


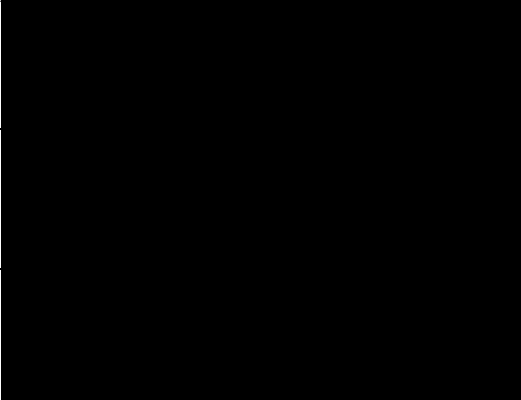


**PLANT IDENTIFICATION**

<b>Site</b>	Sellafield
<b>Operating Unit</b>	Utilities

**DOCUMENTATION**

<b>Document Number</b>	IU MSC (18) P008
<b>Title</b>	SAV RSA Major Permit Review
<b>Revision Number</b>	Issue 1
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**PREPARATION AND APPROVALS**

	<b>Name</b>	<b>Signature</b>	<b>Date</b>
<b>Prepared by</b>	 SAV Stack Coordinator		
<b>Methodology and Presentation Checked by</b>	 EHS Manager		
<b>MSC Approval</b>	 MSC Chairman		

## **1 Background**

The Radioactive Substances Act (RSA) Major Permit Review includes an examination of historical discharge data. There are a number of radionuclides or group of nuclides in the RSA Permit (Ref. 1) that are routinely reported from Limit Of Detection (LOD) or Minimum Detectable Activity (MDA) analytical results or have greatly reduced compared to the plant permit limit. The historical discharge data for the Separation Area Ventilation (SAV) Stack have been examined alongside the RSA Major Permit Review to determine if limits can be removed, amended or more appropriate (proportionate) techniques can be applied including the consideration of standardised reporting.

## **2 Examination of historical discharge data**

The historical discharge data for the SAV Stack is shown in Appendix 1 with annual plant permit limit expressed as a monthly value and in Appendix 2 with monthly decision threshold data (see Section 3) as a reference point for the discharge data. The discharge data for radionuclides reported against Throughput Related Limits (Tritium H-3, Carbon-14 and Krypton-85) and I-129 are routinely determined from 'real' analytical results and will continue to be reported against permit limits (see Section 5).

The analytical results for Iodine-131, Plutonium-alpha and Plutonium-241 are routinely at LOD and MDA. Reporting consistently similar, and potentially over estimated, values does not add benefit to the control of radioactive aerial waste. The discharge data for Iodine-131, Plutonium-alpha and Plutonium-241 is also predominantly below the associated monthly decision thresholds (see Appendix 2). The requirement to report Iodine-131 discharge data is historically from short cooled fuel which is no longer reprocessed in the Donor Plants to SAV and this is reflected by the Iodine-131 discharge data which is reported from MDA analytical results. The Plutonium-alpha and Plutonium-241 discharge data is lower via the SAV Stack than it was via the previous Stacks which may be due to a new system including new ducts without historic contamination and two additional banks of High Efficiency Particulate in Air (HEPA) filters on the vessel ventilation aerial waste streams to the SAV Stack. It is therefore proposed that the RSA Permit plant limits for Iodine-131, Plutonium-alpha and Plutonium-241 are removed in the Major Permit Review (Phase 1 in October 2019).

The analytical results for Alpha and Beta-emitting radionuclides associated with particulate matter are also routinely LOD values which may be also due to a new system including new ducts without historic contamination and two additional banks of HEPA filters on the vessel ventilation aerial waste streams to the SAV Stack. The discharge data for Alpha and Beta-emitting radionuclides associated with particulate matter is also predominantly below the associated monthly decision thresholds. The RSA Permit plant limits for Alpha and Beta-emitting radionuclides in the Major Permit Review could be removed without losing control of these groups of nuclides.

It is therefore proposed that standard values will be routinely reported in the Major Permit Review. Sample cards will be monitored against action levels to maintain control of discharge without the need for analysis, saving time and money.

SAV has been operational for two years and a comparison of the SAV discharges against those from the previous Stacks (Primary Separation Plant and Head End Plant Stack and the Pile Chimney) are shown in Table 1. The SAV data as a percentage of the previous Stacks values confirm the reduced discharges which may be due to a new system including new ducts without historic contamination and two additional banks of HEPA filters.

