Hinkley Point A Site Stakeholder Group Report for 2017

PREPARER	René Stent	Date: 25/6/18
APPROVER	Stephen Booth	Date 25/6/18

Published in the United Kingdom by Magnox Limited, Hinkley Point ‘A’ Site, Nr Bridgwater, Somerset, TA5 1YA.

REPORT TITLE

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1 EXECUTIVE SUMMARY

This report by Magnox Limited is presented to the Hinkley Point Site Stakeholder Group (SSG) and provides data covering radioactive discharges, solid radioactive waste disposals and environmental monitoring at Hinkley Point A site for 2017. The results of the environmental monitoring programme for 2016 are also reported here, together with an assessment of the maximum likely dose to the general public resulting from combined operations at both Sites at Hinkley Point (A&B). Although historic data is available from the previous years' reports, graphs are provided here to show the trends for the past six years.

All radioactive discharges from both sites are made under the terms of the authorisations granted by the Environment Agency. The disposal of radioactive waste from nuclear sites is regulated under the Environmental Permitting (England and Wales) Regulations 2016 (amended) (EPR). The authorisations are set after considering the actual quantities of radioactivity that both sites need to discharge but with consideration of the overall requirement to keep the levels as low as reasonably practicable and to keep doses to the public below the internationally recognised limits. During 2017, there were no variations to the permit for either Hinkley Point A.

During 2017, the levels of radioactivity in liquid and gaseous effluents discharged to sea and air, together with transfers of solid radioactive low-level waste to the Low Level Waste Repository (LLWR) and other locations, remained below the authorised limits set by the Environment Agency. Although releases of radioactivity to the environment are controlled at source, a condition of the authorisations is that a programme of environmental monitoring is maintained. Such monitoring provides reassurance by demonstrating that the controls used to limit radioactive releases are satisfactory, and that there is no chronic accumulation of radioactivity in the environment. AMEC FOSTER WHEELER (AFW) carries out the environmental monitoring programme on behalf of Hinkley Point A. Note that this represents a change to previous arrangements which were administered by the Combwich Laboratory. This change (formally implemented in Q3, 2017) provides a standardised approach across the Magnox Fleet through framework arrangements intended to save time and money by using a single provider across multiple sites.

The monitoring programme showed that radiological discharges have minimal impact on the environment. There is no evidence of any long-term accumulation of radioactivity resulting from the operation of Hinkley Point B power station, or from work to decommission the Hinkley Point A site. Radiation doses to members of the public from the discharges, and from direct radiation from both sites, were less than the UK legal limit and within the 1000µSv per year dose level recommended by the International Commission on Radiological Protection (ICRP). In 2016, the total dose to members of the public from the all pathways of exposure was assessed as <5 µSv (Annual Retrospective Dose Assessment 2016), which is 0.5% of the dose limit and well within the public dose constraint value of 300 µSv per year from a 'single site', recommended by Public Health England. It is expected that the 2017 retrospective dose assessment value, when available, will likely be similar.

2 GENERAL ENVIRONMENTAL MANAGEMENT INITIATIVES AT HINKLEY

2.1 ISO 14001:2004

ISO 14001:2004 is an International Standard that provides the elements for an effective Environmental Management System. This system enables us to work and act responsibly towards the environment and it applies to all of the environmental aspects which an organisation has control or influence over. The Standard is integrated with other management requirements to help the stations achieve their environmental goals.

Three significant benefits are gained by adopting this standard:

- A formal mechanism to apply Company Environmental Policy at site level
- A formal requirement for continual environmental improvement
- Independent verification of Company environmental protection standards

Hinkley Point A operates under an ISO 14001:2004 certification. Regular reviews and audits are carried out to ensure that the requirements of the standard are being met. ISO14001:2004 is a fleet wide certification for Magnox, therefore any non-conformities identified at any site must be addressed at all other sites. This more vigorous approach will continue to improve the stations environmental performance.

2.2 ENVIRONMENTAL PERMITTING REGULATIONS 2016 (Amended)

Hinkley Point A holds permits under the Environmental Permitting (England & Wales) Regulations 2016 (Amended) (EPR 2016). The permits cover:

- Discharges to air and sea
- Radioactive waste management
- Operation of the waste facilities

2.3 ENVIRONMENTAL POLICY

The Magnox Limited Environment, Health and Safety (EH&S) policy applies at Hinkley Point A site namely seeking continual improvement, to achieve and maintain excellence in EH&S as an integral part of our activities.

It is of paramount importance to us that no harm to people or the environment should result from our activities and that we will be respected and trusted by our workforce, the public and our stakeholders. In pursuing this and with specific reference to Environmental performance, we will work in partnership with employees, contractors and tenants, and will strive to:

- Develop controls and set objectives to manage potentially significant environmental aspects;
- Prevent pollution and minimise waste and the use of natural resources as part of our contribution to sustainability and environmental improvement;
- Manage waste according to good industry practice ensuring safe and environmentally sound storage and disposal of radioactive and other waste;
- Achieve and sustain an excellent safety and environmental culture, consistently reinforcing appropriate behaviours;
- Learn the lessons from events, implement corrective actions and seek out and use good practices wherever we may find them;
- Ensure that our activities, products and services are in compliance with applicable legal requirements, apply good practice and comply fully with all requirements to which the company subscribes;
- Integrate environmental management into all relevant business processes;
- Operate an integrated management system that meets the requirements of ISO 14001.

In doing this we will:

- Make adequate resources and support available;
- Consult our employees on EH&S matters of mutual interest; listen to and respond to our customers, shareholder, suppliers and neighbours;
- Openly report our EH&S performance every year;
- Work with our regulators, the rest of our industry and our customers and contractors to raise EH&S standards;
- Inform, instruct, train and develop the people who work for us and ensure that competent EH&S

advice is available;

- Set improvement objectives and targets aimed at reducing risks and improving environmental performance;

- Audit the management system which flows from this policy, and set and review EH&S objectives and targets;

- Maintain high standards in the conduct of our operations, in particular by ensuring that they are adequately resourced and carried out by suitably qualified and experienced people at all times.

2.4 REQUESTS FOR INFORMATION, COMPLAINTS AND ENVIRONMENTAL EVENTS

The Site receives requests for information (largely for student projects) and occasionally complaints which are formally recorded under the Environmental Management System.

The site has mechanisms for both voluntary reporting of events and those that are required to be reported formally by the Site's EPR Permit. All formally required notifications are reported to the EA in the timescales required by the Permit and in accordance with Magnox Company Standards. In addition, reporting all events, including those that are reported voluntarily, is achieved by providing the site Regulator with a weekly event report.

