Trawsfynydd Reactor Buildings
Asbestos Bagwash Quantity

1. Introduction & Purpose

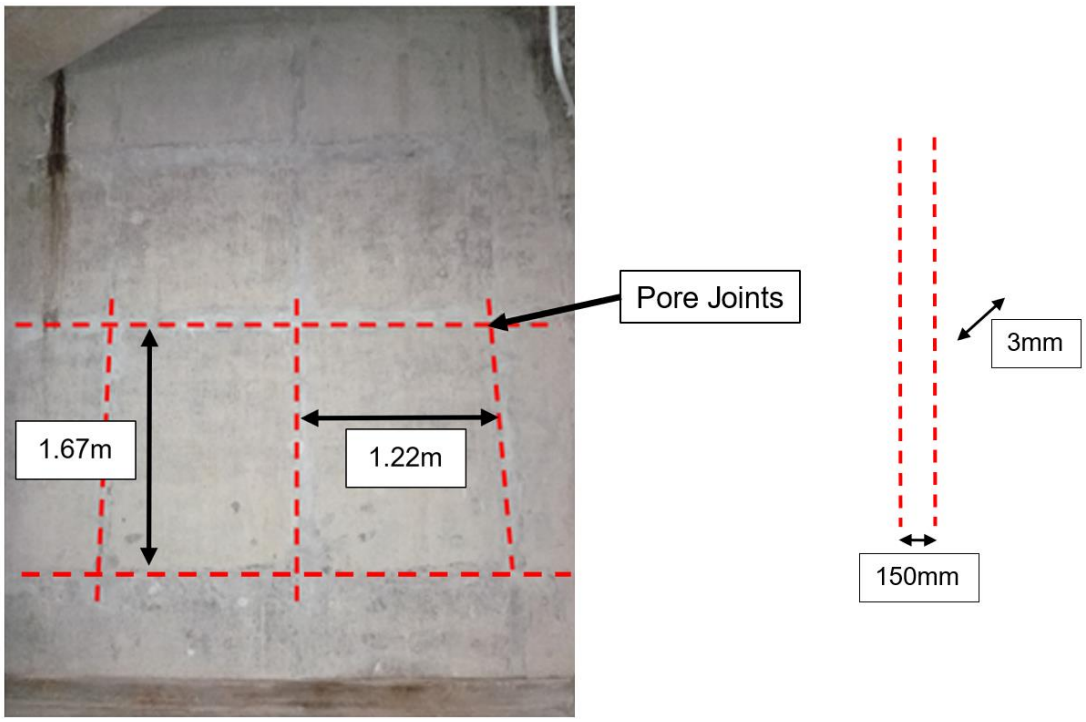
1 The Height Reduction project involves partial demolition of the two Reactor Buildings at Trawsfynydd site. Several reinforced concrete walls will be demolished above the cut line. During the construction of the Trawsfynydd Reactor Buildings, asbestos bagwash was applied to the walls' rough concrete pour joints or in locations of pour imperfections. During demolition, the concrete waste is to be crushed to a grade of 6F2 and used as fill material to improve and extend an existing site laydown area. This report measures the proportion of asbestos bagwash within the total concrete waste, noting that the permissible limit for bagwash is 0.1% of the overall concrete waste.

2. Site Data

1 Pour joints site data:

- Pore joints have a vertical separation of 1.67m and a horizontal separation of 1.22m.
- Pore joints have a depth of 3mm and a width of 150mm.

These figures reflect a conservative interpretation of the pour joint site data.

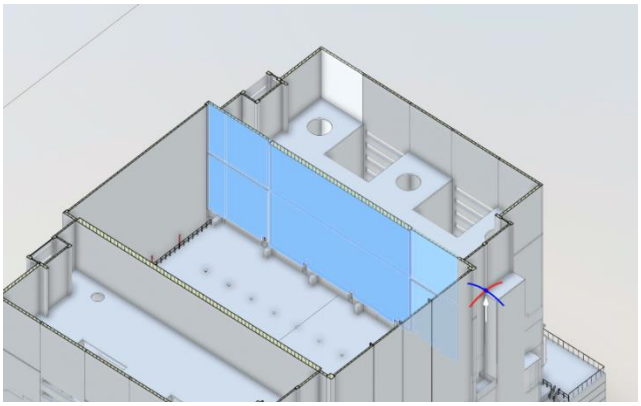


The table below details the walls considered in this calculation. These are based off Reactor Building 2 North End, which will provide the worse case results due to having the largest volume of walls. The results will be used for all other ends (RB2 South, and RB1 North & South) and considered in the final calculation (section 4). The number of walls is also detailed in the table where some individual ones are identical, refer to the images in each individual calculation in section 3 for a visual representation.

Wall Number	Wall	Height	Length	Depth	Number of Walls
1	Between the Charge Hall and Hot Gas Duct Cells	21m	47.9m	0.8m	1
2	Inner Boiler Boxes (E-W Elevation)	15m	8m	0.4m	3
3	Inner Boiler Boxes (N-S Elevation)	14.9m	8.9m	0.4m	4
4	Outer Boiler Boxes (E-W Elevation)	29.6m	8m	0.42m	3
5	Outer Boiler Boxes (N-S Elevation)	29.6m	8m	0.475m	2
6	Inner Hot Gas Duct Cells (N-S Elevation)	13.5m	4.6m	0.3m	2
7	Outer Hot Gas Duct Cells (N-S Elevation)	13.5m	4.6m	0.6m	2
8	Outer Hot Gas Duct Cells (E-W Elevation)	13.5m	29m	0.6m	1
9	Between Stairwell and Capping Roof (East & West)	24.9m	4.3m	0.3m	2
10	Above Stairwell (East)	14.5m	5.2m	0.3m	1
11	Above Interspace Pre-Cast Panels	14.5m	9.3m	0.3m	2

3. Individual Wall Calculations

1 **Wall 1: Between Charge Hall and Hot Gas Duct Cells**



Number of walls: 1
Height: 21m, Length: 47.9m, Depth: 0.8m.
Pore joints are on both sides of the wall.

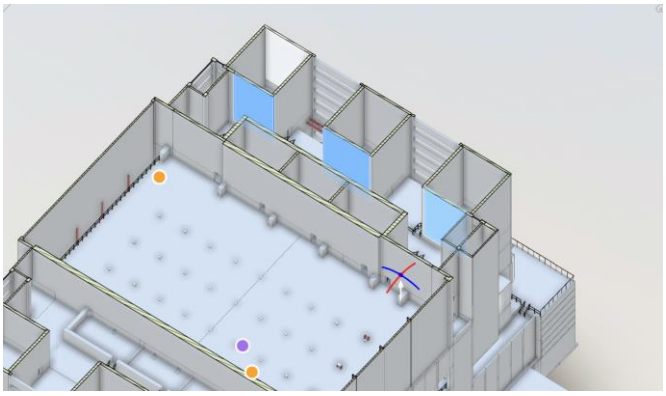
Volume of Wall: 21m x 47.9m x 0.8m = 805m^3

Number of Vertical Pore Joints: (47.9m ÷ 1.22m) x 2 sides x 1 wall = 78.5
Number of Horizontal Pore Joints: (21m ÷ 1.67m) x 2 sides x 1 wall = 25.1

Total Volume of Pore Joints:
(78.5 x 21m x 0.003m x 0.15m) + (25.1 x 47.9m x 0.003m x 0.15m) = 1.28m^3

Percentage Volume of Pore Joints Compared to Wall Volume
(1.28m^3 ÷ 805m^3) x 100% = **0.16%**

2 **Wall 2: Inner Boiler Boxes (East – West Elevation)**



Number of walls: 3
Height: 12.35m, Length: 8m, Depth: 0.4m
Pore joints are on both sides of the wall.

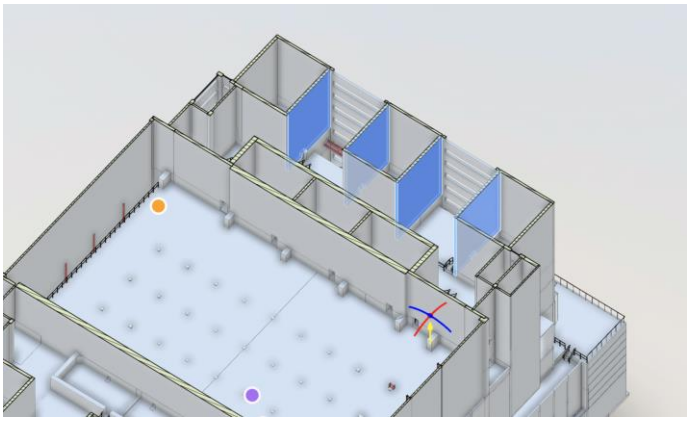
Volume of Wall: 12.35m x 8m x 0.4m = 40m^3
Volume of All Walls: 48m^3 x 3 = 119m^3

Total Number of Vertical Pore Joints (All Walls): (8m ÷ 1.22m) x 2 sides x 3 walls = 39.3
Total Number of Horizontal Pore Joints (All Walls): (12.35m ÷ 1.67m) x 2 sides x 3 walls = 44.4

Total Volume of Pore Joints:
(39.3 x 12.35m x 0.003m x 0.15m) + (44.4 x 8m x 0.003m x 0.15m) = 0.38m^3

Percentage Volume of Pore Joints Compared to Wall Volume
(0.38m^3 ÷ 119m^3) x 100% = **0.32%**

3 **Wall 3: Inner Boiler Boxes (North – South Elevation)**



Number of walls: 4
Height: 13.45m, Length: 8.9m, Depth: 0.4m.
Pore joints are on both sides of the wall.

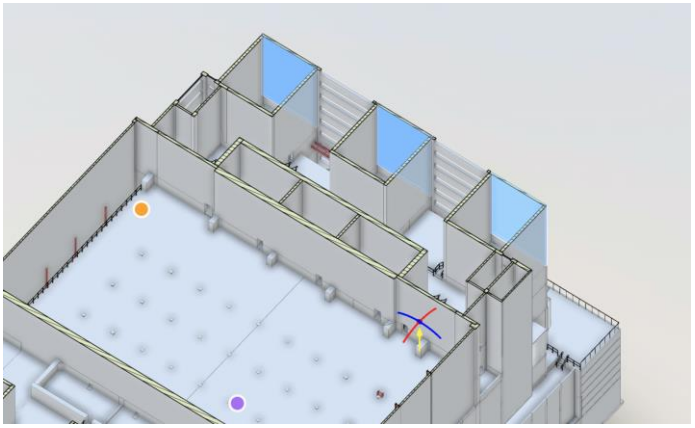
Volume of Wall: 13.45m x 8.9m x 0.4m = 48m^3
Volume of All Walls: 48m x 4 = 192m^3

Total Number of Vertical Pore Joints (All Walls): (8.9m ÷ 1.22m) x 2 sides x 4 walls = 58.4
Total Number of Horizontal Pore Joints (All Walls): (13.45m ÷ 1.67m) x 2 sides x 4 walls = 64.4

Total Volume of Pore Joints:
(58.4 x 13.45m x 0.003m x 0.15m) + (64.4 x 8.9m x 0.003m x 0.15m) = 0.61m^3

Percentage Volume of Pore Joints Compared to Wall Volume
(0.61m^3 ÷ 192m^3) x 100% = **0.32%**

4 **Wall 4: Outer Boiler Boxes (East – West Elevation)**



Number of walls: 3
Height: 27.9m, Length: 8m, Depth: 0.42m.
Pore joints are on the internal side of the wall only.

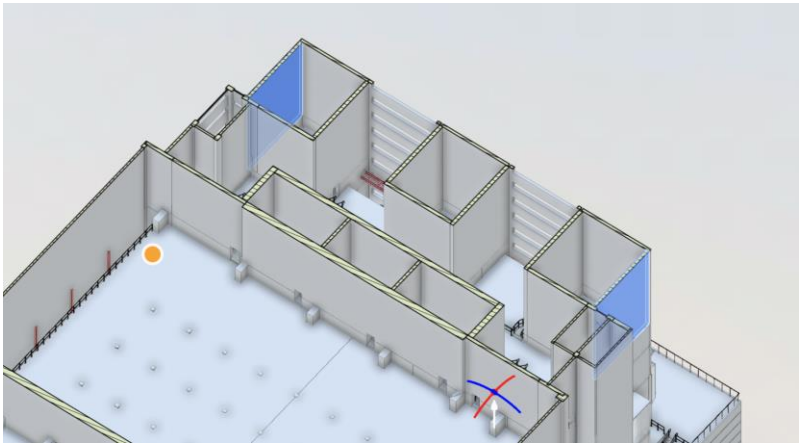
Volume of Wall: 27.9 x 8m x 0.42m = 94m^3
Volume of All Walls: 94m^3 x 3 = 281m^3

Total Number of Vertical Pore Joints (All Walls): (8m ÷ 1.22m) x 1 side x 3 walls = 19.7
Total Number of Horizontal Pore Joints (All Walls): (27.9m ÷ 1.67m) x 1 side x 3 walls = 50.2

Total Volume of Pore Joints:
(19.7 x 27.9m x 0.003m x 0.15m) + (50.2 x 8m x 0.003m x 0.15m) = 0.43m^3

Percentage Volume of Pore Joints Compared to Wall Volume:
(0.43m^3 ÷ 281m^3) x 100% = **0.15%**

5 **Wall 5: Outer Boiler Boxes (North – South Elevation)**



Number of walls: 2
Height: 27.9m, Length: 8m, Depth: 0.475m.
Pore joints are on the internal side of the wall only.

