



Offgas Management in the Australian Nuclear Medicine (ANM) Mo99 Facility

June 2016



 OPAL Reactor

 Current Mo-99 Plant

 New ANM Facility

 Generator Plant

ANSTO Site

ANSTO Mo-99 History

Late 1970's
operated MEK extraction of Tc-99m from n-activated Mo-99

1980
commenced fission product Mo-99 from 1.8% enriched UO₂ target

1984
increased fp Mo-99 production with development of sterile Tc-99m generator

1990
Ceased n-activated Mo-99 production due to cessation of demand

1994
UO₂ enrichment increased to 2.2% to meet Australian demand for Tc-99m generators

2008
New fp Mo-99 installed utilising 19.97% enriched UAl_x targets. Increased Mo-99 production four times

2010
Mo-99 capacity doubled. Capacity now 1000 6d Ci per week. Significant export commenced

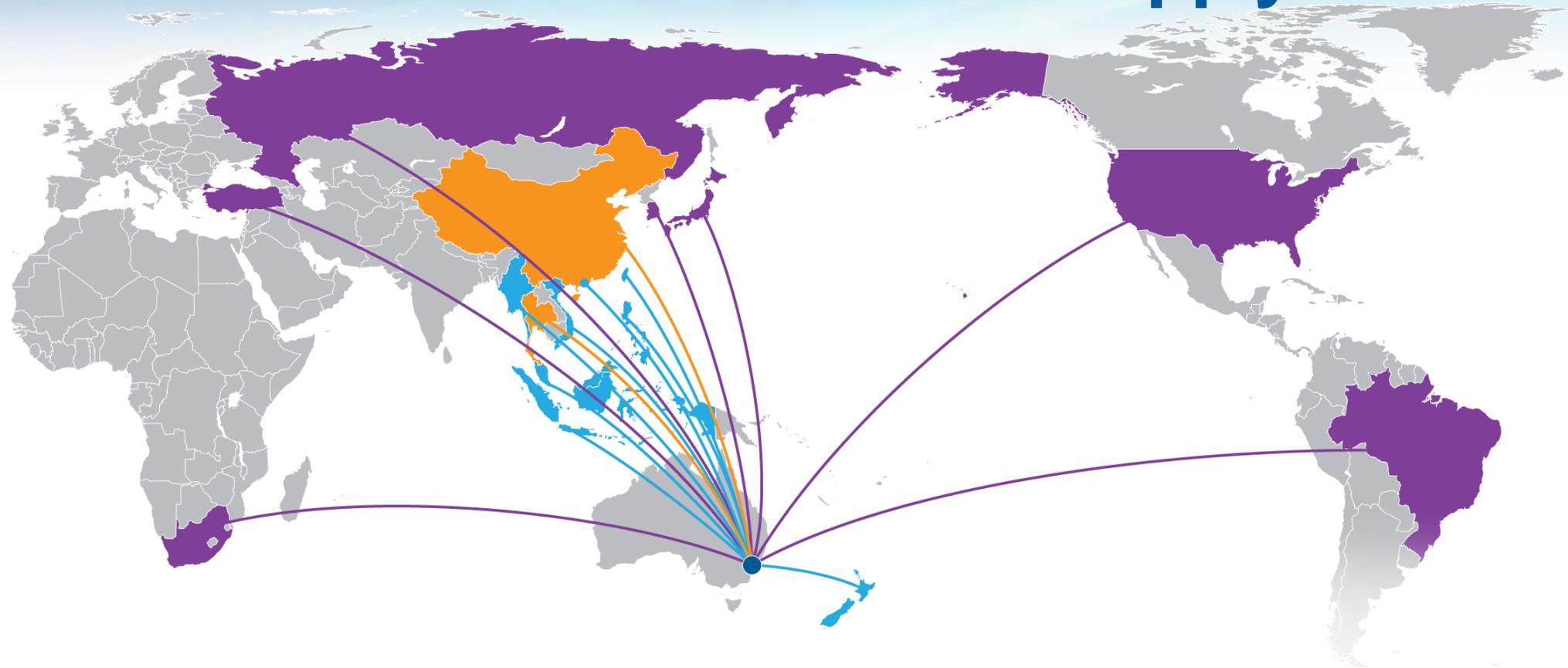
2012
Commenced Planning for ANM plant - 3500 6d Ci Mo-99 per week

