073	211.60
Am241	232.5	233	234.4	1.01
Am243	1.399	1.399	1.4	1.00
Cm245	0.00347	0.003471	0.003471	1.00
U233	143.3	37340	148800	1038.38
U234	12.43	3234	12890	1037.01
U235	0.0005657	0.1395	0.556	982.85
U236	0.004162	0.5819	2.313	555.74
U238	0.009522	0.009523	0.009525	1.00
Pu238	74.55	456.2	1600	21.46
Pu239	29.43	29.75	30.71	1.04
Pu240	46.48	46.68	47.25	1.02
Pu241	3801	3810	3835	1.01

Table 91: Variance in activity based on precursor concentration used – all results are for the "halfway" core position

APPENDIX 9 – GRAPHITE DEGRADATION RESULTS

Neutron Energy Spectra

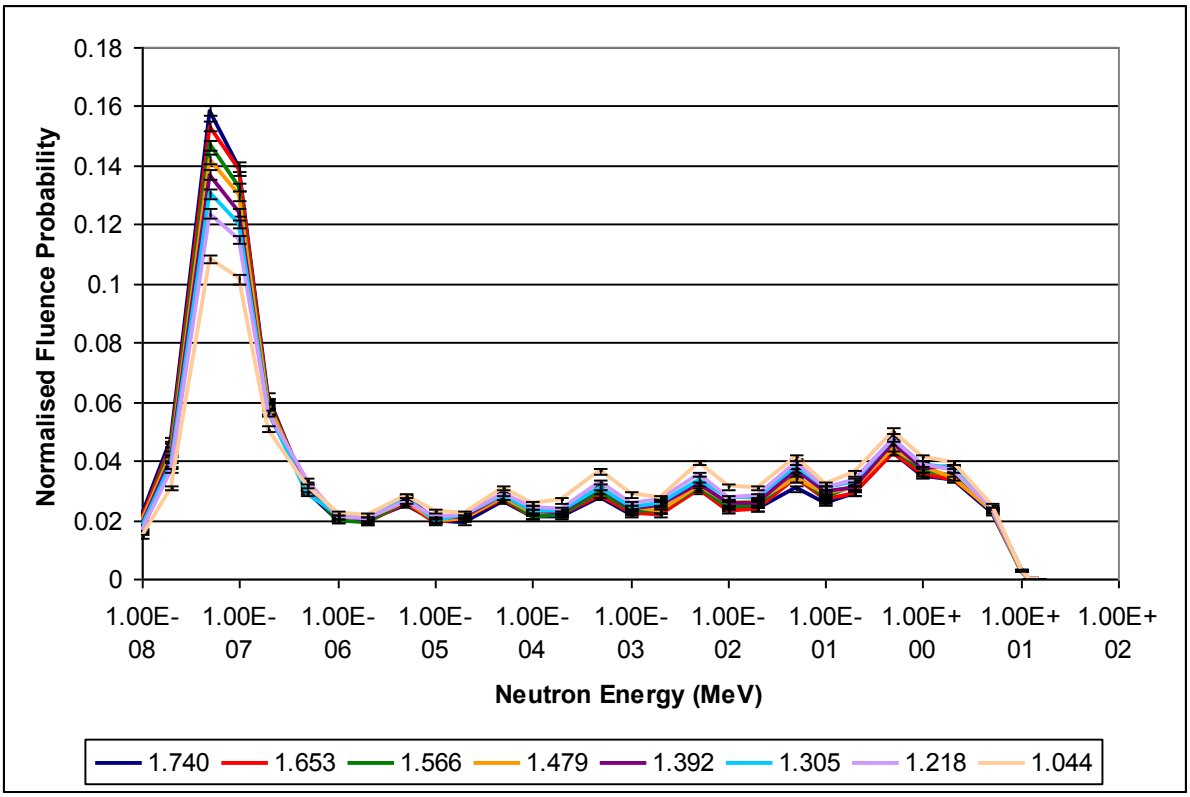

Figure 27: Normalised Energy Spectra as a function of graphite density

As can be seen in Figure 27, as the core density decreases, there is a probability shift towards faster neutron energies from thermal energies. This is due to less neutron scattering interactions taking place.