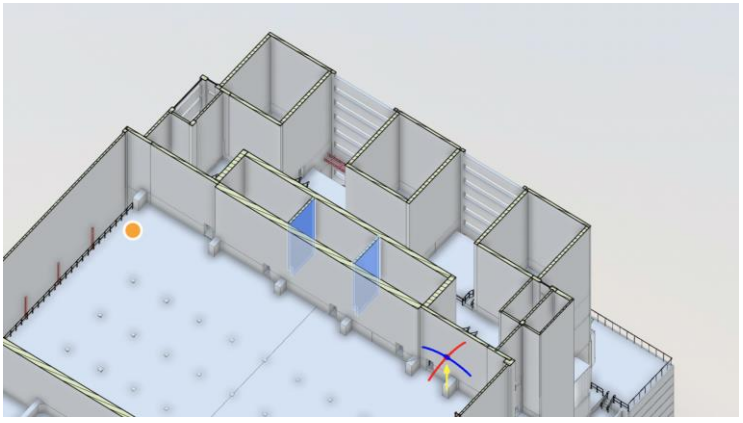
Volume of Wall: 27.9m x 8m x 0.475m = 106m^3
Volume of All Walls: 106m^3 x 2 = 212m^3

Total Number of Vertical Pore Joints (All Walls): (8m ÷ 1.22m) x 1 side x 2 walls = 13.1
Total Number of Horizontal Pore Joints (All Walls): (27.9m ÷ 1.67m) x 1 side x 2 walls = 33.4

Total Volume of Pore Joints:
(13.1 x 27.9m x 0.003m x 0.15m) + (33.4 x 8m x 0.003m x 0.15m) = 0.29m^3

Percentage Volume of Pore Joints Compared to Wall Volume
(0.29m^3 ÷ 212m^3) x 100% = **0.14%**

6 **Wall 6: Inner Hot Gas Duct Cells (North – South Elevation)**



Number of walls: 2
Height: 11.5m, Length: 4.6m, Depth: 0.318m.
Pore joints are on both sides of the wall.

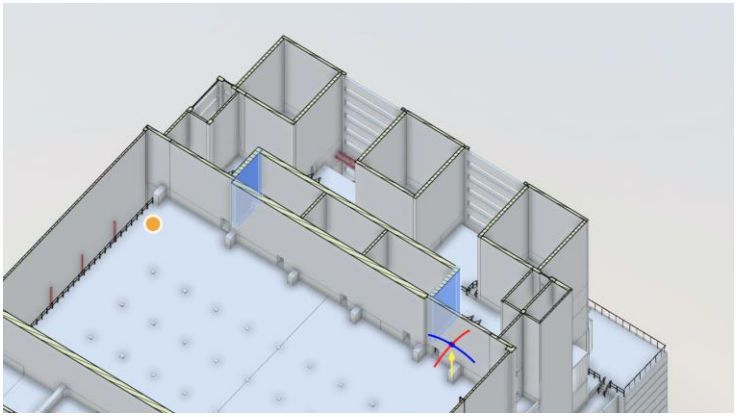
Volume of Wall: 11.5m x 4.6m x 0.318m = 17m^3
Volume of All Walls: 17m^3 x 2 = 34m^3

Total Number of Vertical Pore Joints (All Walls): (4.6m ÷ 1.22m) x 2 sides x 2 walls = 15.1
Total Number of Horizontal Pore Joints (All Walls): (11.5m ÷ 1.67m) x 2 sides x 2 walls = 27.7

Total Volume of Pore Joints:
(15.1 x 11.5m x 0.003m x 0.15m) + (27.7 x 4.6m x 0.003m x 0.15m) = 0.14m^3

Percentage Volume of Pore Joints Compared to Wall Volume
(0.14m^3 ÷ 34m^3) x 100% = **0.41%**

7 **Wall 7: Outer Hot Gas Duct Cells (North – South Elevation)**



Number of walls: 2
Height: 10.45m, Length: 4.6m, Depth: 0.61m.
Pore joints are on both sides of the wall.

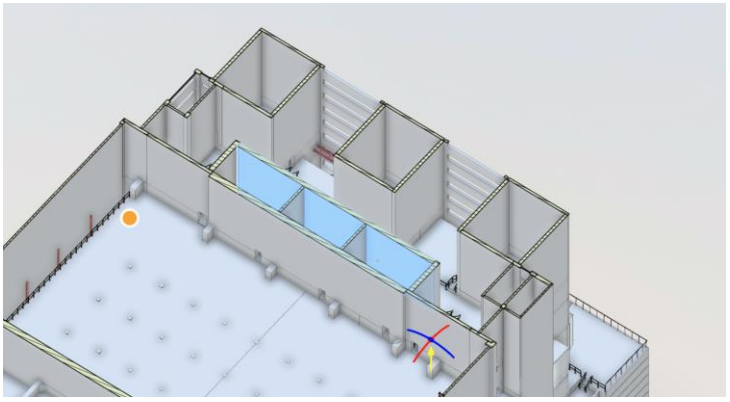
Volume of Wall: 10.45m x 4.6m x 0.61m = 29m^3
Volume of All Walls: 29m^3 x 2 = 58m^3

Total Number of Vertical Pore Joints (All Walls): (4.6m ÷ 1.22m) x 2 sides x 2 walls = 15.1
Total Number of Horizontal Pore Joints (All Walls): (10.45m ÷ 1.67m) x 2 sides x 2 walls = 25.0

Total Volume of Pore Joints:
(15.1 x 10.45m x 0.003m x 0.15m) + (25.0 x 4.6m x 0.003m x 0.15m) = 0.12m^3

Percentage Volume of Pore Joints Compared to Wall Volume
(0.12m^3 ÷ 58m^3) x 100% = **0.21%**

8 **Wall 8: Outer Hot Gas Duct Cells (East – West Elevation)**



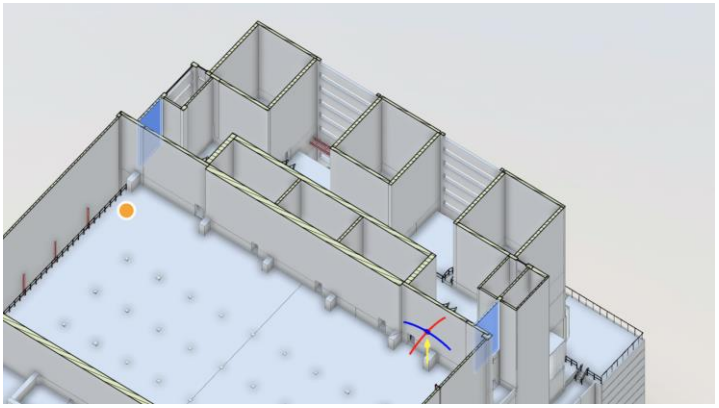
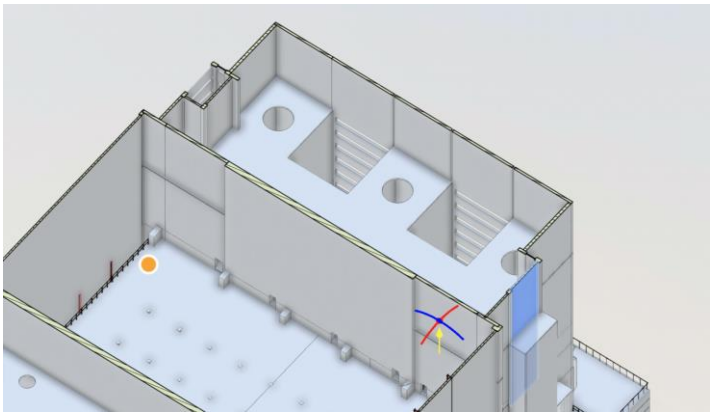
Number of walls: 1
Height: 10.45m, Length: 29m, Depth: 0.61m.
Pore joints on both sides of the wall.

Volume of Wall: 10.45m x 29m x 0.61m = 185m^3

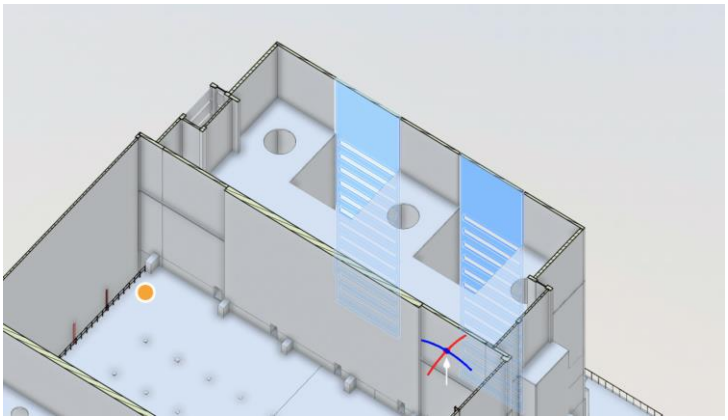
Total Number of Vertical Pore Joints: (29m ÷ 1.22m) x 2 sides x 1 wall = 47.5
Total Number of Horizontal Pore Joints: (10.45m ÷ 1.67m) x 2 sides x 1 wall = 12.5

Total Volume of Pore Joints:
(47.5 x 10.45m x 0.003m x 0.15m) + (12.5 x 29m x 0.003m x 0.15m) = 0.39m^3

Percentage Volume of Pore Joints Compared to Wall Volume
(0.39m^3 ÷ 185m^3) x 100% = **0.21%**

9	**Wall 9: Outer Wall Between Charge Hall and Stairwells**  Number of walls: 2 Height: 24.9m, Length: 4.3m, Depth: 0.3m. Pore joints are on the internal side of the wall only. Volume of Wall: 24.9m x 4.3m x 0.3m = 32m^3 Volume of All Walls: 32m^3 x 2 = 64m^3 Total Number of Vertical Pore Joints (All Walls): (4.3m ÷ 1.22m) x 1 side x 2 walls = 7.0 Total Number of Horizontal Pore Joints (All Walls): (24.9m ÷ 1.67m) x 1 side x 2 walls = 29.8 Total Volume of Pore Joints: (7.0 x 24.9m x 0.003m x 0.15m) + (29.8 x 4.3m x 0.003m x 0.15m) = 0.14m^3 Percentage Volume of Pore Joints Compared to Wall Volume (0.14m^3 ÷ 64m^3) x 100% = **0.22%**
10	**Wall 10: Above East Staircases Cut Off**  Number of walls: 1 Height: 14.5m, Length: 5.2m, Depth: 0.3m. Pore joints are on the internal side of the wall only. Volume of wall: 14.5m x 5.2m x 0.3m = 23m^3 Total Number of Vertical Pore Joints: (5.2m ÷ 1.22m) x 1 side x 1 wall = 4.3 Total Number of Horizontal Pore Joints: (14.5m ÷ 1.67m) x 1 side x 1 wall = 8.7 Total Volume of Pore Joints: (4.3 x 14.5m x 0.003m x 0.15m) + (8.7 x 5.2m x 0.003m x 0.15m) = 0.05m^3 Percentage Volume of Pore Joints Compared to Wall Volume (0.05m^3 ÷ 23m^3) x 100% = **0.22%**

11 **Above Interspace Pre-Cast Panels**



Number of walls: 2
Height: 14.5m, Length: 9.3m, Depth: 0.3m.
Pore joints are on the internal side of the wall only.

Volume of Wall: 14.5m x 9.3m x 0.3m = $40m^3$
Volume of All Walls: $40m^3$ x 2 = $80m^3$

Total Number of Vertical Pore Joints (All Walls): (9.3m ÷ 1.22m) x 1 side x 2 walls = 15.2
Total Number of Horizontal Pore Joints (All Walls): (14.5m ÷ 1.67m) x 1 side x 2 walls = 17.4

Total Volume of Pore Joints:
(15.2 x 14.5m x 0.003m x 0.15m) + (17.4 x 9.3m x 0.003m x 0.15m) = $0.17m^3$

Percentage Volume of Pore Joints Compared to Wall Volume
($0.17m^3$ ÷ $80m^3$) x 100% = **0.21%**

4. Total Bagwash Calculation

1 The bagwash quantity calculations for each individual wall in section 3 are for Reactor Building 2 North. The quantities are the same for Reactor Building 2 South and Reactor Building 1 North & South.