The open reporting of "minor events" and "near misses" at the site remains encouraging and continues to demonstrate a greater awareness of environmental impacts amongst staff and contract partners. This openness highlights that staff are not willing to tolerate practices that may have the potential for environmental damage and allows the station to rectify potential problem areas before the environment is put at risk.

Environmental events that require reporting to regulators form one of the key performance indicators for Magnox; events are taken very seriously at all levels within both organisations.

Any environmental 'events' or 'near misses' are recorded as part of the Company's corrective action database, Q-Pulse. The significant events occurring in the period specifically covered by this report that specifically affected compliance with environmental legislation and the stations' authorisations/consents are discussed as follows:

- Statistically significant data supplied by EdF - 3 and 4 sigma results for Sediment and Herbage returns for Q2. 4 Herbage measurements, although no greater than the required MDA, when MDA data is input into the site trending spreadsheet triggering a 3 or 4 sigma notification.

  Sediment samples were reported at above 3 and 4 sigma thresholds respectively at sites 55 and 56 for Sr-90. These results are positive (i.e. >MDA). Returns were annotated to reflect statistically significant results. Future results will be kept under review for trends.

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- Discharge route air sampler failure. The site has experienced a number of L60iF stack sampler failures during the period, despite having put in place a proactive maintenance regime in 2016 and replacing all sampler pump units in the period 2016-17. The sampler failure triggered a Magnox wide review and an investigation by James Fisher Nuclear (JFN) into the failure mechanism of each of the faulty instruments. The conclusion is that carbon vanes fitted by JFN during proactive maintenance at routine calibration were sub-standard and have prematurely failed in operation, resulting in low flow and seizure type failures.

- R1 Discharge Shaft Vent Flow Monitoring 'out of range'. Dampers on R1 Discharge Shaft discharge route required fully opening due to concerns with vibration and therefore potential plant failure in their current throttled back configuration. The current device that measures discharge volume is unable to read the flow when the dampers are opened fully due to it being over range. Assessment of volume instead of measurement of discharges for returns is being used until the volume measurement device can be brought back into range.

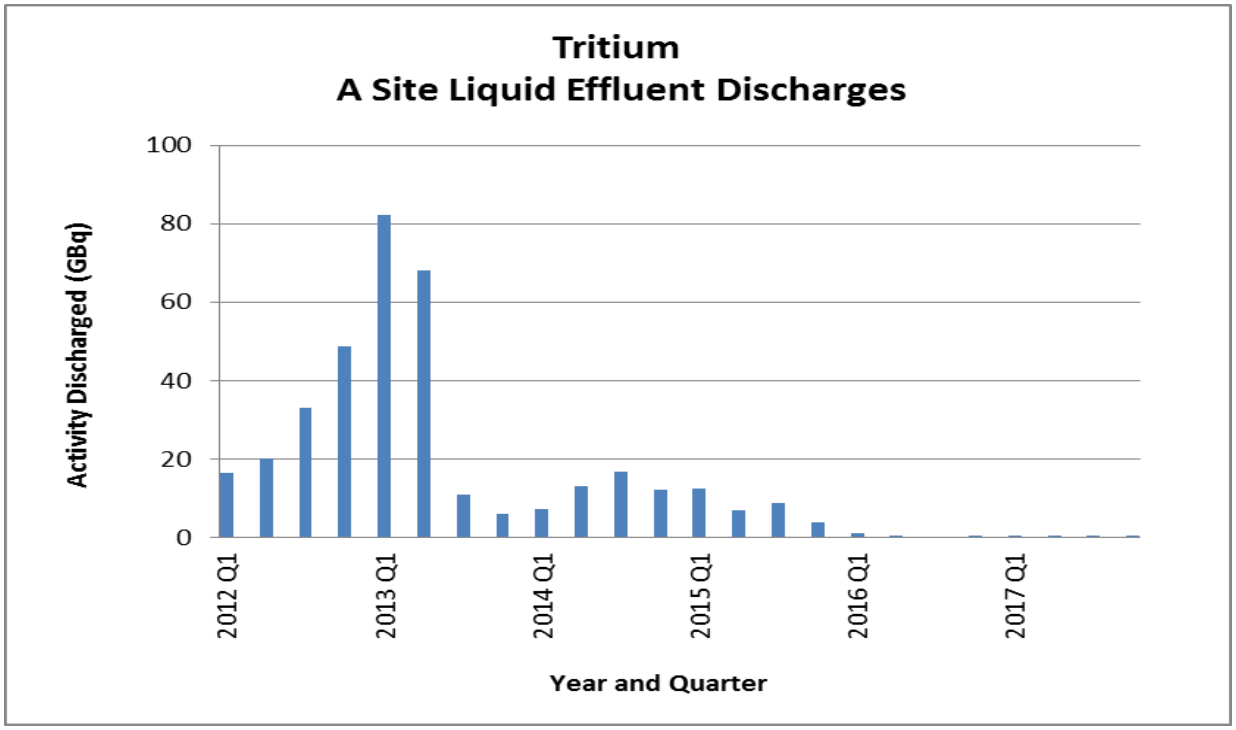
- In January 2017, the Site received a Warning Letter relating to the use of 'out of date' fingerprints in routine clearance arrangements which could have given rise to waste leaving the site as 'out of scope' of the Environment Permitting Regulations when in fact it should have been captured as 'in scope'. Investigations concluded that in fact no waste had been incorrectly sentenced from the site

but that the Management System was not sufficiently robust. All remedial actions, agreed with the Environment Agency, have been implemented and the learning shared across the wider Magnox fleet.

All events above were reported to the EA.

3 HINKLEY POINT A LIQUID EFFLUENT DISCHARGES

Graph 3a)