Radionuclides or group of nuclides	SAV Stack average monthly discharge (MBq) *	Previous Stacks combined average monthly discharge (MBq) #	SAV as a percentage of the previous Stacks
Iodine-129	1.75E+02	1.86E+02	94%
Iodine-131	3.31E+00	4.87E+00	68%
Plutonium-alpha	1.38E-02	8.26E-02	17%
Plutonium-241	3.82E-01	1.72E+00	22%
Alpha-emitting radionuclides associated with particulate matter	7.78E-02	4.49E-01	17%
Beta-emitting radionuclides associated with particulate matter	4.99E-01	2.63E+00	19%

\* April 2016 to February 2018

# March 2014 to February 2016

Table 1: SAV Stack discharges compared to the previous Stacks' discharges for the same ventilation sources

### 3 Monthly decision thresholds

The monthly decision threshold data plotted in the graphs in Appendix 2 is determined from the associated dose factor values (Ref. 2) to provide an indication whether the discharges are environmentally important (i.e. > 0.01  $\mu$ Sv/year to the critical group). The annual and monthly decision threshold data was determined as follows:

Annual decision threshold = (0.01 / dose factor) / 2

Monthly decision threshold = Annual decision threshold / 12

#### 4 Alpha and Beta-emitting radionuclides threshold and standard values

The historical discharge data calculated from the sample card counts is shown in Appendix 3 for Alpha and Beta-emitting radionuclides along with the proposed threshold levels which were determined from the SAV Stack Dose Trigger (SDT) values (Ref. 3):

Threshold levels = 10 % of the SDTs

The proposed threshold levels which prompt a sample card to be submitted for analysis are 11 and 12 MBq for Alpha and Beta-emitting radionuclides respectively and the 'real' result will be reported to the Environment Agency. As the analytical results for Alpha and Beta-emitting radionuclides associated with particulate matter are routinely LOD values the proposed standard values to be routinely reported are zero, removing the need for analysis, saving time and money.

#### 5 Future discharges

The forecasted future discharges for SAV are lower than the current levels following the planned end of Magnox Reprocessing in 2020; a major contributor of activity to the SAV Stack. As of 29 May 2018, there are 1,107 tonnes of Magnox fuel to be reprocessed until closure of the Magnox operating programme. The Post Operational Clean Out (POCO) and decommissioning of the Donor Plants is not expected to increase future discharges.

##### 5.1 Proposed Tritium H-3, Carbon-14 and Krypton-85 Notification Levels

Discharges of Tritium H-3, Carbon-14 and Krypton-85 are related to the tonnes of Magnox fuel that is reprocessed per year. In the last six years the average tonnes of Magnox fuel reprocessed is approximately 430 tonnes which correlates well with the remaining 1,107 tonnes i.e. approximately 440 tonnes per year. It is therefore proposed that the notification levels for Tritium H-3, Carbon-14 and Krypton-85 are fixed as the current throughput related limits for 'more than 100 but less than 400' tonnes per year, as shown in Table 2. The proposed notification levels will provide an early warning of elevated discharges and for monitoring purposes. The notification levels will replace the current plant permit limits and will be more restrictive than the proposed Site limits.

Radionuclide	Calendar year notification levels (MBq)
Tritium H-3	3.7E+08
Carbon-14	4.3E+05
Krypton-85	4.0E+10

Table 2: Proposed notification levels for throughput related nuclides

## **5.2 Proposed Iodine-129 Notification Levels**

The Iodine-129 discharges are historically about 20% of the plant permit limit (17% for Financial Year 2017/2018) indicating that there is some headroom which could be reduced for the Major Permit Review. Plotting the recent Iodine-129 discharges with a calculated mean + 3 times the standard deviation of the discharges provides a proposed annual plant limit worst case prediction of 4.73E+03 MBq, which is expressed as a monthly value and plotted with the recent Iodine-129 discharges in Appendix 4.

## **6 Conclusion**

The proposed changes will be included in the Major Permit Review and will be put into place following the Major Permit Review timelines in Phase 1 in October 2019.