Total Wall Volume RB1 & RB2	$8214m^3$
Total Pore Joints Volume RB1 & RB2	$16.0m^3$
Total Percentage Volume of Pore Joints Compared to Wall Volume RB1 & RB2	**0.28%**

5. Sampling Results – Worst Case

1 Based off the 2021 HSE Laboratory Sampling results, the amount of asbestos in the joints (worse case) was 3.11%.

Based off this worse case:
3.11% of the Total Pore Joints Volume RB1 & RB2: $16.0m^3$ x (3.11/100) = $0.50m^3$

Final Bagwash Quantity is therefore the percentage volume of pore joints (above) compared to the total wall volume:
($0.498m^3$ ÷ $8214m^3$) x 100% = **0.0060%** **[therefore OK]**
0.0060% is less than the allowable percentage volume of asbestos in compacted concrete waste (0.1%, therefore this value is acceptable).

6. Sampling Results – Average

1 For comparison the average asbestos level taken from the same 2021 HSE Laboratory Sampling Results equals 1.50%.

Based off the average:
1.50% of the Total Pore Joints Volume RB1 & RB2: $16.0m^3$ × (1.50/100) = $0.24m^3$

Final Bagwash Quantity based off the average:
($0.24m^3$ ÷ $8214m^3$) × 100% = 0.0029% **[therefore OK]**
0.0029% is less than the allowable percentage volume of asbestos in compacted concrete waste (0.1%, therefore this value is acceptable).

7.	Theoretical Worst Case Concentration – Discrete Block
1	A 1m³ rc block consigned and processed in isolation could result in a theoretical discrete worst case. Using the highest output volume of Pore Joints Compared to Wall Volume from the above studies cases, Wall Number 6 is identified as the theoretical worst case due to the slenderness and reduction in rc volume for dilution. For a 1m³ consignment the volume of asbestos can be calculated as: Contaminant in total pour joint volume for Wall 6 = 0.14 x 0.0311 = 0.00435m³ Convert to 1m³ of wall = 0.00435 / 34 = 0.00012806m³ % = (0.000128 / 1) x 100 = **0.0128%** **[therefore OK]** **0.0128% is less than the allowable percentage volume of asbestos in compacted concrete waste (0.1%, therefore this value is acceptable).** **Calculation conservatism (applicable to Section 5, 6 & 7 above:** • The worst-case results from HSE testing and analysis have used for the above calculation (Section 5). • There is a clear trend of results between RB1 & RB2. The above worst case is based upon the worst-case result. • The likelihood of a 1m3 rc block being crushed in isolation is not considered credible given the nature of demolition works undertaken i.e. superstructure demolished in courses systematically to managed local and global stability.

Author:

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Position: Project Engineer — Date: 09/06/2026

Calculation Verifier:

Name: Gruffudd Ap Gwyndaf — Signature: G.H.Ap Gwyndaf

Position: Senior Project Engineer — Date: 10/06/2026

Approver:

Name: Gareth Van Heerden — Signature:

Position: Engineering Lead — Date: 10/06/2026

References:

Refer to the following attachments:

- Underpinning Chrysolite Analysis of Wash Bagged Surface Finish within the RCA - M/EF/TRA/REP/0008/21 Issue 1 (May 2021)
- Element Certificate of Analysis – Document Reference 3.10.7 Issue 12
- XRD Analysis of Concrete Fibres – HSE-SD ref. PE11650
- HSE Laboratory Report – Worksheet No. FIB/21-4562 (PLM)
- HSE Laboratory Report – Worksheet No. 21-4562 (XRD)
- HSE Laboratory Report - Worksheet No. FIB/21-4563 (PLM)
- HSE Laboratory Report - Worksheet No. 21-4563 (XRD)
- HSE Laboratory Report - Worksheet No. FIB/21-4619 (PLM)
- HSE Laboratory Report - Worksheet No. 21-4619 (XRD)
- HSE Laboratory Report - Worksheet No. 22-4760 / FLM (XRD)
- HSE Laboratory Report - Worksheet No.22-4759 / MF (XRD)

M/EF/TRA/REP/0008/21
Issue 1 May 2021

TRAWSFYNYDD SITE: UNDERPINNING CHRYSOTILE ANALYSIS OF WASHBAGGED SURFACE FINISH WITHIN THE RCA

By Dr D Buckley
Magnox Limited

TRAWSFYNYDD SITE:
UNDERPINNING CHRYSOTILE ANALYSIS OF WASHBAGED SURFACE FINISH IN THE RCA

Dr D Buckley: Senior Consultant, Technical Function, RA&S, OTC.
Issue Date: May 2021

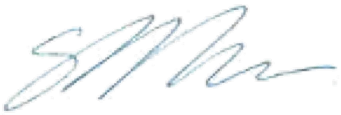
This report has been subject to the following verification at QA Grade 3.

- Confirm that technical content is adequate.
- Confirm that the document is self-consistent.
- Check spelling, punctuation and grammar are correct.

Signature:  **26/05/2021**

Mr G Van Heerden; Senior Project Engineer & SME (Asbestos)

Approved for Issue

Signature:  02/06/2021

Mr S Mclauchlan; RA & S; Team Leader, Technical Consultancy

Document issue/amendment record

Issue No.	Date	Description of changes
Issue 1	May 2021	First formal issue

SUMMARY

This document has been prepared with regards to the Radiation Controlled Area (RCA) Ponds Complex to support the Ponds Down Programme for the Trawsfynydd site.

This report provides details of the work required for the characterisation of areas within the RCA Ponds Complex and the individual rooms and the two future reactor Safestores, to determine the level of contamination on / within the concrete surface coating containment by chrysotile.

This will be used to inform the Plants & Structures programme on the preparations for the In-Situ and On-site disposal of the construction material; and help underpin decisions in developments going forward such as remediation requirements where applicable along with suitable methods and applications. This document covers:

1. Taking randomised samples and the analysis for the presence of chrysotile (on site capability),
2. From samples identify a statistically significant number that are positive for chrysotile for quantitative analysis,
3. Engage a suitably accredited laboratory for those samples for positive discriminatory testing to confirm % content asbestos.

Subsequently the programme can back calculate, using the sample size, to building a value of the fabric total % asbestos and measure against the Guidance on the Classification and Assessment of Waste (Technical Guidance WM3).

TABLE OF CONTENTS

1.0 INTRODUCTION

The Plant & Structures programme at Trawsfynydd has been tasked to reconfigure buildings to facilitate entry into C&M or On Site Disposal of RCA ponds buildings and future Safestores of the reactor buildings. Coated surfaces, concrete screeds and Bagwash are encountered throughout the RCA, and it has been shown that there are asbestos fibres within the surface coat. Consequently asbestos analysis of the areas will be undertaken to confirm the status with regards to fibres content and its relative abundance compared with waste regulations. This document underpins the sampling strategy for the sampling and for qualitative and quantitative analysis of chrysotile asbestos fibres contaminating the Bagwash on concrete surfaces.

2.0 OBJECTIVE OF THE WORK

The analysis to be undertaken takes cognisance that the building of the RCA Ponds Complex are to be partially demolished to facilitate the on-site/in-situ proposed disposal programme, and assess the asbestos contamination of the reactor buildings prior to their reconfiguration into Safestores. The asbestos data will form part of the underpinning substantiation to Natural Resources Wales as part of the safety case for disposal. This document, is association with "sampling location" drawings produced for each population and agreed with by Magnox's Intelligent Customer (IC), underpins both the amount of samples to be taken and their location, and will be included in the Health & Safety file forming part of the pre-construction information at time of demolition.

To develop sampling plans, the area to be demolished has been sub-divided into three Zones. This is as a consequence that insufficient underpinning is available to support a hypothesis that construction materials building(s) of these area can be assigned as a single population albeit they were constructed within a single construction time frame. Therefore the Radiation Controlled Area (RCA) has been divided into Zones accordingly and each Zone is treated as a separate population: these comprise buildings that make up the Original Ponds Complex; Reactor Building 1 (RB1) and Reactor Building 2 (RB2). In addition these areas are made of sub-divisions that have been selected to allow the assumption that contamination is distributed relatively homogeneously and representative of the asbestos distribution in the wider area of the sampled population.

It is perceived that the final outcome from the sampling campaign will underpin the supposition that *'the level of asbestos contamination is below the 0.1% wt/wt level required to prove that it is below the threshold test for hazardous waste in WM3".*

For the purposes of sampling and characterisation, the three Zones have been divided to provide sub-zones. A total of six (6) sub-zones for the Original Ponds Complex; making up one population, and eleven (11) sub-zones each for the two Reactor Safestores.

3.0 PROJECT SCOPE & OVERVIEW

An overview of the facility being assessed for Chrysotile was developed from information that was gathered during scoping of the Trawsfynydd's Site's Ponds Down Programme for the preparation of this document and those to be presented to Natural Resources Wales. The area for asbestos sampling and analysis are shown in Site Plan 1, 2 and 3 includes:

- Original Ponds Complex Buildings containing six areas that will be sampled,
- RB1 and RB2 future Safestores (reactor floor levels), of which twenty two (22) will be sampled.

The scope of this document covers the retrieval of a statistically significant number of samples of the bagwash wall treatment material for quantitative analysis as a percentage asbestos content in the coating. The aim is to acquire adequate samples such that sufficient data is available to underpin decisions with regards to building contamination prior to demolition or any remediation that may be required in the future for the end state of the three Zones that make up the RCA. Programme. This is summarised as follows:

- Facilitate the collection of the appropriate amount of data,
- Enable the sampling to be representative of the populations of interest,
- Mitigate unnecessary re-work,
- Supply sufficient and substantive data to reduce the possibility of omissions that may be challenged by third-parties,
- Reduce unnecessary clean up.

Trawsfynydd Site asbestos SQEP will initially analyse each sample to confirm the presence of asbestos. No quantitative analysis will be undertaken. This initial analysis is a screening process as walls have not necessarily had 100% coverage of bagwash material. Samples that show no asbestos will be rejected and replaced by asbestos contaminated material. This procedure is undertaken to ensure that sufficient Bagwash samples have been acquired, not untreated wall coating, such that the samples sent to an accredited laboratory for quantitative analysis conform to the statistical requirements.

Sample acquisition will be covered in the Sampling Plan covering: Acquisition Methods, Quality Assurance details, sample Identification and Storage details as a minimum.

An analytical scope of work will also be prepared detailing transport requirements analytical requirements to include: Uncertainties; Limits of Detection, and Contractual details for the purpose of engaging a suitably certified laboratory.

4.0 THE BOUNDARIES OF THE SAMPLING

The spatial and temporal components of the population that are covered by the sampling campaign to ensure that the data collected are representative of the populations of the different areas that make up the Trawsfynydd RCA buildings of concern. Practical constraints that could interfere with sampling will also be identified. This activity will help to ensure that the data are representative of the population.

The three location(s) of interest, (RCA Building, Safestore 1 & 2) categorised into sub-areas that will be treated as separate units for sampling.

In addition materials to be sampled are listed. Importantly to note the period of time to which the sample areas decided upon and its applicability is fixed to the time of demolition and disposal. A caveat here is that there will be no changes during this period.

Locations of interest and sub-areas which will be treated as units for sampling includes:

- Decontamination Centre,
- Active Ancillary Building,
- South Acceptance Bay,
- Main Ponds Building and Dispatch Bay,
- North Acceptance Bay,
- Miscellaneous Sludge Vaults (MSV) and Resin Vault 1 (RV1),
- RB 1 Safestore, comprising ten floors (including a basement),
- RB 2 Safestore, comprising ten floors (including a basement).

The materials to be sampled (for each area of interest):

- Surface coating material that is a Bagwash coating that contains some level of chrysotile asbestos.

5.0 VSP INPUT PARAMETERS AND SAMPLE NUMBER

The number of samples that constitute the population for analysis of Chrysotile in the facility have been calculated using the statistical software Visual Sample Plan (VSP) [3]. The VSP output has generated 32 samples for each of the three Zones of interest based upon the parameters and assumptions, agreed with the site SQEP, and Magnox SME as inputs to VSP.

To design and develop a sampling plan and calculate the number of samples required for each of the sub-areas of interest in this analysis programme some variables are required as input parameters: an action level, which states the upper limit of contamination at which remediation may have to be undertaken (% wt/wt), an estimated standard deviation of the sample mean of the contamination; as well as the parameters ***Alpha*** and ***Beta,*** the tolerable limits of errors.

For the Bagwash material the number of samples generated by VSP will be taken for analysis. However, the number is an approximation of the minimum required for quantitative analysis. The surface coatings of some areas are patchy due to wear and age; consequently VSP will be used as guidance, and after onsite analysis other samples may be acquired that contain asbestos to replace those that tested negative in the Trawsfynydd qualitative assessment on site.

5.1 VSP CALCULATION

The calculation of the number of samples is formulated around a hypothesis, H_0, of the level of the assumed contamination and refers to the assumption about the areas. Since many projects are undertaken to demonstrate that a given facility is clean, H_0 states that the facility is contaminated, unless there is convincing data pointing to the contrary. The more rigorous statistical test is to assume that the site exceeds the action level, and then prove that it is does not by acquiring adequate representative samples. In this case H_0 states that the asbestos level exceeds 0.1% wt/wt.