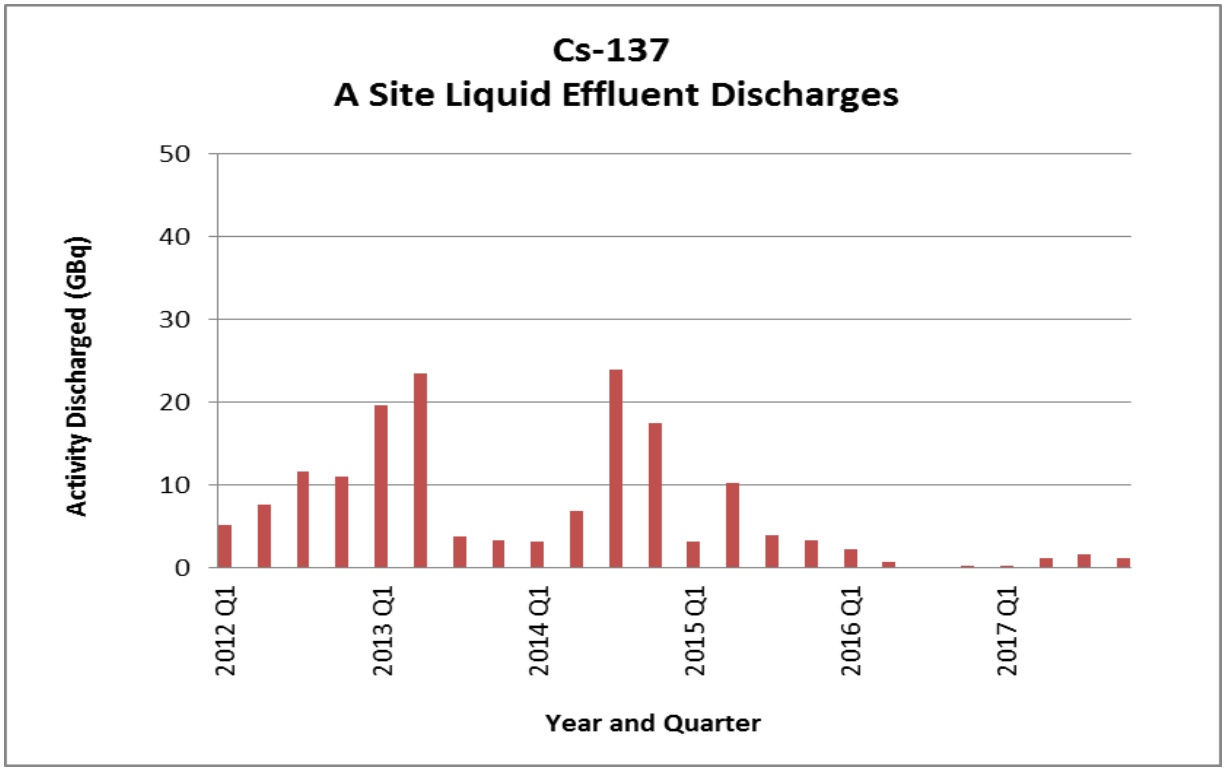


Tritium is an isotope of hydrogen and is largely present in the liquid discharge as tritiated water; it has low radio-toxicity and a radioactive half-life of about 12 years. Decommissioning of the fuel ponds was completed during the latter months of 2015 including the removal of radioactive sludges to settling tanks, final drain-down of the fuel cooling ponds and sealing of the pond walls. The predominant source of the radioactive liquid discharges from Hinkley Point A site, including tritium, results from a requirement to discharge radioactive liquor from storage vaults and decommissioning processes. Discharges of radioactive liquid are expected to be minimal now the decommissioning of the fuel cooling ponds is complete.

The Hinkley Point A site annual aqueous discharge limit for tritium is 1000 GBq.

The annual and monthly discharges of tritium in 2017 are listed in Table 1.

Graph 3b)

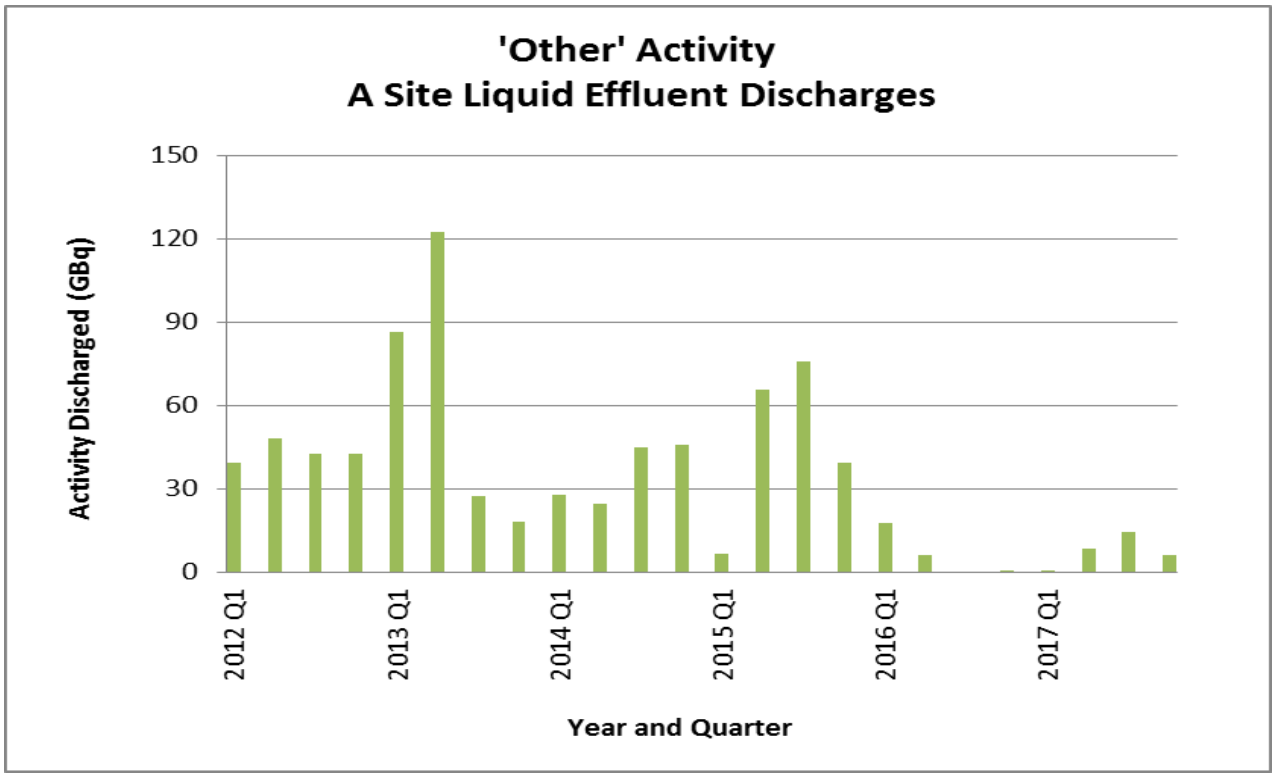


Caesium 137 is a fission product with a half-life of approximately 30 years. As mentioned previously for tritium, caesium 137 contamination exists in the pond water from past corrosion of the Magnox can surrounding the fuel elements, when fission products diffused into the pond water. The increased discharges in 2013/2014 are due to the fuel ponds being cleaned, treated and drained.

The Hinkley Point A site annual aqueous discharge limit for caesium 137 is 1000 GBq.

The annual and monthly discharges of caesium137 in 2017 are listed in Table 1.

Graph 3c)



'Other' activity is dominated by strontium 90 (in association with its short-lived daughter product yttrium 90) but also includes smaller amounts of radionuclides such as plutonium 241 and americium 241. Strontium 90 is a fission product and decays by emission of a beta particle and has a half-life of approximately 28 years. Plutonium 241 and americium 241 have half-lives of approximately 14 and 432 years, respectively.