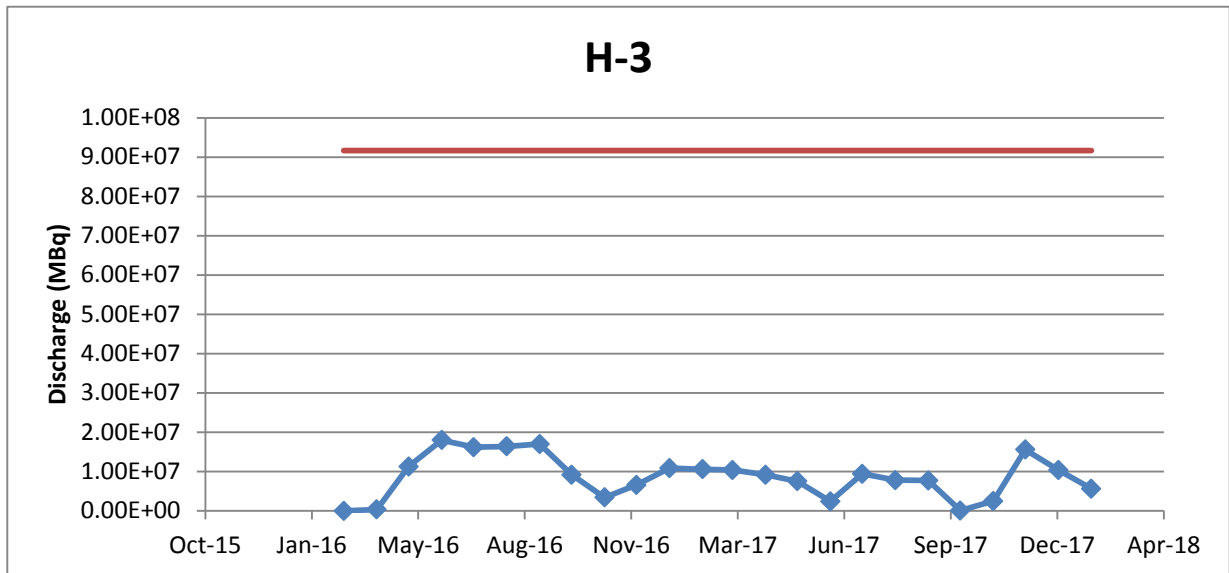
## **7 References:**

1. Environment Agency, Environmental Permit for the Radioactive Substances Authorisation, No. KP3690SX, December 2017.
2. SLF 2.11.109.01 Public dose factor tables, Issue 2, April 2013.
3. SLSP 2.10.300.02 Rapid Assessment of Abnormal Stack Discharges, Issue 1, July 2013.

## Appendix 1

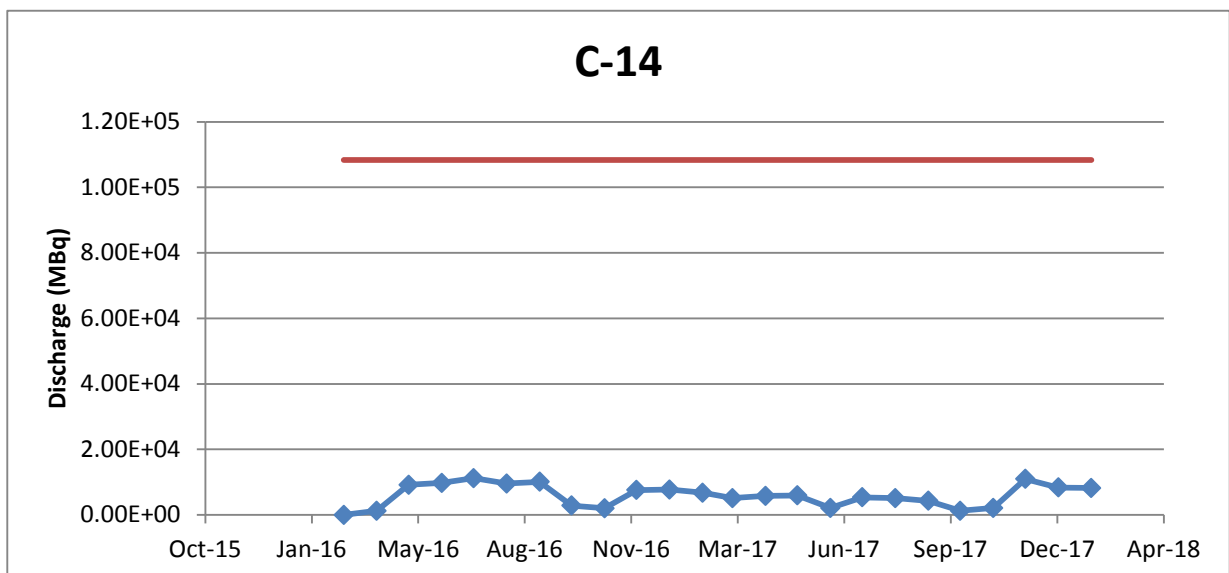
The historic discharge data for SAV for H-3, C-14, Kr-85 and I-129 is shown in the following four graphs. The blue lines shows the reported discharge data and the red lines show the annual plant permit limit expressed as a monthly limit as a reference point for the discharge data.