5.2 ACTION LEVEL

An action level is used by VSP as a threshold level of a contaminant that should not be exceeded such that any activities are within the regulatory bounds. In the case in question when quantifying the amount of Chrysotile asbestos present in the surface coatings of interest for demolition and disposal, the regulatory stance is that 0.1% wt/wt should not be exceeded. As stated in the Guidance on the Classification and Assessment of Waste (Technical Guidance WM3).

5.3 ESTIMATED STANDARD DEVIATIONS

A second parameter required for the calculation is, an estimate of the samples standard deviation on the action level. 0.025 % wt/wt is an upper estimate based on a pessimistic assumption that Chrysotile could range up to the action level of 0.1 % wt/wt. This standard deviation is consistent with recommendations for the application of VSP. When no current data is available for a population the relative standard deviation of one quarter of the action level should be applied. This is an intrinsic conservatism in the calculation.

5.4 TOLERABLE LIMITS ON ERRORS

The parameters ***Alpha*** (**α**)and ***Beta*** (**β**) is required to specify the tolerable limits on errors, used to establish performance goals for the data collection, where **α** is the tolerable *probability* of wrongly rejecting H_o. and **β** is the tolerable *probability* of wrongly accepting H_o ; chrysotile exceeds 0.1% wt/wt in the coating. For the analysis of chrysotile contamination the values used are as follows:

Acceptable probability of incorrectly deciding the site is < 0.1%: Alpha = 5%

This equates to a 95% confidence level (2-sigma), which is generally accepted as the measure of adequate accuracy in data reporting.

Acceptable probability of incorrectly deciding the site is > 0.1%: Beta = 10%

Values between 5% and 20% are generally accepted as balancing sampling costs against risk of unnecessary clean-up or alternative disposal costs/routes.

5.5 BOUNDARIES OF THE REGION OF UNCERTAINTY AND ERROR TOLERANCES

The region of uncertainty, delta (Δ) establishes the minimum distance from the action level where the programme addresses false negative errors. The upper bound of the region Δ will be the action level and the lower bound will be some value below which incorrectly alternative remediation and/or dispose is chosen.

The lower bound of the region is the boundary (value of true mean) below which there is an acceptable probability, 10% in this case that the site will be incorrectly deemed as exceeding the threshold. The value selected is 80% of the action level that is 0.080 % wt/wt. This is the value to which Beta is associated relates.

6.0 VSP CALCULATION OUTPUT SUMMARY

The primary purpose of sampling of each zone is to compare a median or mean value with a fixed threshold. This section summarises the sampling design used, associated statistical assumptions. Sampling plan components presented here include how many sample locations to choose.

The material medium to sample, cementitious material, paint/surface coating, and how to analyse the samples (laboratory, etc.) are addressed in greater depth in the sampling and analysis technical specification.

6.1 SELECTED SAMPLING APPROACH

A non-parametric random sampling approach was selected to determine the number of samples. This approach was chosen because the conceptual model and historical information indicate that typical parametric assumptions cannot be underpinned. Non-parametric approach requires fewer assumptions and allows for more uncertainty about the distribution of values in the facility's populations. Consequently the number of samples required is higher than a parametric approach.

Locating the sample points randomly provides data that are separated by many distances therefore providing more information about the spatial structure of the contamination than systematic sampling. Random sampling also provides information regarding the mean value, but there is the possibility that the areas of a characterisation zone will not be represented with the same frequency as if uniform grid sampling were performed.

The following table is an overview of the sampling design principles.

Table 3.0 SUMMARY OF SAMPLING DESIGN

Primary Objective of Design	Compare a site mean or median to a fixed threshold
Sampling Design	Nonparametric
Sample Placement	Simple random sampling
Working (Null) Hypothesis (H_0)	The median (mean) value exceeds the threshold
Formula for calculating sample number	Sign Test (MARSSIM version (5% oversampling))

6.2 NUMBER OF SAMPLES: EQUATION AND INPUTS

The equation used to calculate the number of samples for each of the populations in the RCA is based on a Sign test. The formula used to calculate the number of samples is:

$$n = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{4(SignP - 0.5)^2} \qquad \text{where} \qquad SignP = \Phi\left(\frac{\Delta}{s_{total}}\right)$$

$\Phi(z)$ is the cumulative standard normal distribution on $(-\infty,z)$
n is the number of samples,
S is the estimated standard deviation of the measured values including analytical error,
Δ is the width of the grey region (uncertainty),
α is the acceptable probability of incorrectly concluding the site median (mean) is less than the threshold,
β is the acceptable probability of incorrectly concluding the site median (mean) exceeds the threshold,
$Z_{1-\alpha}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\alpha}$ is $1-\alpha$,
$Z_{1-\beta}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\beta}$ is $1-\beta$.

The values of these inputs that result in the calculated number of sampling locations are:

Table 4.0 Parameter

	S	Δ	α	β	$Z_{1-\alpha}$ [a]	$Z_{1-\beta}$ [b]
32 Samples	0.25	0.2	0.05	0.1	1.64485	1.28155

[a] This value is automatically calculated by VSP based upon the user defined value of **α**
[b] This value is automatically calculated by VSP based upon the user defined value of **β**

Figure 1 is a performance goal diagram. It shows the probability of concluding an area is contaminated on the vertical axis versus a range of possible true median (mean) values on the horizontal axis.

The red vertical line shows the action level on the horizontal axis. The width of the grey shaded area is Δ; the upper horizontal dashed blue line is positioned at $1-\alpha$ on the vertical axis; the lower horizontal dashed blue line is positioned at β on the vertical axis. The vertical green line is one standard deviation below the action level. The

shape of the red curve corresponds to the estimates of variability. The calculated number of samples results in the curve that passes through the lower bound of Δ at β and the upper bound of Δ at 1-α. If any of the inputs are changed, the number of samples that result in the correct curve changes.

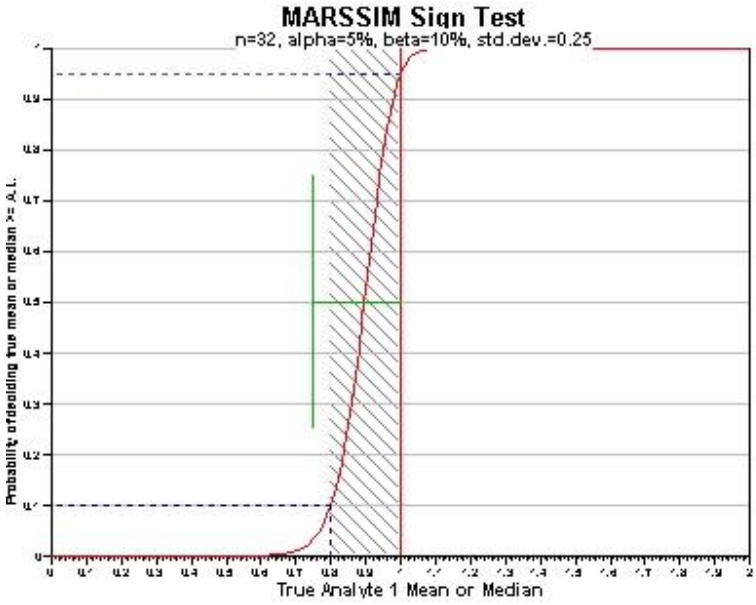


FIGURE 1 VSP Performance Goal Diagram

6.3 STATISTICAL ASSUMPTIONS

The assumptions associated with the formulas for computing the number of samples are:

1. The computed sign test statistic is normally distributed,
2. The variance estimate, S^2, is reasonable and representative of the population being sampled,
3. The population values are not spatially or temporally correlated, and
4. The sampling locations will be selected randomly.

The first three assumptions will be assessed in a post data collection analysis. The last assumption is valid because the sample locations were selected using a random process.

6.4 SENSITIVITY ANALYSIS

The sensitivity of the calculation of number of samples was examined by varying the standard deviation, lower bound of uncertainty region the shaded area, Δ in figure 1; beta the probability of mistakenly concluding that the mean μ > out of scope threshold; and alpha the probability of mistakenly concluding that μ < out of scope threshold. The following table shows the results of the sensitivity test.

Table 5.0 Number of Samples

Number of Samples							
AL=1		α=5		α=10		α=15	
		s=0.5	s=0.25	s=0.5	s=0.25	s=0.5	s=0.25
LBRU=90	β=5	518	136	410	107	345	90
	β=10	410	107	315	82	257	68
	β=15	345	90	257	68	206	54
LBRU =80	β=5	136	40	107	32	90	27
	β=10	107	32	82	24	68	21
	β=15	90	27	68	21	54	16
LBRU =70	β=5	65	23	52	18	44	16
	β=10	52	18	40	15	33	12
	β=15	44	16	33	12	27	10

LBRU is the Lower Bound of the region of uncertainty. (% of threshold)
s is the Standard Deviation
β probability of mistakenly concluding that μ > threshold (%)
α probability of mistakenly concluding that μ < threshold (%)

7.0 SAMPLING PROGRAMME: LOCATIONS

The sample number calculated using VSP gives thirty two (32) samples per population. This amounts to a total number of samples over the three populations of ninety six (96) samples requiring analysis.

Figure 2 is a general view of the Origin Ponds Complex including the areas that make up the population of this complex that comprise the following sub-zones:

- Decontamination Centre,
- Active Ancillary Building,
- South Acceptance Bay,
- Main Ponds Building and Dispatch Bay,
- North Acceptance Bay,
- Miscellaneous Sludge Vaults (MSV) and Resin Vault 1 (RV1).

These can be distinguished on the site plan by the identifiers: 29; 31; 32; 33; 35; and 36, for each sub-zone respectively. A total of thirty two (32) samples will be taken across the whole of these six sub–zones that constitute a single statistical population. The samples acquired will comprise fifty grammes (50 g) of surface coating acquired by an appropriate sampling technique.

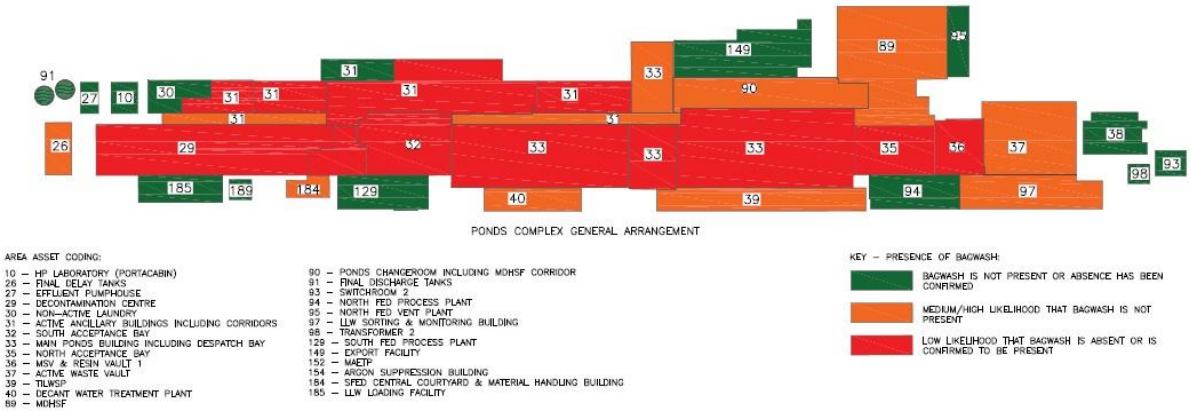


Figure 2 Site Plan of RCA Buildings

Figures 3 and 4 are multiple views of the future Safestores 1 and 2 in reactor buildings 1 and 2 respectively that make up the populations of these buildings that comprise the following sub-zones:

- Eleven distinct levels: Floors 1 through 10 plus the basement (Reactor Building 1),
- Eleven distinct levels: Floors 1 through 10 plus the basement (Reactor Building 2).

These can be distinguished on the Safestore plans by the colour red identifying each sub-zone. For each Safestore, RB1 and RB2 a total of thirty two (32) samples will be taken across all ten sub–zones that constitute a single statistical population (that is roughly three per floor). The samples acquired. will comprise fifty grammes (50 g) of surface coating; acquired by appropriate sampling technique.