The Hinkley Point A site annual aqueous discharge limit for 'other' activity is 700 GBq.

The annual and monthly discharges of 'other' activity in 2017 are listed in Table 1.

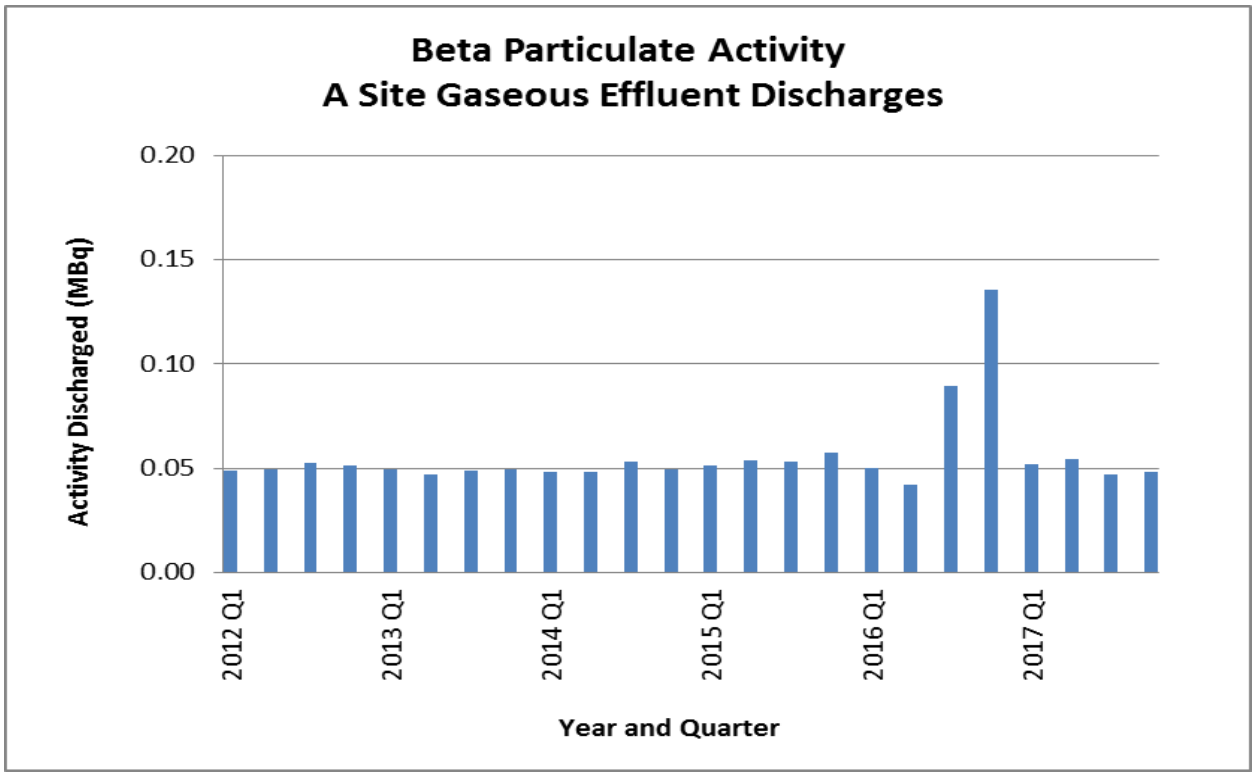
TABLE 1

LIQUID EFFLUENT DISCHARGES AND AUTHORISATION LIMITS IN 2017

Month	Tritium (GBq)	Caesium-137 (GBq)	'Other' Activity (GBq)
January	0.000	0.000	0.000
February	0.031	0.013	0.031
March	0.022	0.010	0.032
April	0.000	0.000	0.000
May	0.364	1.217	8.511
June	0.000	0.000	0.000
July	0.246	1.638	14.683
August	0.000	0.000	0.000
September	0.023	0.016	0.041
October	0.000	0.000	0.000
November	0.304	1.098	6.259
December	0.000	0.000	0.000
Annual Total (2017)	0.990	3.992	29.556
Previous year (2016)	1.526	3.075	24.394
Annual Limit	1000	1000	700

4 HINKLEY POINT A SITE GASEOUS EFFLUENT DISCHARGES

Graph 4a)



Gaseous discharges are from the extract ventilation systems servicing contamination controlled areas on site. 'Leakage' from reactor vents occurs when the air inside the steel pressure vessels expands and contracts.

The Hinkley Point A site annual discharge limit for beta emitting particulate is 50 MBq.

The annual and monthly discharges of beta emitting particulate in 2017 are listed in Table 2.

Argon 41

Argon 41 is no longer present, since the cessation of electricity generation, due to the absence of a neutron flux to produce it. Due to its short half-life (less than 2 hours), all historical argon 41 has decayed and therefore discharge sampling for this nuclide is no longer required.

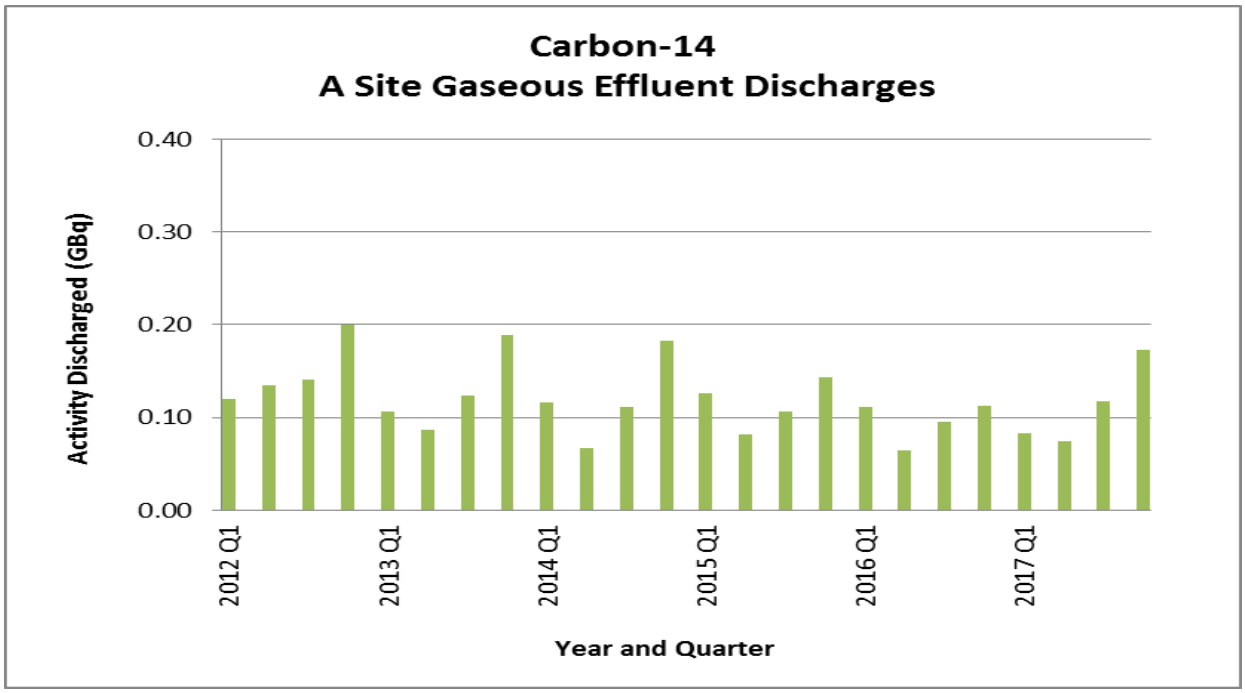
There is now no specific limit for argon 41.