## Tritium H-3:



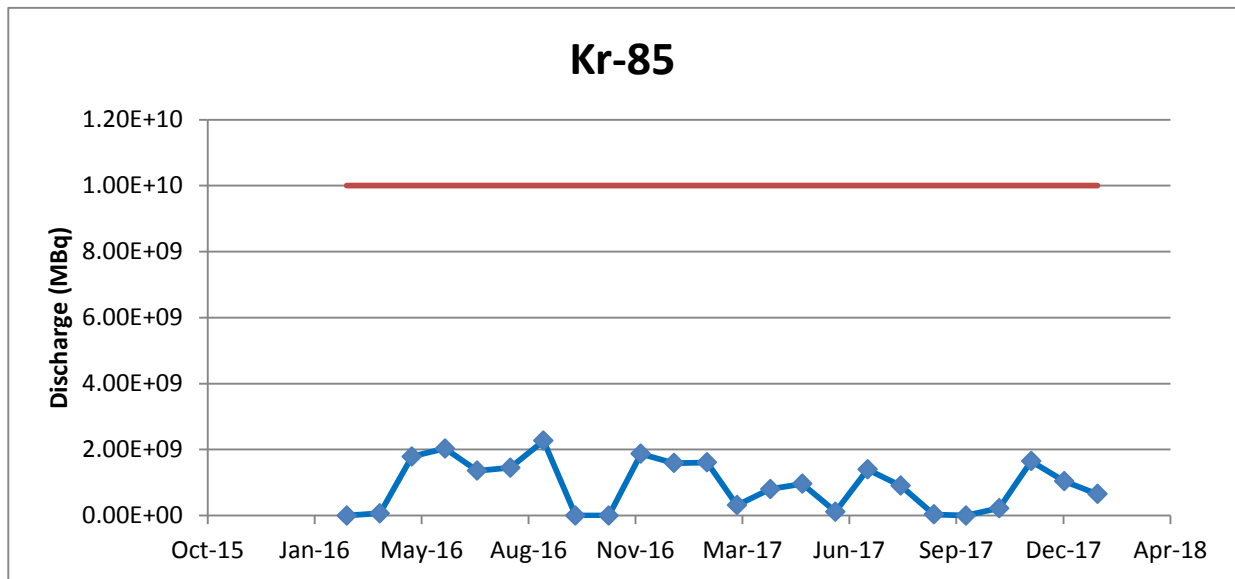
(The maximum monthly discharge is 20% of the monthly equivalent of the annual plant permit limit)

## Carbon-14:



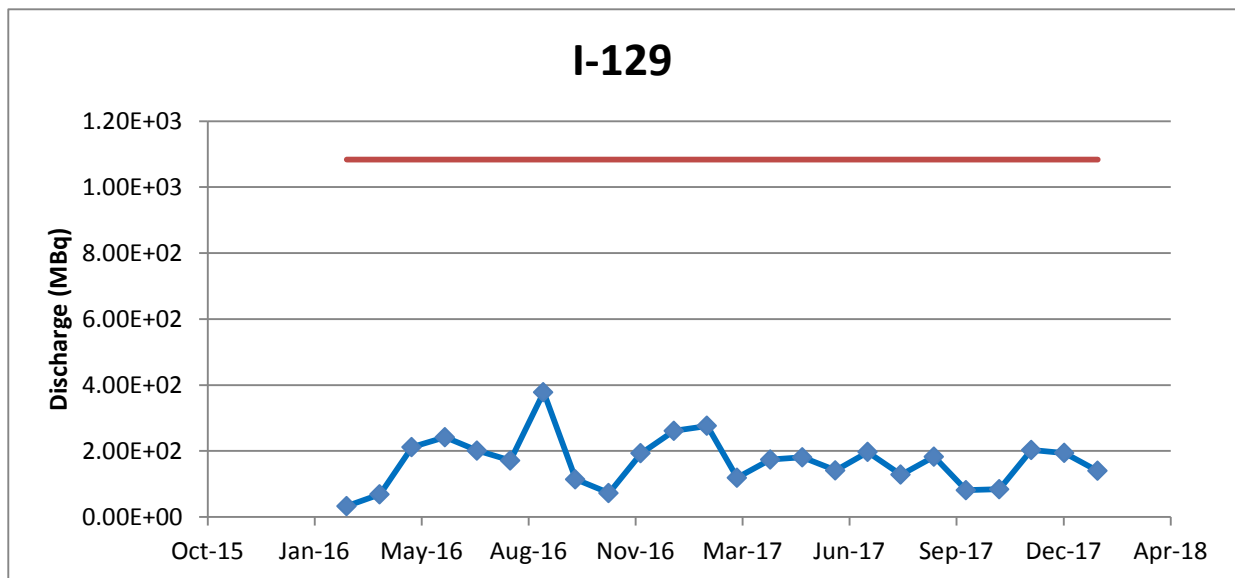
(The maximum monthly discharge is 10% of the monthly equivalent of the annual plant permit limit)