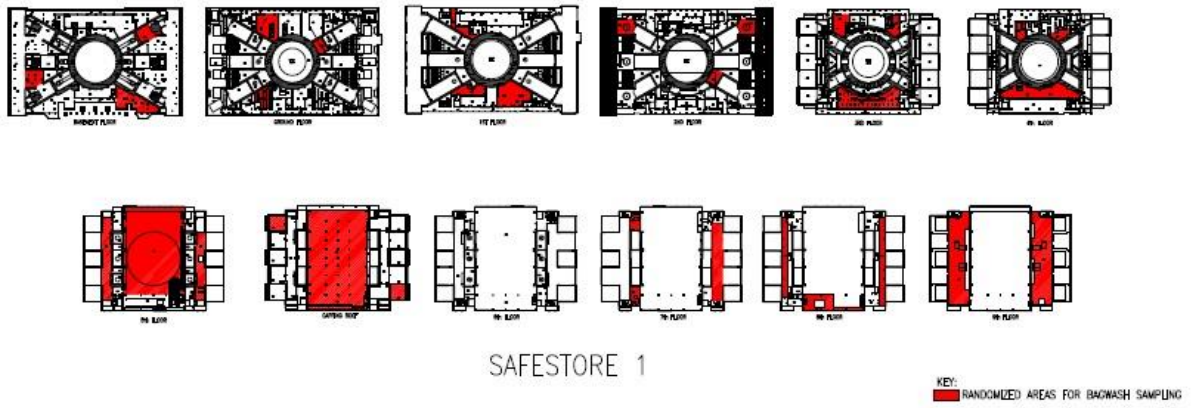


Figure 3: Site Plan of RCA Reactor 1 Safestore

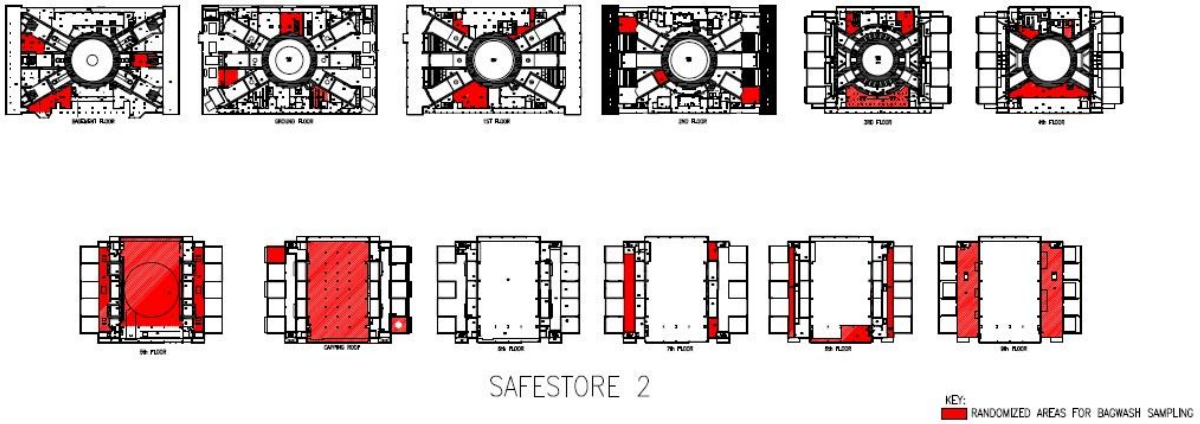


Figure 4: Site Plan of RCA Reactor 2 Safestore

8.0 DATA ANALYSIS ACTIVITIES

The data will be verified and validated by the analytical laboratory before being subjected to statistical evaluation by the nominated IC 38. As the primary objective for sampling is to compare the site median (mean) value with a threshold value, the data will be assessed in this context. It will be assessed to determine whether they are adequate in both quality and quantity to support the primary sampling objective. The degree of analysis applied to the results will be based upon an initial survey of the data, if no outstanding anomalies are identified the most simple statistical evaluation will be deemed sufficient. Assuming the data are adequate, at least one statistical test will be done to perform a comparison between the data and the threshold of interest, subsequently formal acceptance, on behalf of the Project, following the company procedures will be made to the laboratory.

The data then can be formally documented in an interpretive report for future reference with regards to civil works undertaken by the site with regards to demolition and disposal.

9.0 DISTRIBUTION

TRAWSFYNYDD SITE

Mr G Van Heerden.
Mr N Wright
Mr T Slaven.

OLDBURY TECHNICAL CENTRE

Dr D Buckley
Mrs H E Bean
Mr S Mclauchlan

Oldbury Document Centre

Certificate of Analysis

1506

Client: Magnox Ltd, Berkeley Centre, Berkeley, Gloucestershire, GL13 9PB

Sampling Location: Trawsfynydd Site, Blaenau Ffestiniog, Trawsfynydd, LL41 4DT

Samples analysed by polarised light microscopy (PLM) in accordance with documented in-house procedures and the method defined in HSG248 'Asbestos: The analysts' guide for sampling, analysis and clearance procedures' Element Materials Technology Environmental UK Limited is accredited to ISO/IEC 17025 for asbestos sampling and identification by PLM.

Samples were taken by Element Materials Technology Environmental UK Limited.

Date Sample Taken/ Received	Date Sample Analysed	Analyst	Lab	Our Reference	Client Reference or Location of Sample Point	Analysis Result
26/05/2021	28/06/2021	NJA	Tw	107834-001	Safestore 2, 1st Floor, 2143 - Gas Circ Basement Vent Room Southeast, coating, virgin concrete wall	Chrysotile
26/05/2021	28/06/2021	NJA	Tw	107834-002	Safestore 2, 1st Floor, 2143 - Gas Circ Basement Vent Room Southeast, coating, virgin concrete wall	none detected
26/05/2021	28/06/2021	NJA	Tw	107834-003	Safestore 2, 1st Floor, 2143 - Gas Circ Basement Vent Room Southeast, coating, feathering lines on concrete wall	Chrysotile
26/05/2021	28/06/2021	NJA	Tw	107834-004	Safestore 2, 1st Floor, 2143 - Gas Circ Basement Vent Room Southeast, coating, feathering lines on concrete wall	Chrysotile
26/05/2021	28/06/2021	NJA	Tw	107834-005	Safestore 2, 1st Floor, 2112 - Gas Circ Basement Vent Plant Room - Northeast, coating, virgin concrete wall	none detected

Analysed & authorised by:

Nicola Adams

Date of issue: 05/07/2021

Issued by: Tw

Sampling and analysis of solid (bulk) samples taken by Element Materials Technology Environmental UK Limited:-
Where asbestos is not positively identified the result is quoted as "none detected"; • Sampling of suspected asbestos containing materials is in accordance with in-house documented methods, complying with HSG264: 'Asbestos: The survey guide'.
Samples not taken by Element Materials Technology Environmental UK Limited:-
Results are given in good faith based on the information supplied by the client; • No responsibility can be accepted for incorrect information, interpretations, actions or errors or omissions by persons other than Element Materials Technology Environmental UK Limited's staff;
• Opinions and interpretations expressed herein, including the description of the material are outside the scope of UKAS accreditation.

Lab identifiers used in table above indicate location of analysis: DE: Delph • LU: Luton • CX: Chapelcross • WF: (RCA – Flexible scope) Wylfa • SW: (RCA – Flexible scope) Sizewell • OB: Oldbury • DN: Dungeness • TW: Trawsfynydd • HKA: Hinkley • HI: Hillington • BK: Berkeley (Flexible scope) • LE: Leicester (Flexible scope) • SP: Stockport (Flexible Scope)
Refer to current UKAS schedules at www.ukas.org for lab address details.

Element Materials Technology Environmental UK Limited. (Registration No: 11371415) Registered Office: 10 Lower Grosvenor Place, London, SW1W 0EN
: www. Element.com ☎ 01457 873266 🖷 01457 870966 ✉ Environmental@ Element.com

Certificate of Analysis

1506

Client: Magnox Ltd, Berkeley Centre, Berkeley, Gloucestershire, GL13 9PB

Sampling Location: Trawsfynydd Site, Blaenau Ffestiniog, Trawsfynydd, LL41 4DT

Samples analysed by polarised light microscopy (PLM) in accordance with documented in-house procedures and the method defined in HSG248 'Asbestos: The analysts' guide for sampling, analysis and clearance procedures' Element Materials Technology Environmental UK Limited is accredited to ISO/IEC 17025 for asbestos sampling and identification by PLM.

Samples were taken by Element Materials Technology Environmental UK Limited.

Date Sample Taken/ Received	Date Sample Analysed	Analyst	Lab	Our Reference	Client Reference or Location of Sample Point	Analysis Result
26/05/2021	28/06/2021	NJA	Tw	107834-006	Safestore 2, 1st Floor, 2112 - Gas Circ Basement Vent Plant Room - Northeast, coating, virgin concrete wall	none detected
26/05/2021	28/06/2021	NJA	Tw	107834-007	Safestore 2, 1st Floor, 2112 - Gas Circ Basement Vent Plant Room - Northeast, coating, feathering lines on concrete wall	Chrysotile
26/05/2021	28/06/2021	NJA	Tw	107834-008	Safestore 2, 1st Floor, 2112 - Gas Circ Basement Vent Plant Room - Northeast, coating, feathering lines on concrete wall	Chrysotile

Analysed & authorised by:

Nicola Adams

Date of issue: 05/07/2021

Issued by: Tw

Sampling and analysis of solid (bulk) samples taken by Element Materials Technology Environmental UK Limited:-
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Samples not taken by Element Materials Technology Environmental UK Limited:-
Results are given in good faith based on the information supplied by the client; • No responsibility can be accepted for incorrect information, interpretations, actions or errors or omissions by persons other than Element Materials Technology Environmental UK Limited's staff;
• Opinions and interpretations expressed herein, including the description of the material are outside the scope of UKAS accreditation.

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Refer to current UKAS schedules at www.ukas.org for lab address details.

Element Materials Technology Environmental UK Limited. (Registration No: 11371415) Registered Office: 10 Lower Grosvenor Place, London, SW1W 0EN
: www. Element.com ☎ 01457 873266 🖷 01457 870966 ✉ Environmental@ Element.com

Health and Safety Executive

Magnox Ltd - XRD analysis of Concrete Fibres

Proposal prepared for:

Magnox

27 July 2021, v.2.0
HSE-SD ref. PE11650

CONTENTS

1 Introduction

Health and Safety Executive's (HSE) Science Division have been contacted by various colleagues at Magnox Ltd to carry analysis of concrete samples to determine the percentage content of asbestos present. It has also been requested that a price be given for initial PLM bulk analysis of the samples sent as an option for Magnox to consider.

HSE are happy to provide this proposal contract in response to this request.

2 Project Delivery

HSE scientists will carry out analysis to determine the percentage content of asbestos present using X-Ray Diffraction (XRD) with an extended sample preparation. This sample preparation will involve taking all samples sent from Magnox from one site (as indicated by Magnox) where the combined total volume does not exceed 1000 cm^3 and crushing them to form one homogeneous sample. This crushing will be carried out first manually and then by feeding the material through a mechanical mill. The powder obtained from this stage will then be mixed to ensure homogeneity. Following this step the powder will be treated with acid in order to remove some of the concrete matrix.

After this preparation three sub-samples will be taken from the material and analysed by XRD using an internal standard method [Taylor, 1978 #545], an XRD Rietweld method may also be used for verification purposes. The percentage content for each sub-sample will be reported along with an average and standard deviation. This average will be a measure of the overall asbestos percentage content present across the combined total sample volume (a maximum of 1000cm^3). The limit of detection for this analysis is dependent on the effectiveness of the sample preparation procedure and but is expected to be less than 0.1 %.

If required, HSE scientists will carry out polarised light microscopy (PLM) bulk analysis of the initial samples for each site before they are crushed and combined for the quantitative analysis. This analysis will identify the presence and type of asbestos. The analysis will be carried out following the method in Appendix 2 of HSG 248.

Three sites, of 32 samples from each, are anticipated by Magnox at the time of this contract. If there are changes to the site numbers or significant changes to the sample numbers Magnox should inform HSE.

A short analyitical report will be provided for each analysis type (XRD and PLM) outlining the results of each.

2.1 Project Team

Daniel Barrowcliffe, a Higher Scientist in our Fibres and Minerals Team at HSE's Science Division in Buxton will lead our team to complete this project.

Daniel is working on a number of research projects involving the study of workplace exposure to asbestos. He has four years of experience of working in the asbestos consultancy industry prior to joining HSE. During this time he worked as an asbestos bulk analyst, an on-site consultant monitoring asbestos removal and an asbestos surveyor.

Qualifications and Membership of Professional Bodies

BSc(Hons) Chemistry, University of Manchester;

Member of the Faculty of Asbestos Assessment and Management (FAAM)

BOHS Qualifications:

Certificate of Competence in Asbestos and other fibres

P401 – Identification of Asbestos in Bulk Samples (PLM)

P402 – Buildings Surveys and Bulk Sampling for Asbestos

P403 – Asbestos Fibre Counting (PCM) (including sampling strategies)

P404 – Air sampling of Asbestos and MMMF and Requirements for a Certificate of Reoccupation following Clearance of Asbestos

P405 – Management of Asbestos in Buildings

2.2 Project Management

HSE's Science Division (HSE-SD) has a comprehensive project management system in place, aligned to the Association for Project Management (APM) standard and governed by our accredited Quality Management System. HSE-SD's Programme Office supports project managers and leads on continuous improvement. Our Project Management Professional Development Programme is accredited by APM, demonstrating our commitment to excellence in project management.