Sulphur 35

Sulphur 35 has a half-life of 87 days and is no longer produced due to the absence of neutron flux. Due to its short half-life sulphur 35 is no longer present in measurable quantities and therefore discharge sampling for this nuclide is no longer required.

There is now no specific limit for sulphur 35.

Graph 4b)

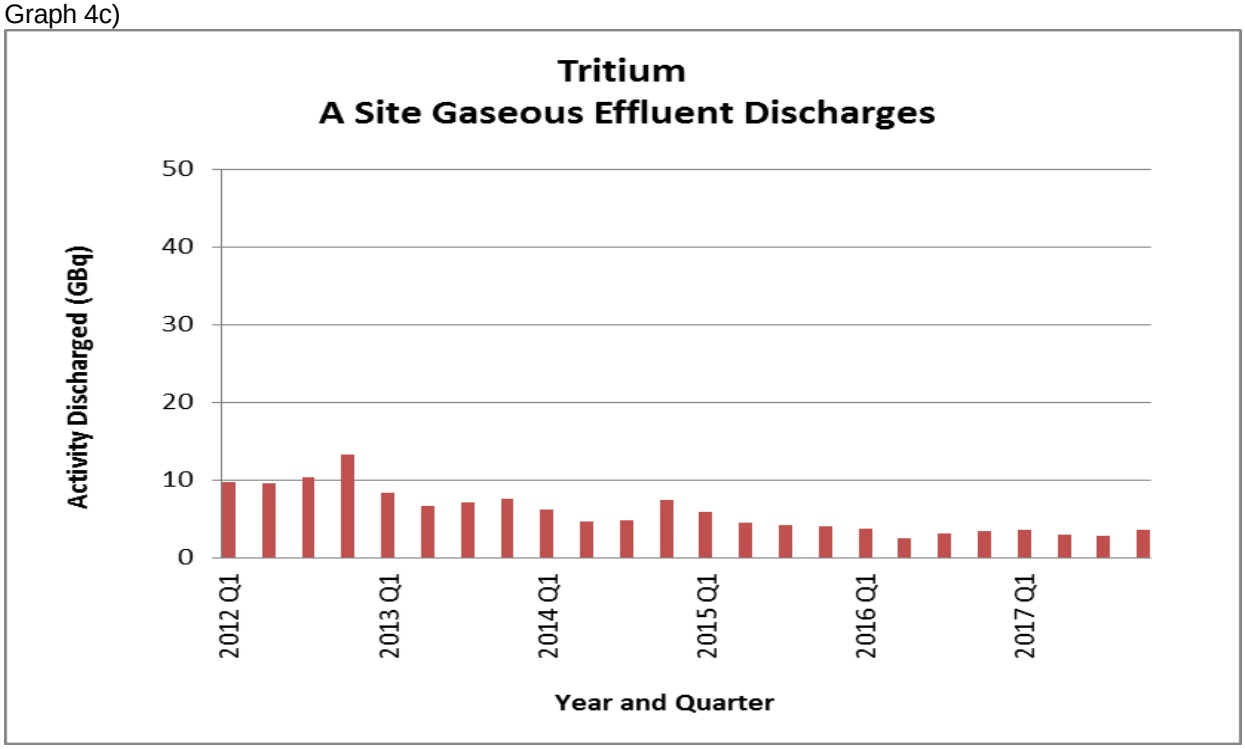


During generation, the principle source of carbon 14 was neutron activation of carbon in the graphite and reactor coolant. Carbon 14 has a half-life of 5730 years and therefore continues to be discharged to atmosphere, albeit in small amounts, via the reactor vents.

The Hinkley Point A site annual discharge limit for carbon 14 is 50 GBq.

The annual and monthly discharges of carbon 14 in 2017 are listed in Table 2.

Graph 4c)



Extract ventilation systems for the pond buildings are were the major source of gaseous tritium discharges from Hinkley Point A site, although this is likely has changed now ponds drain and seal has been completed. Water from the fuel element cooling ponds historically contained tritium, which evaporated into the air within the buildings. The tritium levels in the pond water declined in recent years due to the absence of irradiated

uranium and discharges of gaseous tritium continued to decline in as a result of ponds decommissioning.

The Hinkley Point A site annual discharge limit for tritium is 750 GBq.

The annual and monthly discharges of tritium in 2017 are listed in Table 2.