Krypton-85:



(The maximum monthly discharge is 23% of the monthly equivalent of the annual plant permit limit)

Iodine-129:

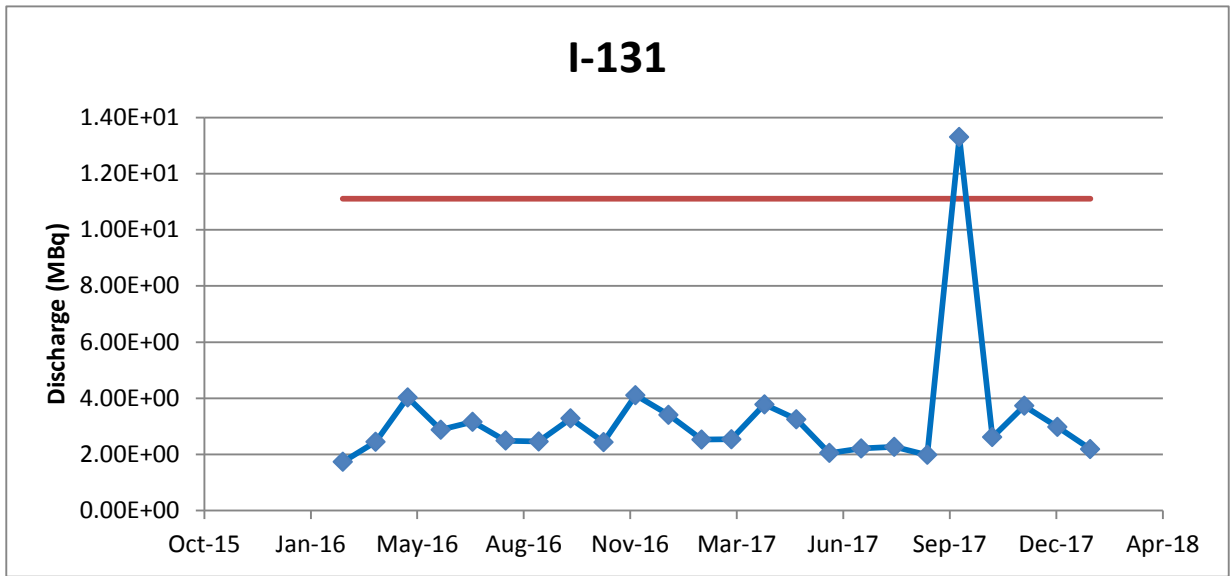


(The maximum monthly discharge is 35% of the monthly equivalent of the annual plant permit limit)

## Appendix 2

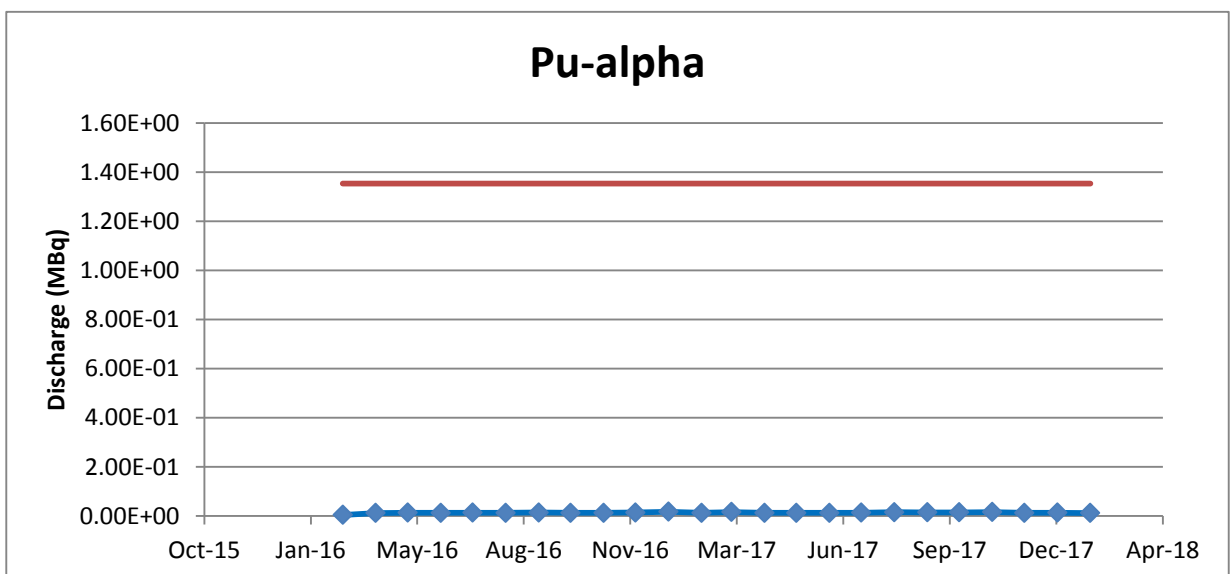
The historic discharge data for SAV for I-131, Pu-alpha, Pu-241, Alpha and Beta-emitting radionuclides associated with particulate matter is shown in the following five graphs. The blue lines shows the reported discharge data and the red lines show the monthly decision threshold as a reference point for the discharge data.