This reduction of thermal neutron probability will cause activation rates to decrease for most radionuclides for a set neutron flux, as thermal neutrons have a higher probability of interacting with the nucleus of an atom and cause an activation event.

Activation Comparison

The graphite density test used the flux profile for a sample at the centre of Sizewell A that has been assumed to have been removed in 1998. Material precursors are based on NPL average inactive precursor concentrations.

Once the activation calculations have taken place, the inventories are balanced by removing an amount of all carbon radionuclides equal to the density loss and balancing the inventory back up to a full kilogram (this data is referred to as “mass corrected”). The results of this are presented below (Table 92).

Activity (Bq/g)	Density (g/cc)							
Radionuclide	**1.740**	**1.653**	**1.566**	**1.479**	**1.392**	**1.305**	**1.218**	**1.044**
C14	192600	187800	181700	178000	172300	166200	159600	143300
Co60	15950	15860	15720	15660	15520	15350	15180	14690
Ba133	1391	1374	1354	1347	1322	1300	1279	1230
Eu154	159.7	165.2	174	180.1	188.7	198.9	210.7	247.8
Eu155	79.14	80.26	83.6	85.01	86.32	90.26	93.92	103.8

Table 92: Activity for key radionuclides as a function of graphite density (Non mass corrected)

Activity (Bq/g)	Density (g/cc)							
Radionuclide	**1.740**	**1.653**	**1.566**	**1.479**	**1.392**	**1.305**	**1.218**	**1.044**
C14	192600	187800	181700	178000	172300	166200	159600	143300
Co60	15950	16695	17467	18424	19400	20467	21686	24483
Ba133	1391	1446	1504	1585	1653	1733	1827	2050
Eu154	160	174	193	212	236	265	301	413
Eu155	79	84	93	100	108	120	134	173

Table 93: Activity for key radionuclides as a function of graphite density (Mass corrected)

From Table 92, it can be seen that the change in energy spectrum alone has a varying effect on the inventory. For C-14, activity drops off quite significantly; this is likely because C-14 activation from nitrogen is very dependent on thermal neutron flux, which decreases with density (Figure 27). For Co-60 (Figure 28) and Ba-133, the activity decrease is much less pronounced; this is likely due to activation from their precursors being from a wider range of neutron energies. For europium nuclides (Figure 29), activity actually increases. This is due to less burn up of these radionuclides occurring. The burn-up of europium nuclides has been previously covered [5].

From Table 93, which has been mass corrected for carbon loss, it can be seen that until a density of about 1.392 g/cc (20% carbon loss) is experienced, the actual change in activity is well within the error margins seen (typically ~20% error in analytical results).

These results are all based on MCNP calculations which are time independent. As a result, the FISPACT calculations assume that this density was always present. In reality should the graphite experience ~20% density loss over a given time, it is likely that the activity would be more in line with the results that used the spectrum for 10% density loss (1.566 g/cc) as an average over the time of irradiation.