We have a track record of successful project management and are committed to delivering projects to the highest standards. As such, we will assign a professional Project Manager to this important project.

Your Project Manager will:

- Ensure you receive the highest standard of service
- Serve as your primary project contact point
- Provide clear project leadership to those involved in delivery

- Manage any scope changes in line with our change request procedure and your requirements
- Ensure all work is conducted to the highest standards of safety and quality
- Ensure the project is delivered to agreed timescales and cost
- Seek feedback on all aspects of our performance.

3 Deliverables

Analysis of percentage content of asbestos across all samples supplied from one site (as indicated by Magnox) as a combined total. This will be reported as the three results from the sub samples and an average result.

If requested, PLM analysis of individual samples will be carried out before they are combined. These results will be reported in line with the requirement's of HSE's UKAS accreditation.

3.1 Timescale

The following assumes a start date of late July 2021 and sample batches will be analysed on a standard turnaround time basis of 20 working days.

This turnaround time is based on the caveat that the the sample batches for the initial PLM analysis (if requested) do not exceed 35 bulk ID in any given calendar month. Samples received above these figures in any given calendar month, will be subject to resourcing capabilities within the technical team at the time.
HSE will communicate the additional turnaround time required for these additional samples at the time of receipt.

4 Price

The batch price for the work described above is as follows:

Activity	Price
Concrete XRD sample analysis for bulk asbestos content per site (samples totalling no more than 1000 cm^3)	£5,000
1 sample x initial PLM analysis	£102

N.B – The pricing detailed above assumes efficiency savings and samples are part of a minimum monthly batch of 20 PLM samples.

Pricing for samples under the minimum batch is as follows:

Activity	Price
1 sample for PLM analysis and reporting	£226

These prices are in Pounds Sterling, exclusive of VAT and based on work being completed before 31st March 2022. The quotation is valid for a period of 30 days.

Work arising out of this proposal is subject to HSE's Standard Conditions of Business unless otherwise agreed in writing before commencement of the project. A copy of these Conditions is presented at Annex 1 of this proposal.

If any of the dependencies identified below are not met, leading to unanticipated costs, then HSE reserves the right to revise the price accordingly.

In order to comply with HSE financial policy, invoicing will be arranged on a monthly basis.

5 Dependencies and Exclusions

5.1 Dependencies

Successful completion of this project depends on Magnox for the following:

Ref.	Dependency	Deadline
D1	HSE turnaround times will begin after the following have been received: • A completed EM2 form (to be completed by Magnox) that gives the details of all samples for each calendar month • All samples that are to be analysed that calendar month	On receipt of the given calendar month's samples
D2	All deliveries and couriers from Magnox must be marked clearly (quoting the project number – PE11650)	On delivery

5.2 Exclusions

The project will be conducted as described above, but the following items are specifically excluded:

Ref.	Exclusion
E1	Work extending beyond 31st March 2022
E2	Delays due to circumstances beyond HSE's control
E3	Any changes to the scope, deliverables or cost, unless agreed in writing
E4	Weekend working by HSE staff
E5	Retention/Disposal of materials
E6	Transport costs for samples

6 Management Systems

6.1 Quality

HSE's Science Division (HSE-SD) operates under a quality management system that is certified by Lloyd's Register Quality Assurance (LRQA) as complying with the ISO 9001:2015 standard; all our scientific activities and project management are covered, from planning through to delivery, reporting and post-project evaluation. The current certificate is valid until February 2024 and a copy is available on our website.

6.2 Health & Safety

HSE sets itself exemplary standards of health and safety performance so as to ensure the wellbeing of staff as well as those who may work at or visit our premises. We recognise the importance of organisational culture in this and – in common with many other organisations – use the *HSL Safety Climate Tool* as part of a process of continuous improvement. HSE-SD's comprehensive health and safety management system is certified by LRQA to OHSAS 18001:2007. The current certificate is valid until September 2021 and a copy is available on our website.

6.3 Environment

We fully accept the need to protect the environment and make environmental considerations an integral part of our business activities. HSE-SD's environmental management system covers all our activities and follows the principles of ISO 14001.

7 About HSE

The Health and Safety Executive (HSE) is Britain's statutory regulator of occupational health and safety, employing over 2,500 staff. Our work covers a varied range of activities: shaping and reviewing regulations, producing research and statistics, investigating incidents and enforcing the law. Health and safety regulation in Great Britain can be traced back to the first Factory Inspectors

in the early 19th Century; HSE in its current form was created by the Health and Safety at Work etc. Act 1974.

HSE's Science Division (HSE-SD) is one of the world's leading providers of workplace health and safety research, training and consultancy, employing around 420 staff across a wide range of disciplines. We have been developing health and safety solutions for over 100 years, so we know what goes wrong in the workplace and why. Our relationship with the rest of HSE gives us a unique insight into the regulatory context of the work we do for our clients.

Our capabilities encompass a wide range of topics, including:

- human factors and safety culture
- risk management
- large-scale testing
- health risk management
- fire, explosion and process safety
- analytical services
- safety engineering
- data analytics
- ergonomics and falls prevention
- specialist photographic, video and modelling services.

This breadth of expertise underpins our particular strength in building multidisciplinary teams to create practical, useful solutions. These solutions can take the form of targeted research, expert advice and consultancy, testing and modelling, or specialised training.

HSE-SD has a strong international reputation for high-quality, published research and we collaborate worldwide through a network of formal and informal partnerships. We are a designated WHO Collaborating Centre for Occupational Health and Safety Research.

8 Contacts

Health and Safety Executive
HSE Science and Research Centre
Harpur Hill
Buxton SK17 9JN
United Kingdom

https://solutions.hse.gov.uk
www.hse.gov.uk

VAT number: GB 888810177

Main Point of Contact: Helen Bugg, Business Development Manager

Tel: +44 (0)203 028 1987
Email: helen.bugg@hse.gov.uk

Technical Contact: Daniel Barrowcliffe, Higher Scientist (Fibres and Minerals Team)

Tel: +44 (0)203 028 1919
Email: daniel.barrowcliffe@hse.gov.uk

Contracts and POs: Sales Contracts Team
Email: salescontracts@hse.gov.uk

Annex 1: Standard Conditions of Business

CONTRACTS

1.1 The Health and Safety Executive is hereby acting through its Science Division, whose main office is located at the HSE Science and Research Centre, Harpur Hill, Buxton, Derbyshire, SK17 9JN (hereinafter referred to as "HSE").

1.2 These Conditions apply to the written agreement ("the Agreement") between HSE and the Client under which HSE is to provide certain works and services (together referred to as "the Work") to the Client.

1.3 No variation of or addition to these Conditions or to the Agreement is effective without the written agreement of both HSE and the Client.

1.4 These Conditions override and take the place of any other terms or conditions emanating from or referred to by the Client.

THE WORK

2.1 HSE shall carry out the work using professional skill and care in the light of information available to HSE at the time.

2.2 HSE will use all reasonable endeavours to carry out the Work in accordance with any timetable agreed in writing with the Client. HSE will inform the Client immediately if it becomes apparent that the Work will not be carried out in accordance with the timetable and will seek to agree a new timetable with the Client.

LIABILITY

3.1 Where the Work comprises or includes the carrying out of tests undertaken by HSE in conditions controlled by HSE, HSE shall not be responsible for any application of or reliance upon the results of such tests in other conditions.

3.2 HSE reserves the right to dispose of unused or remaining post-analysis or post-test sample(s) at HSE's discretion unless otherwise directed in writing by the Client at the point HSE takes delivery of the sample(s). An additional charge may be made by HSE for the return of the sample(s) to the Client.

3.3 HSE shall not be responsible for anything caused by reason of any deficiency, insufficiency or inadequacy in the information or materials supplied to HSE by the Client or any other third party.

3.4 HSE shall not be responsible for anything outside the control of HSE (including changes in external circumstances) or for any inability or failure on the part of the Client to put any HSE recommendation into effect.

3.5 Any liability for damages (except in respect of the death or personal injury of the Client) incurred by HSE to the Client in respect of the Work or arising under the Agreement shall be limited to the amount which the Client has or would have paid to HSE for the carrying out by HSE of the Work in full.

REPORTS

4.1 Any Report produced by HSE for the Client as part of the Work ("a Report") may be freely published by the Client subject to the following provisions of this clause.

4.2 The Client shall not without the prior written agreement of HSE:

(a) publish a Report in any abridged or altered form;

(b) use a Report for the settlement of any civil dispute or action;

(c) publish a Report in part or whole in connection with any prospectus, advertisement, sales literature or any similar material.

INTELLECTUAL PROPERTY

5.1 A Report shall be the copyright of HSE except to the extent that it contains pre-existing copyright material belonging to the Client or third parties.

5.2 Where Intellectual Property Rights arise out of the Work those rights shall belong to HSE but nothing in this clause shall operate to deprive the Client or any third party of pre-existing Rights.

5.3 In 5.2 "Intellectual Property Rights" means all patents, copyrights, design rights, trade marks, service marks, trade secrets, know-how and any other intellectual property rights (whether registered or unregistered) and all applications for the same, anywhere in the world.

5.4 The Client warrants that any design, documentation, software, or any other material or information provided, produced, or furnished by the Client in connection with this Agreement will not be such as to infringe any intellectual property rights or any other right whatsoever of any third party, and the Client shall fully indemnify HSE in respect of any claims relating thereto.

5.5 The Client shall not use the name of the Health and Safety Executive (including its Science Division, the Health and Safety Laboratory or any other associated part or division) in connection with any prospectus, advertisement, sales literature or any similar material.

CONFIDENTIALITY

6.1 HSE shall not, subject to the following provisions of this clause, disclose or permit the disclosure by HSE staff of confidential information regarding the Client's business or organisation.

6.2 HSE's Science Division may communicate the results of the Work or any information given to it by the Client within other parts of HSE.

6.3 Where the results of the Work or any information supplied by the Client indicate that there is or may be a danger to health and safety the Health and Safety Executive may use or disclose such results or such information in connection with the carrying out of any functions under the Health and Safety at Work etc Act 1974.

6.4 The Health and Safety Executive may publish factual information arising out of the Work provided that it does not associate such information with the Client. In such a case HSE will consult the Client before publication and will take reasonable account of any objections which the Client may make on the grounds that publication would be prejudicial to the commercial interests of the Client.

USE OF HSE'S EQUIPMENT, APPARATUS AND FACILITIES

7.1 If HSE is required to loan to the Client equipment, apparatus or facilities which are the proprietary belongings of HSE, and which are to be used outside of HSE's premises, and which shall hereinafter be collectively known as the Kit, the loan of the Kit by HSE to the Client shall be subject to the conditions specified at (a), (b), (c), and (d) as written below:

(a) the client shall indemnify HSE against the cost of replacing the Kit if it is lost or stolen during the period of loan;

(b) the Client shall indemnify HSE against the cost of repairing any damage caused to the Kit during the period of loan or if the Kit is rendered beyond economical repair, against its replacement value;

(c) the Client shall indemnify HSE against any third-party claim brought against HSE unless such claims shall arise by reason of the negligence of HSE;

(d) the Client shall have sufficient insurance to cover the costs of any claims which may be made by HSE in accordance with any or all of sub-clauses (a), (b) and (c) as above written.

7.2 If HSE is required to loan to the Client equipment, apparatus or facilities for use at HSE's premises, the 'Standard Conditions for the Hire of HSE's Laboratory Facilities' shall apply; a copy of which can be obtained on request.

7.3 Ownership of all equipment, apparatus, and facilities utilised by HSE in the performance of the Work shall remain vested in HSE.

FEES

8.1 All fees quoted are exclusive of VAT and are valid for 30 days.

8.2 HSE will charge no more than the fee quoted unless the written agreement of the Client is given to a higher charge.

8.3 HSE may increase its time rates and any fee quotations based upon them by giving at least one month's notice to that effect. Such increases will not apply to work done on current assignments before the notice has expired.

8.4 Time rates assume a working day of 7.4 hours excluding travelling time. A proportionate extra charge may be made if longer daily attendances or input are necessary. Where travelling time is to be charged HSE will make this clear in the fee quotation.

8.5 Unless otherwise stated fee quotations and time rates include travelling and accommodation expenses in connection with work done at places described in the Agreement as "assignment locations". Work carried out at the Client's request at other places will be subject to travel and accommodation expenses and will be charged to the Client at HSE travel and subsistence rates, appropriate to the grade of officer carrying out the work, prevailing at the time of the performance of the work.

8.6 All other disbursements and expenses incurred by HSE on the Work will be charged to the Client except in respect of a Fee which is quoted as fixed.

8.7 If, in connection with the Work, any employee of HSE is later called upon to give evidence or expert opinion in Court, the client shall re-imburse HSE with its full costs and expenses.

8.8 If, in connection with the Work, HSE is required to assist the Client fulfil the Client's obligations under the Freedom of Information Act 2000, the Client shall re-imburse HSE's actual full economic costs incurred in providing such assistance.