## Iodine-131:



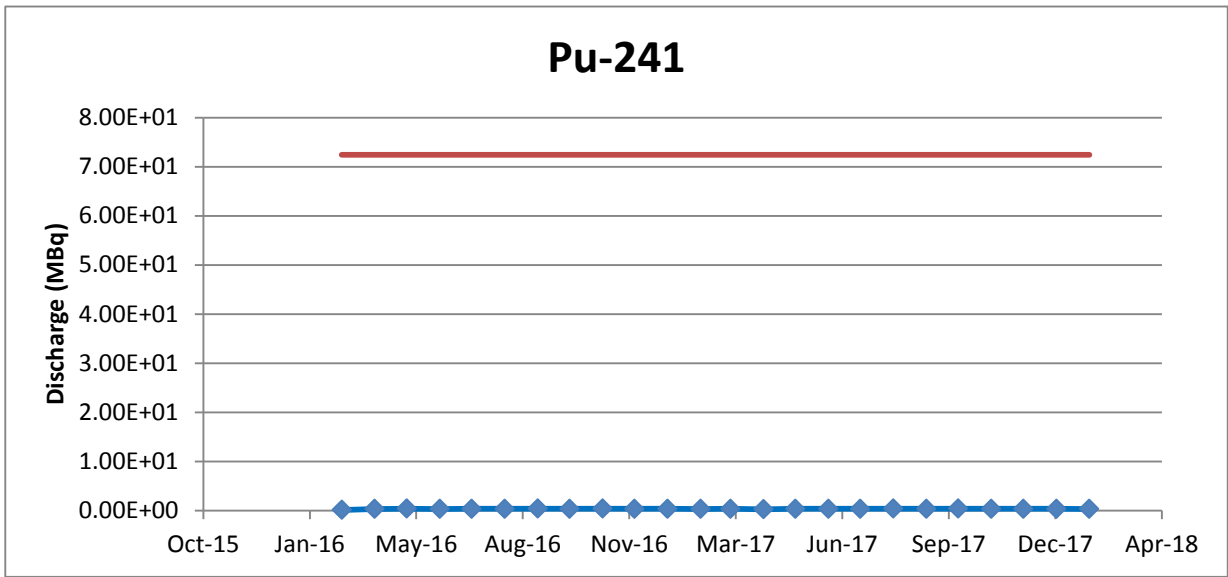
(The October 2017 discharge data for I-131 is artificially inflated from half-life corrected MDA results due to extended analysis timelines)