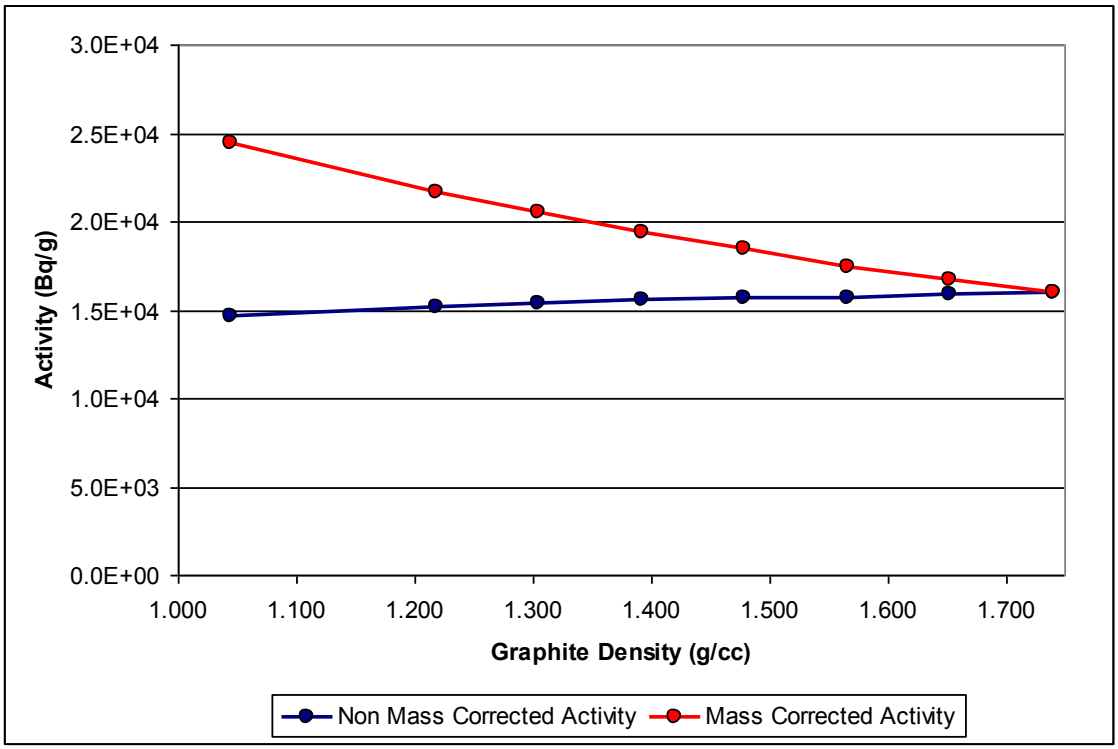

Figure 28: Change in Co-60 activity concentration with bulk graphite density

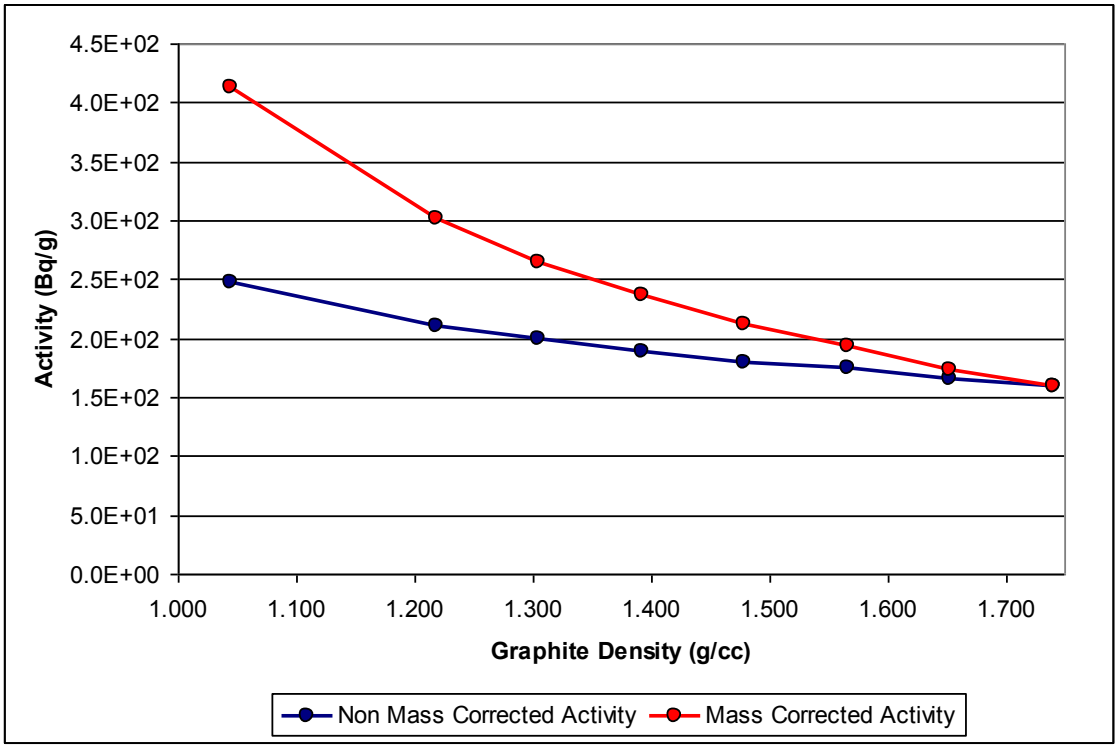

Figure 29: Change in Eu-154 activity concentration with bulk graphite density

The extent of the density loss for the obtained samples is unknown, thus it is difficult to apply these findings to any particular result.