PAYMENT

9.1 HSE shall be entitled to invoice monthly for work done whether or not a fixed fee has been agreed for the work.

9.2 Invoices will show any amount payable in respect of VAT.

9.3 The Client will pay the invoice in full, including any amount shown in respect of VAT, within 30 days of the date of the invoice.

9.4 An invoice shall not be regarded as paid until funds are received into a UK sterling account operated by the Health and Safety Executive.

9.5 Where payment of any sum has not been made by the Client in accordance with the provisions of this clause interest on that sum shall accrue at eight per cent above the base rate of the Bank of England prevailing during the period the sum in question remains unpaid.

TERMINATION

10.1 Either party may by notice in writing terminate the Agreement with immediate effect in the event of a breach of a fundamental term by the other party. A party shall be taken to be in fundamental breach if it fails to remedy a remediable breach within such period as is reasonably stipulated for remedy of the breach in a written notice from the party not in breach.

10.2 HSE may by notice in writing terminate the Agreement with immediate effect if the Client becomes bankrupt or insolvent or makes or proposes any composition or scheme of arrangement with its creditors or being a corporation passes a resolution for winding up or a winding-up order is made by the Court (other than a voluntary winding up for the purposes of amalgamation or reconstruction) or if the Court makes an administration order or if a receiver or manager is appointed by the Court or its creditors.

10.3 Either party may at any time give notice in writing to the other party that the Work is to be discontinued. In the event of such discontinuance HSE shall, if the Client so requests, provide a report on the work carried out to the time of discontinuance. HSE shall take any reasonable steps to reduce costs in the event of such discontinuance. Where the work is discontinued at the insistence of HSE the Client shall be charged only for such part, if any, of the Work as has been completed by HSE and can be utilised by the Client. Where the Work is discontinued at the insistence of the Client, the Client will be charged in respect of all work carried out and costs incurred by HSE on the Work.

10.4 On termination or discontinuance under this Clause these Conditions shall continue to apply except that the duty on HSE to carry out any further part of the Work shall cease.

APPOINTMENT OF HSE PERSONNEL

11.1 The Client shall not, without the prior written consent of HSE, during the duration of the Agreement or within a period of six months thereafter appoint, or offer to appoint or approach with a view to making an appointment, to any position with the Client or any

undertaking associated with the Client any member of staff of HSE who was involved with the negotiation of the Agreement or the Work carried out under the Agreement.

ARBITRATION

12.1 All disputes, differences or questions between HSE and the Client with respect to any matter or thing arising out of or relating to this Agreement except and in so far as may be otherwise provided in this Agreement shall be referred to the Arbitration of two persons, one to be appointed by HSE and one by the Client, in accordance with the provisions of the Arbitration Act 1996 or any statutory modification or re-enactment thereof.

ASSIGNMENT

13.1 The Client may not without the prior written agreement of HSE assign, charge or otherwise dispose of all or any of its rights under the Agreement.

MISCELLANEOUS

14.1 HSE's rights shall not be prejudiced or restricted by any concession, indulgence or forbearance extended to the Client.

14.2 If the Client comprises two or more persons their obligations are joint and several.

SEVERANCE

15.1 Any complete or partial invalidity or unenforceability of a provision in these Conditions or any relevant contract for any purpose shall not affect its validity or enforceability for any other purpose or the remaining provision but it shall be deemed to be severed for that purpose.

GOVERNING LAW

16.1 These Conditions shall be governed by and construed in accordance with English law and the Client hereby irrevocably agrees (without limiting HSE's rights to bring proceedings in any other courts of competent jurisdiction, whether concurrently or not) that the English courts shall have jurisdiction to settle any claim or dispute in relation to any relevant contract and that their judgements will be binding, conclusive and enforceable by the courts of other jurisdictions.

Contract

CONTRACT NO. **PE11650**

BETWEEN The Health and Safety Executive, acting through its Science Division whose main place of business is at the Health and Safety Laboratory, Harpur Hill, Buxton, Derbyshire, SK17 9JN (hereinafter collectively referred to as HSE) of the one part;

AND **Magnox Ltd**
Trawsfynydd Site, Blaenau Ffestiniog, Gwynedd, LL41 4DT
(hereinafter referred to as the Client) of the other part.

WHEREBY HSE will perform certain services (hereinafter referred to as the Work) as set out in this Proposal and forming part of this contract.

1. DURATION This agreement shall come into force following signature by both parties and shall terminate on completion of the Schedule of Work unless previously terminated in accordance with Clause 10 of Annex 1.

2. PRICE The price shall be as set out in this Proposal, version 2.0 dated 27 July 2021.

3. TERMS AND CONDITIONS HSE's Standard Conditions of Business (HSE Con1 Rev 13 April 2019) at Annex 1 shall govern this Agreement.

Signed by D. Lomas Fletcher	Signed by R Cox
on behalf of **Health & Safety Executive**	on behalf of **Magnox Ltd**
Name Delia Lomas Fletcher	Name Ruth Cox
Capacity Head of HSE Testing and Monitoring	Capacity Senior Supply Chain Specialist
Date 11th August 2021	Date 09/08/21

Laboratory Report

HSE Science & Research Centre

Harpur Hill, Buxton, SK17 9JN

Sample Reception Tel: 0203 028 3383

UKAS TESTING

0665

Team / Worksheet No: FIB/21-4562 (PLM)

Report Issue No. 1 **Job Code:** PE11650

Sample Origin: Magnox Ltd, Trawsfynydd Site, Blaenau Ffestiniog, Gwynedd, LL41 4DT

Customer Name and Address: Gareth Van Heerden, Magnox Ltd, Trawsfynydd Site, Blaenau Ffestiniog, Gwynedd, LL41 4DT

Identification of asbestos components in bulk materials using an in-house method based on HSG248. UKAS accreditation applies only to the identification of asbestos. (UKAS accreditation does not include comments about sampling strategy, quantities, identification of non-asbestos components or the results of water absorption tests).

HSE Sample No.	Analyst	Result of Analysis	Comments
		Please see explanatory notes concerning quantification shown on the final page of this report.	
2102985	Matthew Jackson	No asbestos detected	Sample 108640-033 – Safestore 1 - concrete
2102986	Matthew Jackson	No asbestos detected	Sample 108640-034 – Safestore 1 - concrete
2102987	Matthew Jackson	No asbestos detected	Sample 108640-035 – Safestore 1 – fairing coat/bagwash
2102988	Matthew Jackson	No asbestos detected	Sample 108640-036 – Safestore 1 - concrete
2102989	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-037 – Safestore 1 – fairing coat/bagwash
2102990	Matthew Jackson	No asbestos detected	Sample 108640-038 – Safestore 1 – fairing coat/bagwash

Reported by: Matthew WP Jackson Scientist **Signature:** **Date:** 20th September 2021

Checked by: Kirsty Dewberry Scientist **Signature:** **Date:** 11th October 2021

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Date of receipt: 6th September 2021

Date tests complete: 20th September 2021

2102991	Matthew Jackson	No asbestos detected	Sample 108640-039 – Safestore 1 - concrete
2102992	Matthew Jackson	No asbestos detected	Sample 108640-040 – Safestore 1 – fairing coat/bagwash
2102993	Matthew Jackson	No asbestos detected	Sample 108640-041 – Safestore 1 - concrete
2102994	Matthew Jackson	No asbestos detected	Sample 108640-042 – Safestore 1 – fairing coat/bagwash
2102995	Matthew Jackson	No asbestos detected	Sample 108640-043 – Safestore 1 – fairing coat/bagwash
2102996	Matthew Jackson	No asbestos detected	Sample 108640-044 – Safestore 1 - concrete
2102997	Matthew Jackson	No asbestos detected	Sample 108640-045 – Safestore 1 - concrete
2102998	Matthew Jackson	No asbestos detected	Sample 108640-046 – Safestore 1 - concrete
2102999	Matthew Jackson	No asbestos detected	Sample 108640-047 – Safestore 1 – fairing coat/bagwash
2103000	Matthew Jackson	No asbestos detected	Sample 108640-048 – Safestore 1 - concrete

2103001	Matthew Jackson	No asbestos detected	Sample 108640-049 – Safestore 1 - concrete
2103002	Matthew Jackson	No asbestos detected	Sample 108640-050 – Safestore 1 – fairing coat/bagwash
2103003	Matthew Jackson	No asbestos detected	Sample 108640-051 – Safestore 1 – fairing coat/bagwash
2103004	Matthew Jackson	No asbestos detected	Sample 108640-052 – Safestore 1 - concrete
2103005	Matthew Jackson	No asbestos detected	Sample 108640-053 – Safestore 1 – fairing coat/bagwash
2103006	Matthew Jackson	No asbestos detected	Sample 108640-054 – Safestore 1 – virgin concrete
2103007	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-055 – Safestore 1 – fairing coat/bagwash
2103008	Matthew Jackson	No asbestos detected	Sample 108640-056 – Safestore 1 - concrete
2103009	Matthew Jackson	No asbestos detected	Sample 108640-057 – Safestore 1 – fairing coat/bagwash
2103010	Matthew Jackson	Amosite asbestos detected	Sample 108640-058 – Safestore 1 – fairing coat/bagwash

2103011	Matthew Jackson	No asbestos detected	Sample 108640-059 – Safestore 1 - concrete
2103012	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-060 – Safestore 1 – fairing coat/bagwash
2103013	Matthew Jackson	No asbestos detected	Sample 108640-061 – Safestore 1 - concrete
2103014	Matthew Jackson	No asbestos detected	Sample 108640-062 – Safestore 1 – fairing coat/bagwash
2103015	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-063 – Safestore 1 – fairing coat/bagwash
2103016	Matthew Jackson	No asbestos detected	Sample 108640-064 – Safestore 1 - concrete

Laboratory Report

HSE Science & Research Centre

Harpur Hill, Buxton, SK17 9JN

Sample Reception Tel: 0203 028 3383

UKAS TESTING

0665

Team / Worksheet No: FIB/21-4563 (PLM)

Report Issue No. 1 **Job Code:** PE11650

Sample Origin: Magnox Ltd, Trawsfynydd Site, Blaenau Ffestiniog, Gwynedd, LL41 4DT

Customer Name and Address: Gareth Van Heerden, Magnox Ltd, Trawsfynydd Site, Blaenau Ffestiniog, Gwynedd, LL41 4DT

Identification of asbestos components in bulk materials using an in-house method based on HSG248. UKAS accreditation applies only to the identification of asbestos. (UKAS accreditation does not include comments about sampling strategy, quantities, identification of non-asbestos components or the results of water absorption tests).

HSE Sample No.	Analyst	Result of Analysis	Comments
		Please see explanatory notes concerning quantification shown on the final page of this report.	
2103017	Matthew Jackson	No asbestos detected	Sample 108640-001 – Safestore 2 - fairing coat/bagwash
2103018	Matthew Jackson	No asbestos detected	Sample 108640-002 – Safestore 2 - concrete
2103019	Matthew Jackson	No asbestos detected	Sample 108640-003 – Safestore 2 – fairing coat/bagwash
2103020	Matthew Jackson	No asbestos detected	Sample 108640-004 – Safestore 2 - concrete
2103021	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-005 – Safestore 2 – fairing coat/bagwash
2103022	Matthew Jackson	No asbestos detected	Sample 108640-006 – Safestore 2 – concrete

Reported by: Matthew WP Jackson Scientist **Signature:** **Date:** 6th October 2021

Checked by: Kirsty Dewberry Scientist **Signature:** **Date:** 12th October 2021

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Date of receipt: 6th September 2021

Date tests complete: 6th October 2021

2103023	Matthew Jackson	No asbestos detected	Sample 108640-007 – Safestore 2 - concrete
2103024	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-008 – Safestore 2 – fairing coat/bagwash
2103025	Matthew Jackson	No asbestos detected	Sample 108640-009 – Safestore 2 - concrete
2103026	Matthew Jackson	No asbestos detected	Sample 108640-010 – Safestore 2 – concrete
2103027	Matthew Jackson	No asbestos detected	Sample 108640-011 – Safestore 2 – fairing coat/bagwash
2103028	Matthew Jackson	No asbestos detected	Sample 108640-012 – Safestore 2 - concrete
2103029	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-013 – Safestore 2 - fairing coat/bagwash
2103030	Matthew Jackson	No asbestos detected	Sample 108640-014 – Safestore 2 - concrete
2103031	Matthew Jackson	No asbestos detected	Sample 108640-015 – Safestore 2 – fairing coat/bagwash
2103032	Matthew Jackson	No asbestos detected	Sample 108640-016 – Safestore 2 - concrete