TABLE 2

GASEOUS DISCHARGES AND AUTHORISATION LIMITS IN 2017

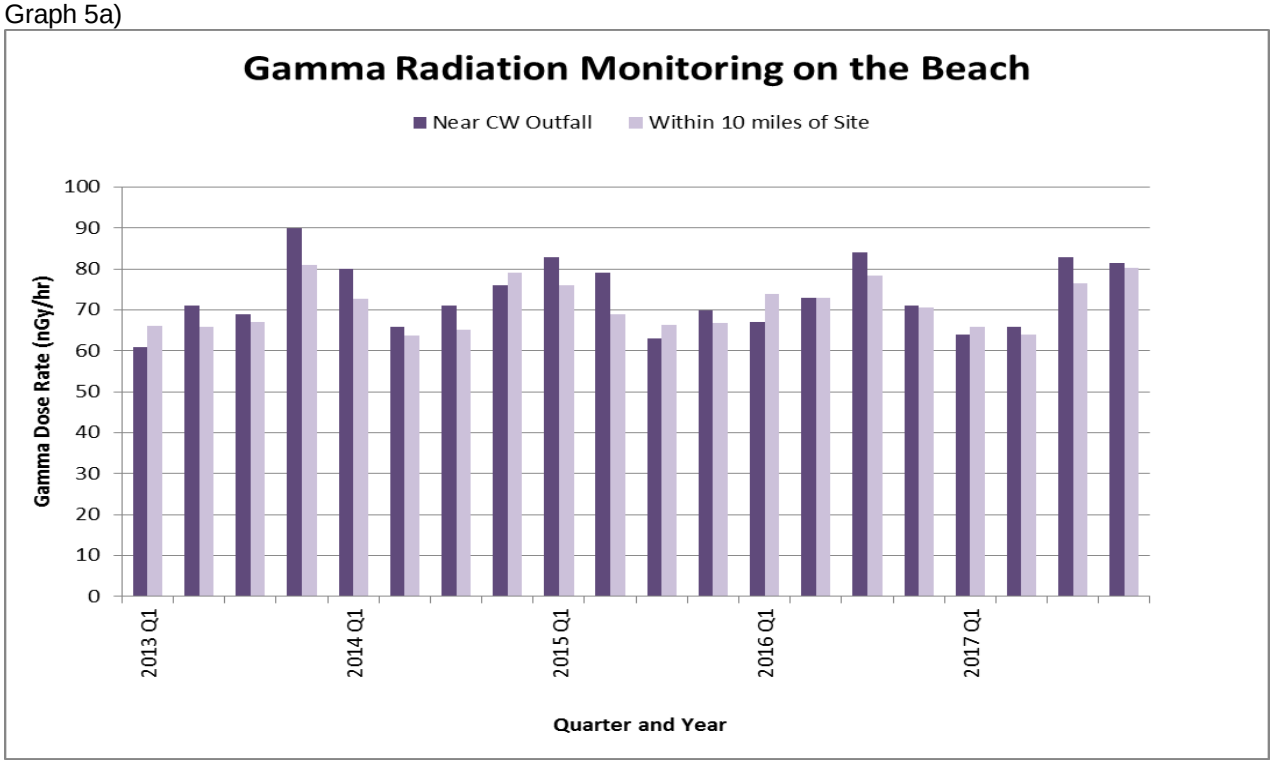
Month	Beta Particulate (MBq)	Tritium (GBq)	Carbon-14 (GBq)
January	1.882E-02	1.117E+00	3.101E-02
February	1.620E-02	1.011E+00	2.645E-02
March	1.713E-02	1.509E+00	2.601E-02
April	1.898E-02	9.313E-01	1.794E-02
May	1.841E-02	1.045E+00	2.350E-02
June	1.694E-02	9.491E-01	3.258E-02
July	1.608E-02	9.665E-01	3.583E-02
August	1.619E-02	8.815E-01	3.167E-02
September	1.476E-02	1.050E+00	5.013E-02
October	1.580E-02	1.082E+00	5.318E-02
November	1.573E-02	1.080E+00	5.161E-02
December	1.679E-02	1.403E+00	6.754E-02
Annual Total (2017)	2.018E-01	1.302E+01	4.474E-01
Previous year (2016)	3.173E-01	1.273E+01	3.834E-01
Annual Limit	50	750	50

5 MARINE MONITORING

Due to a reduction in radiological hazards during decommissioning, there was a full review of the site's environmental monitoring programme. As a result, the frequency of some measurements reduced and some measurements were discontinued altogether. This was implemented in 2016 and had EA input and did not object.

5.1 BEACH GAMMA RADIATION MONITORING

Graph 5a)



The presence of radionuclides in sediments and soils can make a significant contribution to the total exposure of members to the public. For this reason the estimation of 'external dose' is assessed by measuring gamma dose rates at specified locations.

The first set of results provided above (dark purple) show the gamma dose rate in the vicinity of the cooling water outfall on the beach at Hinkley Point. The dose rate has remained fairly stable over the past 5 years with an average dose rate of approximately 73 nGy/hr. The major contribution to the observed gamma dose rate is from natural sources, rather than radioactive discharge from Hinkley Point, and includes cosmic rays and naturally occurring radionuclides in the sediment and rocks. Graph 5c) shows the results for caesium 137 activity concentrations and provides a better indication of the impact of the liquid discharges upon beach sediment.

The second set of results provided above (light purple) show the average gamma dose rate at shoreline sites, other than those in the immediate vicinity of the Hinkley Point cooling water outfall. Each value represents the mean of nine separate measurements, taken at a range of sites within the 10 miles of the outfall and including locations to the east and west of Hinkley Point. Although the dose rates vary slightly between individual sites, depending on the underlying geology, there is no significant difference between the average dose rate at these points and those that are near to the outfall. Table 3 gives details of the 2017 gamma dose data.

TABLE 3

AVERAGE BEACH GAMMA DOSE RATES FOR 2017

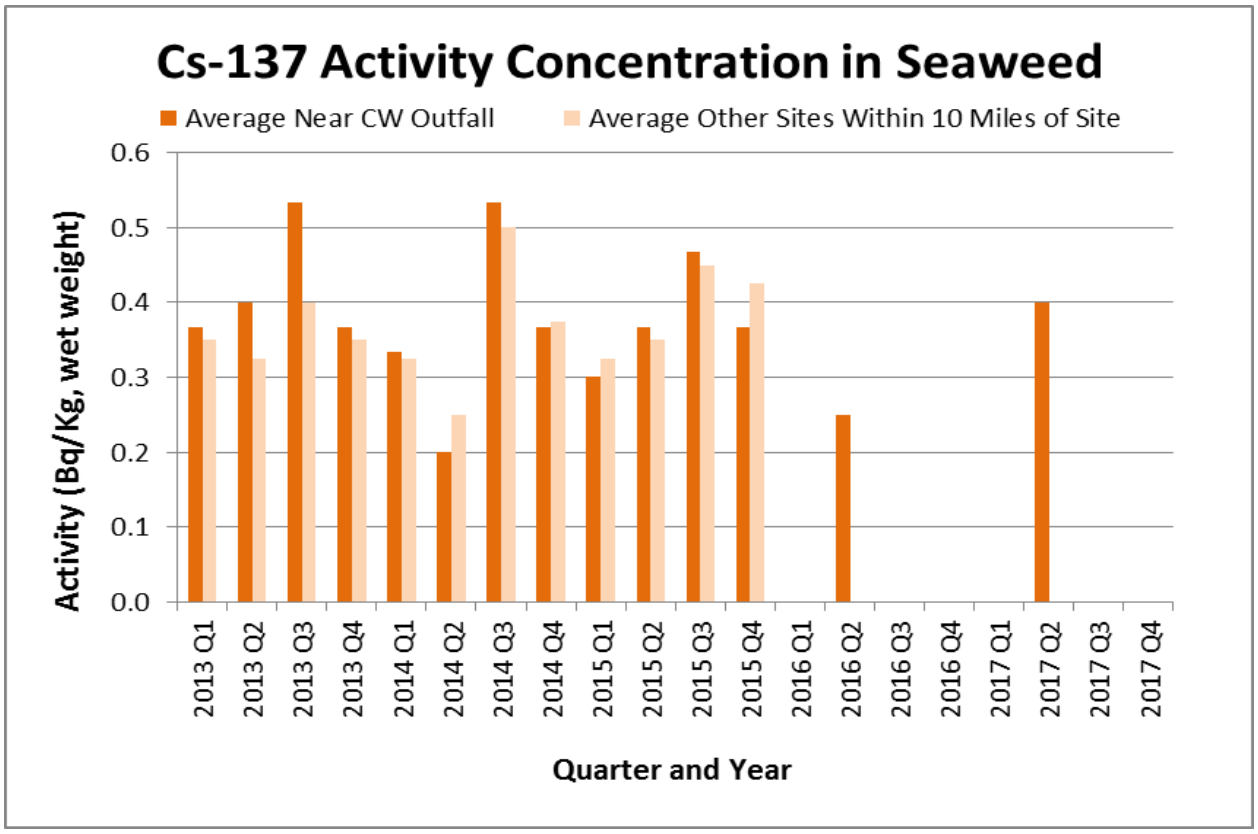
SITE		No. Of Observations	Mean Gamma Dose Rate (nGy/hr)
47	Cooling Water Outfall	4	74
49	East of Cooling Water Outfall	4	62
50	West of Cooling Water Outfall	4	71
51	Stolford	4	65
52	Lilstock	4	72
53	Burnham	4	65
54	Blue Anchor Bay	4	73
56	Kilve	4	83
58	Combwich	4	78
59	Watchet	4	75