## Plutonium-alpha:

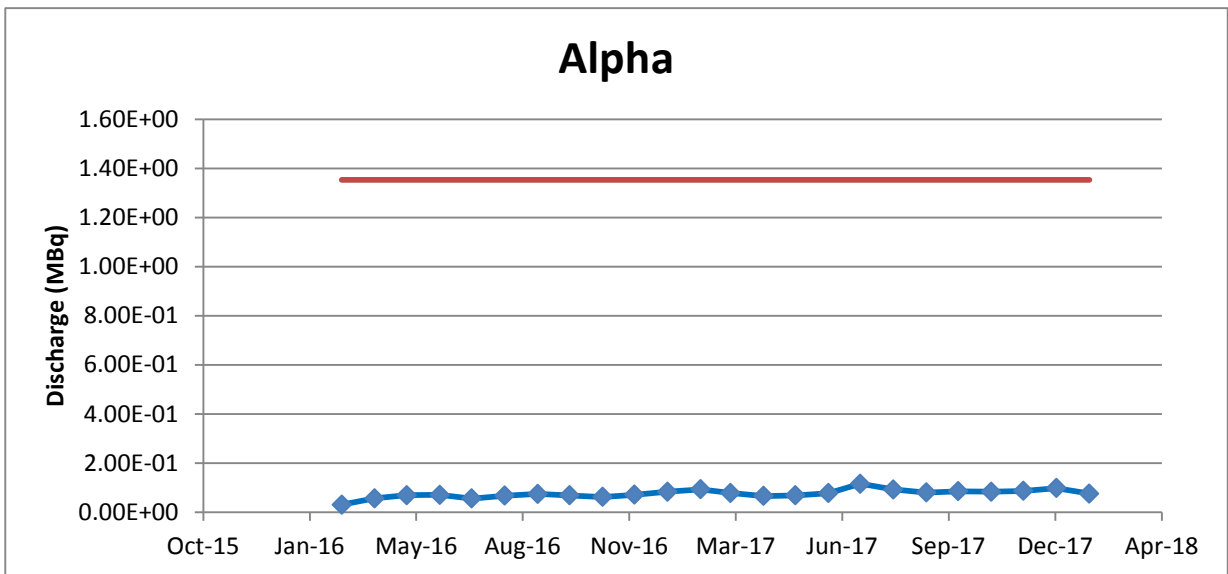




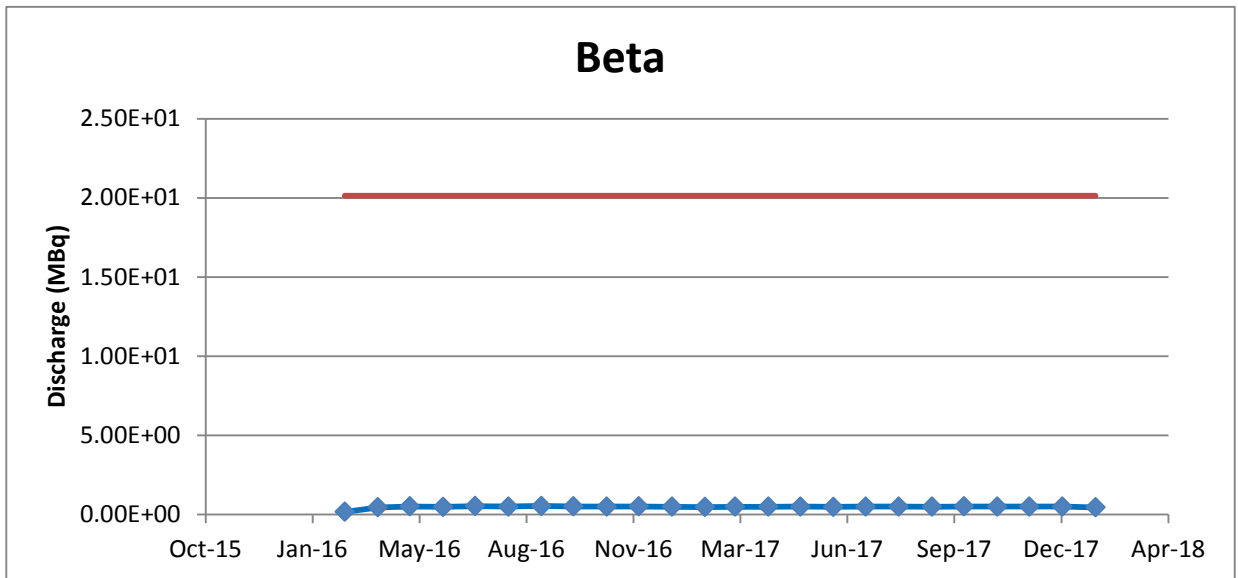
Plutonium-241:



Alpha-emitting radionuclides associated with particulate matter:



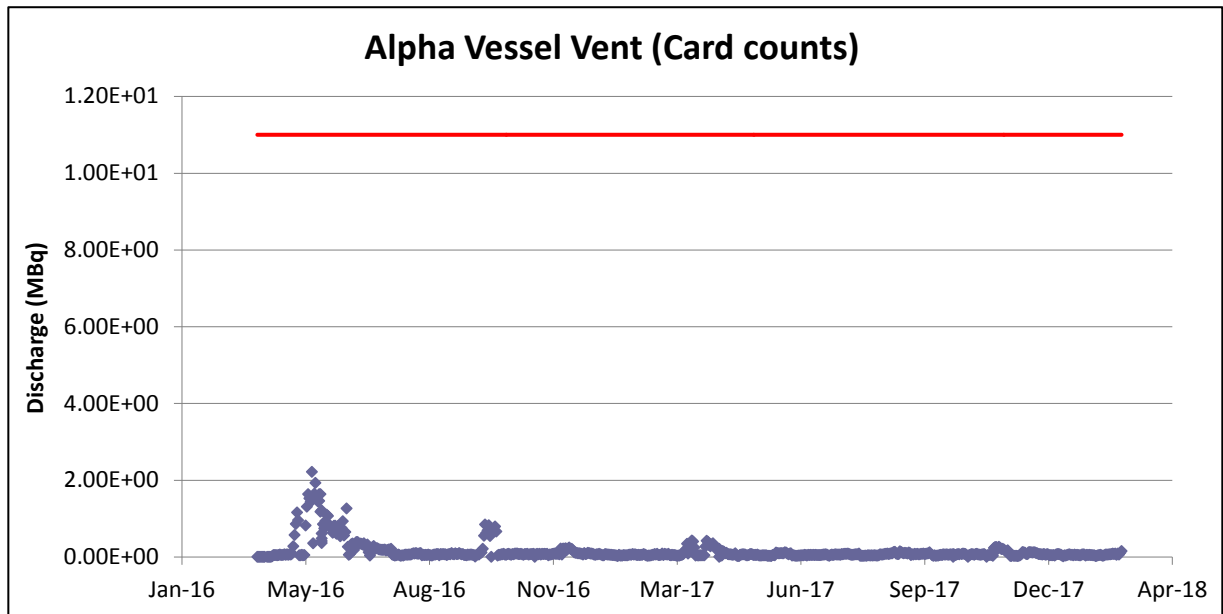
Beta-emitting radionuclides associated with particulate matter:



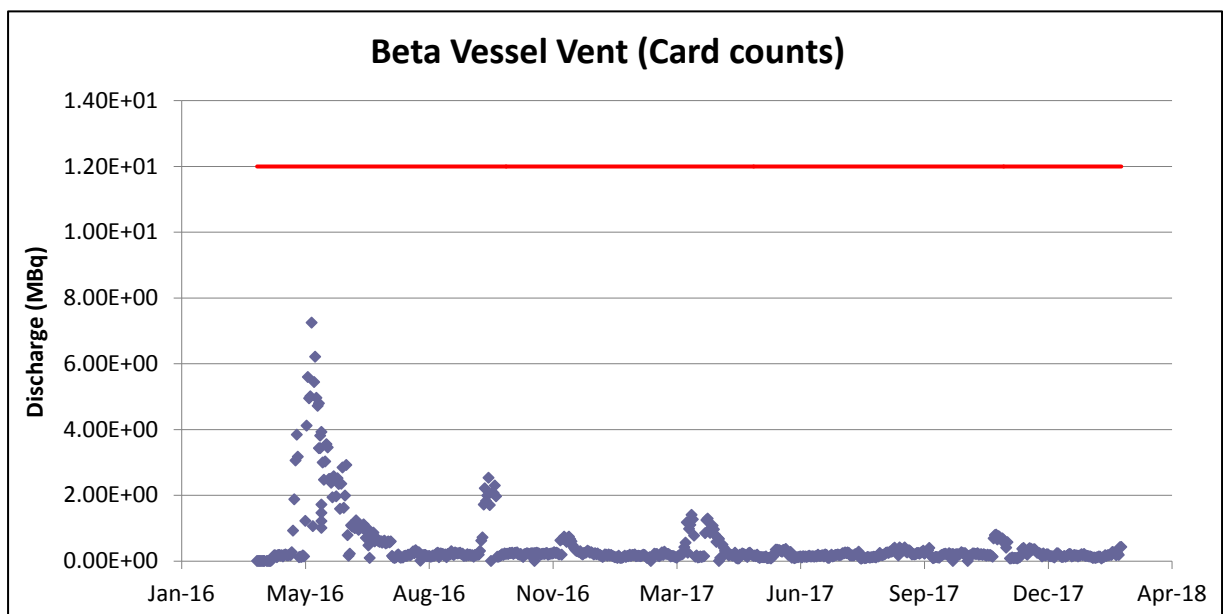
## Appendix 3

The calculated discharges from the SAV Vessel Vent stream sample card counts are shown in the following two graphs (blue line) along with the proposed threshold levels (red line) for Alpha and Beta-emitting radionuclides. (Note: The Cell Vent card counts are not displayed for clarity purposes as the counts are routinely substantially lower than for the Vessel Vent)

Alpha-emitting radionuclides:



Beta-emitting radionuclides:



Appendix 4

Iodine-129 discharges plotted with the proposed notification level expressed as a monthly value