2103033	Matthew Jackson	No asbestos detected	Sample 108640-017 – Safestore 2 - concrete
2103034	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-018 – Safestore 2 – fairing coat/bagwash
2103035	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-019 – Safestore 2 – fairing coat/bagwash
2103036	Matthew Jackson	No asbestos detected	Sample 108640-020 – Safestore 2 - concrete
2103037	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-021 – Safestore 2 – fairing coat/bagwash
2103038	Matthew Jackson	No asbestos detected	Sample 108640-022 – Safestore 2 –concrete
2103039	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-023 – Safestore 2 – fairing coat/bagwash
2103040	Matthew Jackson	No asbestos detected	Sample 108640-024 – Safestore 2 - concrete
2103041	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-025 – Safestore 2 – fairing coat/bagwash
2103042	Matthew Jackson	No asbestos detected	Sample 108640-026 – Safestore 2 – concrete

2103043	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-027 – Safestore 2 - fairing coat/bagwash
2103044	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-028 – Safestore 2 – fairing coat/bagwash
2103045	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-029 – Safestore 2 - fairing coat/bagwash
2103046	Matthew Jackson	No asbestos detected	Sample 108640-030 – Safestore 2 – concrete
2103047	Matthew Jackson	No asbestos detected	Sample 108640-031 – Safestore 2 – concrete
2103048	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-032 – Safestore 2 - fairing coat/bagwash

Laboratory Report

HSE Science & Research Centre

Harpur Hill, Buxton, SK17 9JN

Sample Reception Tel: 0203 028 3383

Team / Worksheet No: 21-4562 (XRD)

Report Issue No. 1

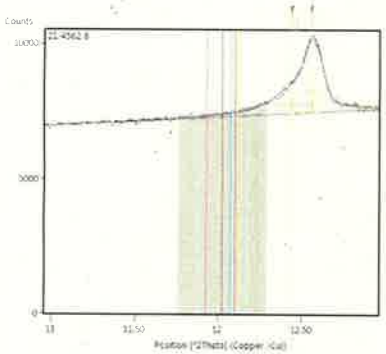
Job Code: PE11650

Sample Origin: Safestore 1, Magnox Ltd, Trawsfynydd Site

Customer Name and Address: Gareth Van Heerden, Magnox Ltd, , Blaenau, Ffestiniog, Gwynedd, LL41 4DT

Samples identified as 21-4562 safe store 1 were powdered and homogenised into one sample. Dilute acetic acid was then used to remove acid soluble material and concentrate any asbestos. X-ray diffraction and an in-house internal standard method were then used to quantify any asbestos present in the homogenised dust. The most intense x-ray reflection at 2 theta degrees of 12.3 was measured for quantification. Three sub-samples were analysed from the homogenised material. The results are presented below:

Sample Identification	Percentage chrysotile
21-4562 Safe store 1	Not detected



An x-ray diffraction scan of sample B with lines showing the position of the chrysotile reflection. The peak shown is for a clay mineral (probably kaolinite).

The lowest blank sample background measurement was 0.17%. Standard deviation of background measurements on these samples (n = 4) is also 0.17 %. No reflections for chrysotile were observed on any of samples measured.

Reported by: Peter Stacey (Senior Scientist) **Signature:** **Date:** 12/11/21

Checked by: Laurie Davies (Principal Scientist) **Signature:** L Davies **Date:** 2/12/21

Date of receipt: 13/10/21

Date tests complete: 2/11/21

Laboratory Report

HSE Science & Research Centre

Harpur Hill, Buxton, SK17 9JN

Sample Reception Tel: 0203 028 3383

Team / Worksheet No: 21-4563 (XRD)

Report Issue No. 1

Job Code: PE11650

Sample Origin: Safestore 2, Magnox Ltd, Trawsfynydd Site

Customer Name and Address: Gareth Van Heerden, Magnox Ltd, , Blaenau, Ffestiniog, Gwynedd, LL41 4DT

Samples identified as 21-4563 safe store 2 were powdered and homogenised into one sample. Dilute acetic acid was then used to remove acid soluble material and concentrate any asbestos. X-ray diffraction and an in-house internal standard method were then used to quantify any asbestos present in the homogenised dust. The most intense x-ray reflection at 2 theta degrees of 12.3 was measured for quantification. Six sub-samples were analysed from the homogenised material. The results are presented below are an average and standard deviation of the six sub-samples.

Sample Identification	Percentage chrysotile
21-4563 Safe store 2	1.2 ± 0.12 %

Reported by: Peter Stacey (Senior Scientist) **Signature:** **Date:** 01/12/21

Checked by: Laurie Davies (Principal Scientist) **Signature:** Laurie **Date:** 2/12/21

Date of receipt: 05/11/21

Date tests complete: 01/12/21

Laboratory Report

HSE Science & Research Centre

Harpur Hill, Buxton, SK17 9JN

Sample Reception Tel: 0203 028 3383

0665

Team / Worksheet No: FIB/21-4619 (PLM)

Report Issue No. 1 **Job Code:** PE11650

Sample Origin: Magnox Ltd, Trawsfynydd Site, Blaenau Ffestiniog, Gwynedd, LL41 4DT

Customer Name and Address: Gareth Van Heerden, Magnox Ltd, Trawsfynydd Site, Blaenau Ffestiniog, Gwynedd, LL41 4DT

Identification of asbestos components in bulk materials using an in-house method based on HSG248. UKAS accreditation applies only to the identification of asbestos. (UKAS accreditation does not include comments about sampling strategy, quantities, identification of non-asbestos components or the results of water absorption tests).

HSE Sample No.	Analyst	Result of Analysis	Comments
		Please see explanatory notes concerning quantification shown on the final page of this report.	
2103711	Matthew Jackson	No asbestos detected	Sample 108640-097 – Safestore 1 - concrete
2103712	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-098 – Safestore 1 - fairing coat/bagwash
2103713	Matthew Jackson	No asbestos detected	Sample 108640-099 – Safestore 1 - concrete
2103714	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-100 – Safestore 1 - fairing coat/bagwash
2103715	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-101 – Safestore 1 – fairing coat/bagwash
2103716	Matthew Jackson	No asbestos detected	Sample 108640-102 – Safestore 1 – concrete

Reported by: Matthew WP Jackson Scientist **Signature:** **Date:** 1st November 2021

Checked by: Kirsty Dewberry Scientist **Signature:** **Date:** 4th November 2021

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Date of receipt: 13th October 2021

Date tests complete: 1st November 2021

2103717	Matthew Jackson	No asbestos detected	Sample 108640-103 – Safestore 1 - concrete
2103718	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-104 – Safestore 1 – fairing coat/bagwash
2103719	Matthew Jackson	No asbestos detected	Sample 108640-105 – Safestore 1 - concrete
2103720	Matthew Jackson	No asbestos detected	Sample 108640-106 – Safestore 1 – fairing coat/bagwash
2103721	Matthew Jackson	No asbestos detected	Sample 108640-107 – Safestore 1 – concrete
2103722	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-108 – Safestore 1 - fairing coat/bagwash
2103723	Matthew Jackson	No asbestos detected	Sample 108640-109 – Safestore 1 - concrete
2103724	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-110 – Safestore 1 - fairing coat/bagwash
2103725	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-111 – Safestore 1 – fairing coat/bagwash
2103726	Matthew Jackson	No asbestos detected	Sample 108640-112 – Safestore 1 - concrete

2103727	Matthew Jackson	No asbestos detected	Sample 108640-113 – Safestore 2 - concrete
2103728	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-114 – Safestore 2 – fairing coat/bagwash
2103729	Matthew Jackson	No asbestos detected	Sample 108640-115 – Safestore 2 – concrete
2103730	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-116 – Safestore 2 - fairing coat/bagwash
2103731	Matthew Jackson	No asbestos detected	Sample 108640-117 – Safestore 2 – concrete
2103732	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-118 – Safestore 2 – fairing coat/bagwash
2103733	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-119 – Safestore 2 – concrete
2103734	Matthew Jackson	No asbestos detected	Sample 108640-120 – Safestore 2 - fairing coat/bagwash
2103735	Matthew Jackson	No asbestos detected	Sample 108640-121 – Safestore 2 – concrete
2103736	Matthew Jackson	No asbestos detected	Sample 108640-122 – Safestore 2 – fairing coat/bagwash

2103737	Matthew Jackson	No asbestos detected	Sample 108640-123 – Safestore 2 - concrete
2103738	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-124 – Safestore 2 – fairing coat/bagwash
2103739	Matthew Jackson	No asbestos detected	Sample 108640-125 – Safestore 2 - concrete
2103740	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-126 – Safestore 2 – fairing coat/bagwash
2103741	Matthew Jackson	No asbestos detected	Sample 108640-127 – Safestore 2 – concrete
2103742	Matthew Jackson	Chrysotile asbestos detected	Sample 108640-128 – Safestore 2 - fairing coat/bagwash

Laboratory Report

HSE Science & Research Centre

Harpur Hill, Buxton, SK17 9JN

Sample Reception Tel: 0203 028 3383

Team / Worksheet No: 21-4619 (XRD)

Report Issue No. 1 **Job Code:** PE11650

Sample Origin: Reactor 1 and 2, Magnox Ltd, Trawsfynydd Site

Customer Name and Address: Gareth Van Heerden, Magnox Ltd, , Blaenau, Ffestiniog, Gwynedd, LL41 4DT

Samples identified as 21-4619 reactor building 1 and reactor building 2 were powdered and homogenised into one sample. Dilute acetic acid was then used to remove acid soluble material and concentrate any asbestos. X-ray diffraction and an in-house internal standard method were then used to quantify any asbestos present in the homogenised dust. The most intense x-ray reflection at 2 theta degrees of 12.3 was measured for quantification. Four sub-samples were analysed from the homogenised material. The results are presented below are an average and standard deviation of the four sub-samples.

Sample Identification	Percentage chrysotile
21-4619 reactor building 1 and reactor building 2	1.1 ± 0.05 %

Reported by: Peter Stacey (Senior Scientist) **Signature:** **Date:** 01/12/21

Checked by: Laurie Davies (Principal Scientist) **Signature:** **Date:** 2/12/21

Date of receipt: 13/10/21

Date tests complete: 24/11/21

Laboratory Report

HSE Science & Research Centre

Harpur Hill, Buxton, SK17 9JN

Sample Reception Tel: 0203 028 3383

Team / Worksheet No: 22_4759 / MF (XRD)

Report Issue No. 1 **Job Code:** PE11650

Sample Origin: Magnox Ltd, Trawsfynydd Site

Customer Name and Address: Gareth Van Heerden, Magnox Ltd, , Blaenau, Ffestiniog, Gwynedd, LL41 4DT

Thirty-two samples identified with sample numbers 111720-01 to 111720-32 Safe store 2 – fairing coat / bag wash were powdered and homogenised into one sample. Dilute acetic acid was then used to remove acid soluble material and concentrate any asbestos. X-ray diffraction and an in-house internal standard method were then used to quantify any asbestos present in the homogenised dust. The most intense x-ray reflections at 2 theta degrees of 12.3 and 24.3 were measured for quantification. Three sub-samples were analysed from the homogenised material. The results are presented below are an average and standard deviation of the three sub-samples.

Sample Identification	Percentage chrysotile
22-4759 Safe store 2 – fairing coat / bag wash	2.86 ± 0.22 %

Individual results for the three sub-samples are as follows: 2.67%, 2.79% and 3.11%.

Reported by: Peter Stacey (Senior Scientist) **Signature:** **Date:** 04/03/22

Checked by: Laurie Davies (Principal Scientist) **Signature:** **Date:** 10/03/22

Date of receipt: 02/02/22

Date tests complete: 04/03/22

Laboratory Report

HSE Science & Research Centre

Harpur Hill, Buxton, SK17 9JN

Sample Reception Tel: 0203 028 3383

Team / Worksheet No: 22-4760 / FM (XRD)

Report Issue No. 1 **Job Code:** PE11650

Sample Origin: Safestore 1, Magnox Ltd, Trawsfynydd Site

Customer Name and Address: Gareth Van Heerden, Magnox Ltd, , Blaenau, Ffestiniog, Gwynedd, LL41 4DT

Thirty-two samples identified with sample numbers 111680-01 to 111680--32 safe store 1 – fairing coat / bag wash were powdered and homogenised into one sample. Dilute acetic acid was then used to remove acid soluble material and concentrate any asbestos. X-ray diffraction and an in-house internal standard method were then used to quantify any asbestos present in the homogenised dust. The most intense x-ray reflection at 2 theta degrees of 12.3 was measured for quantification. Five sub-samples were analysed from the homogenised material. The sensitivity of the method was improved by increasing the proportion of sample in the analysis mixture. The results are presented below are an average and standard deviation of the five sub-samples.

Sample Identification	Percentage chrysotile
22-4760 Safe store 1 – fairing coat / bag wash	0.18 ± 0.26 %

Individual results for the five sub-samples are as follows: 0% (Not detected), 0.26%, 0.44%, 0% (Not detected), 0% (Not detected).

Reported by: Peter Stacey (Senior Scientist) **Signature:** **Date:** 04/03/22

Checked by: Laurie Davies (Principal Scientist) **Signature:** **Date:** 10/03/22

Date of receipt: 02/02/22

Date tests complete: 04/03/22