The average dose rates measured close to the outfall are similar to the ambient background due to the reduction in direct radiation since the shutdown of the reactors on Hinkley Point A site. More specifically, the contribution from caesium 137 (assuming a typical activity concentration of 40 Bq/kg) is just 4.5 nGy/hr or less than 10% of the observed dose rates. This illustrates that the majority of the gamma dose rate is due to the background cosmic radiation combined with the presence of natural series radionuclides in the sediment.

The critical group for external exposure over inter-tidal sediment is a small number of fishermen who work on the beaches. The annual dose is a function of estimated occupancy time (1300 hours) and the estimated contribution from caesium 137 (4.5 nGy/hr). Their annual dose due to liquid discharges from Hinkley Point would have been less than 10 µSv in 2017.

5.2 CAESIUM-137 IN SEAWEED

Graph 5b)



Samples of Bladderwrack seaweed (Fucus Vesiculosis) were collected quarterly from three sites near the cooling water outfall (dark orange) and from beaches within 10 miles of site (light orange). In 2016, however, the sampling programme reduced to annual samples from 2 sites near the cooling water outfall only.

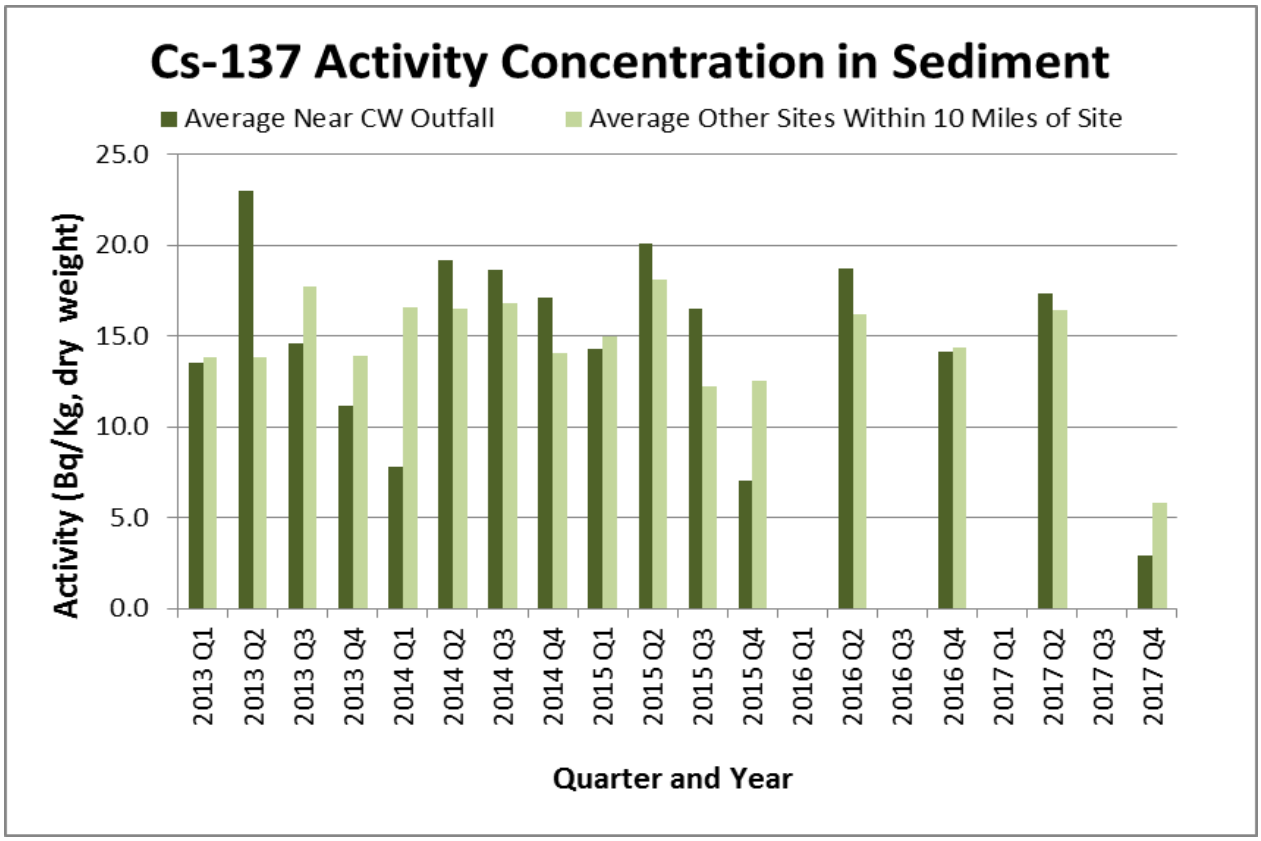
In addition to occasional use in foods and as fertilisers, seaweeds are useful as indicator materials in an environmental monitoring programme because the effectively concentrate radionuclides.

The sole gamma emitting radionuclide that was positively detected in seaweed was caesium 137. Measurements of gross beta activity are also assessed for reassurance monitoring. The gross beta activity in seaweed close to the cooling water outfall in 2017 ranged from 156.9 to 167.0 Bq/Kg (wet weight). The predominant contribution was due to the presence of potassium 40 which is a naturally occurring radionuclide, with levels being considerably greater than those for caesium 137.

The caesium 137 activity concentration appears broadly stable over the period considered here albeit that, due to the low levels, there is significant scatter in the data. Although maximum activity concentrations have been observed in samples obtained closest to the outfall, there is no consistent trend apparent with the inevitable scatter inherent in a series of low level data and both sets of results are similar. Table 4 gives detail of the data.

5.3 CAESIUM 137 IN SEDIMENT

Graph 5c)



Like seaweed, sediment is a useful indicator material in an environmental monitoring programme because it effectively concentrates radionuclides. The presence of radionuclides in sediment can make a significant contribution to the total exposure of members of the public, via the external exposure pathway. The sole gamma emitting radionuclide that was positively detected in sediment in the vicinity of Hinkley Point was caesium 137. There is significant variability in the data. One reason for the variability is that activity concentrations are typically greater in silt than in sand. It is sometimes difficult to find silt at the sampling locations, and hence the radioactivity levels in sediment are variable since they depend on the relative proportions of sand to silt in each sample.

Samples of sediment were collected quarterly from three sites near the cooling water outfall (dark green) and from beaches within 10 miles of site (light green). In 2016, however, the sampling programme reduced to biannual samples only. The results provided above show the average caesium 137 concentration in sediment. The range of activity concentration is broadly similar for both sets of samples, although the actual activity in the samples within 10 miles of site is generally less than the activities present at the cooling water outfall: which is to be expected. Sediment samples are also analysed for strontium 90 (a beta emitting radionuclide). Levels were significantly lower than caesium 137 and below the limit of detection in about half the samples. Measurements of gross beta activity are also undertaken for reassurance monitoring and values close to the outfall in 2017 were in the range of 255 to 1095 Bq/Kg (dry weight). The predominant contribution was due to the presence of natural radionuclides including potassium 40 and beta emitters in the uranium 238 and thorium 232 series.

Table 4 gives details of the 2017 data.

TABLE 4

Sample	Location	Units	No. of Observations	Beta	Caesium 137	Strontium 90
Sediment	Outfall	Bq/Kg Dry	2 (1 for Sr-90)	575	9.5	0.6
Sediment	East of CW Outfall	Bq/Kg Dry	2 (1 for Sr-90)2	650	13.6	0.6
Sediment	West of CW Outfall	Bq/Kg Dry	2 (1 for Sr-90)	490	7.4	0.6
Sediment	Stolford	Bq/Kg Dry	2 (1 for Sr-90)	596	10.2	0.5
Sediment	Lilstock	Bq/Kg Dry	2 (1 for Sr-90)	622	10.6	0.9
Sediment	Burnham-On-Sea	Bq/Kg Dry	2 (1 for Sr-90)	575	10.4	0.7
Sediment	Blue Anchor Bay	Bq/Kg Dry	2 (1 for Sr-90)	743	6.9	1.0
Sediment	Brean Down	Bq/Kg Dry	2 (1 for Sr-90)	684	13.5	1.9
Sediment	Kilve	Bq/Kg Dry	2 (1 for Sr-90)	870	10.0	1.7
Sediment	Combwich	Bq/Kg Dry	2 (1 for Sr-90)	673	18.9	0.5
Sediment	Watchet	Bq/Kg Dry	2 (1 for Sr-90)	657	8.7	0.5
Seaweed	East of CW Outfall	Bq/Kg Wet	1	157	0.3	N/A
Seaweed	West of CW Outfall	Bq/Kg Wet	1	167	0.5	N/A

6 HERBAGE

TABLE 5 Radioactivity in Herbage Samples for 2017

Site	Carbon -14 Bq/Kg (wet)
Inner Farm 20	10.7
Inner Farm 23	12.6
Inner Farm 24	10.1

Herbage, usually grass, is sampled on a biannual basis (Q2 and Q4) but annually for C-14 analysis. See table 5 for more details.

Gamma spectrometry of herbage is also undertaken, with traces of caesium – 137 being occasionally detected but consistent with national background measurements resulting from known historic events.

6 RADIATION DOSE SUMMARY

The estimated annual dose to members of several local groups of the general public is summarised in Table 6. Full dose assessment figures for 2017 are not available to date (This data is normally provided the following year but at the time of writing not yet published). The data shown below is taken from the Radioactivity in Food and the Environment (RIFE) Reports.

Discharges of radioactivity from Hinkley Point A and results from then environmental monitoring programmes measurements, have shown no significant change in 2017 and therefore, it is unlikely annual doses to members of the public will vary significantly from the figures listed in Table 6. In each case, the number of people is small.

Table 6 Summary of doses from RIFE Reports

Radiation Exposure Pathway	Exposure, µSv per year		
	2014	2015	2016
Total dose to the public from all pathways and sources of radiation	22	16	13
Fish and shellfish consumption, and exposure to external radiation over intertidal areas	32	21	18
Terrestrial foods, external exposure and inhalation near site.	15	5	11

For comparison, the average annual radiation dose to the public in the UK from natural radioactivity is over 2000µSv.

7. SOLID WASTE

7.1 RADIOACTIVE SOLID AND NON AQUEOUS LIQUID WASTE DISPOSALS FROM HINKLEY POINT 'A' IN 2017.

Solid low level radioactive waste is transferred to the Low Level Waste Repository in Cumbria for direct disposal or via treatment. Solid low level radioactive waste metal is also transferred for treatment for decontamination using methods such as grit blasting. Combustible solid low level radioactive waste and non-aqueous radioactive waste is also transferred to incinerator operators.

During the period, there have been two disposals of LLW to LLWR, no disposal of VLLW, two transfers of combustible solid LLW to Tradebe (Fawley) and three transfers of surface contaminated metals for further treatment off site.

8 CONCLUSIONS

During 2017 the levels of radioactivity in liquid and gaseous effluents, and solid radioactive low level waste transferred for off-site processing, remained well below the authorised limits set by the Environment Agency, by both Hinkley Point A site.

The environmental monitoring programme confirmed that there is no evidence of any long term accumulation of radioactivity resulting from the operation Hinkley Point A. Radiation doses to members of the public from the discharges and direct radiation from the power station site is well below the UK legal limit of 1000µSv per year. Furthermore, environmental management initiatives suggest that the environment surrounding Hinkley Point is in a good state.

The total dose to members of the public from the all pathways exposure is likely to be similar to previously assessed doses of 13 µSv (RIFE Report 22, 2016), which is well within the public dose constraint value of 300µSv per year from a 'single site', recommended by Public Health England.