2014
Commenced construction of ANM plant

Australian Focus

International Focus

ANSTO Global Mo-99 Supply



Bulk Mo-99

Japan	Turkey
USA	Russia
South Korea	Brazil
South Africa	

Tc-99m Generator

Singapore	New Zealand
Hong Kong	Philippines
Taiwan	Myanmar
Vietnam	Indonesia

Mo-99 & Tc-99m Generator

China
Thailand

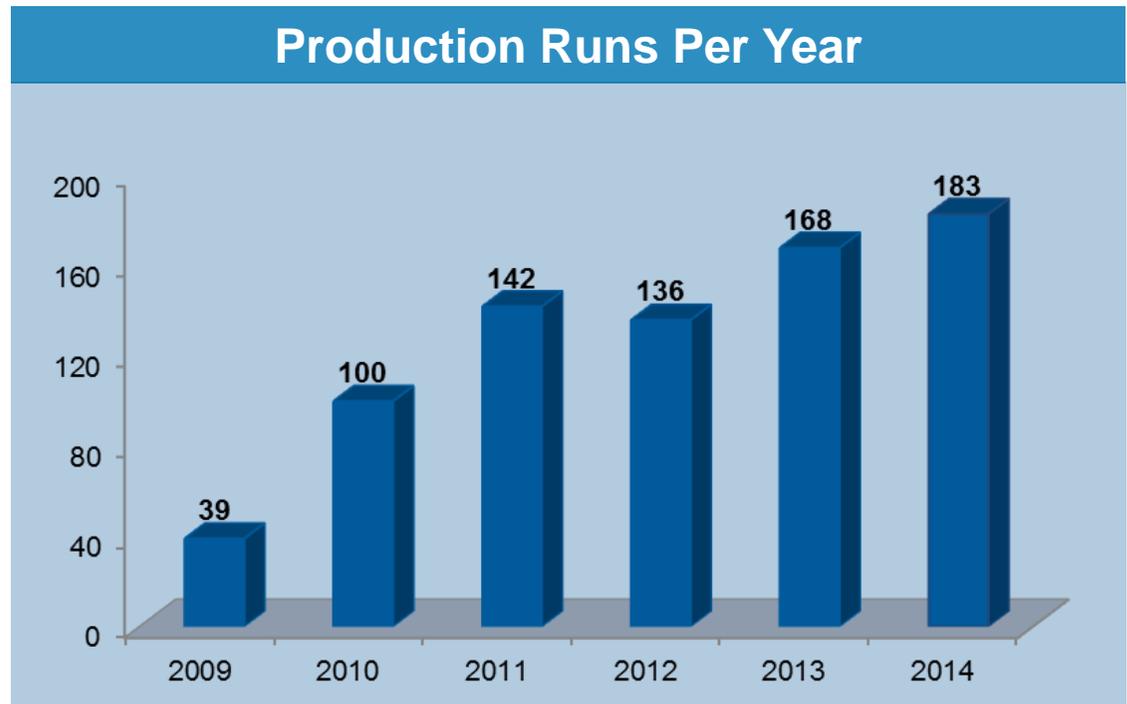
Current Mo-99 Production

OPAL Reactor	Processing Plant
LEU U ²³⁵ targets irradiated in OPAL	LEU Mo-99 separated and purified



7-10 days

1 day



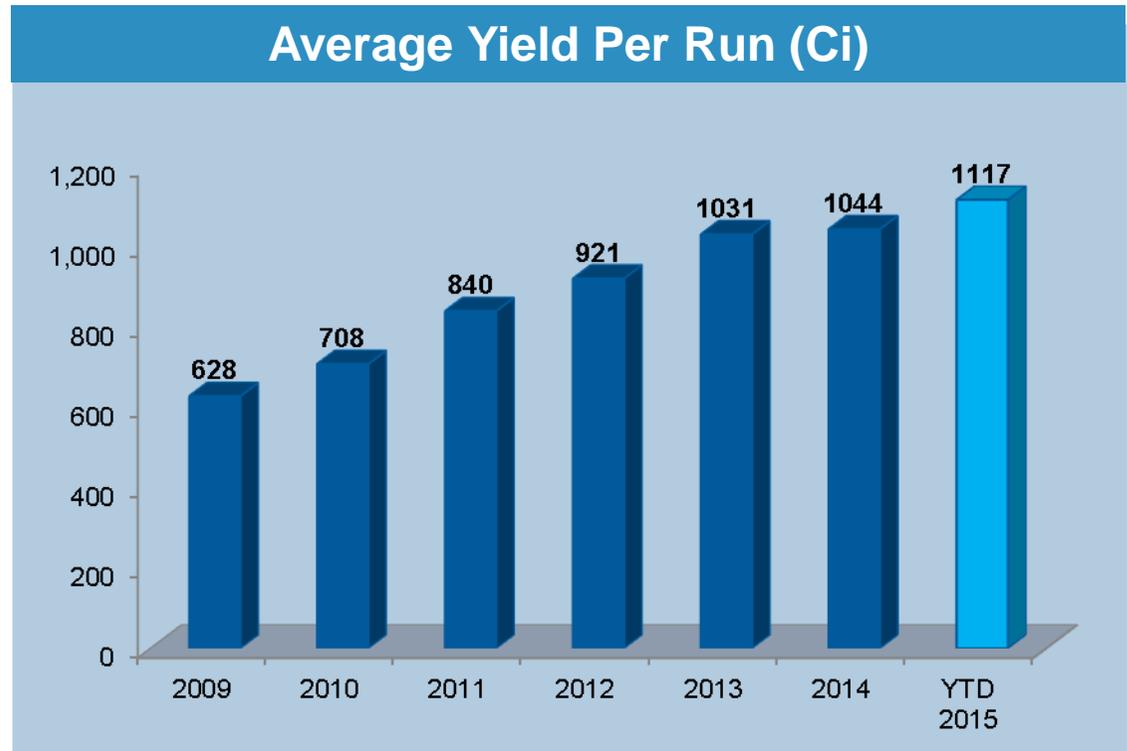
Increasing production

Current Mo-99 Production

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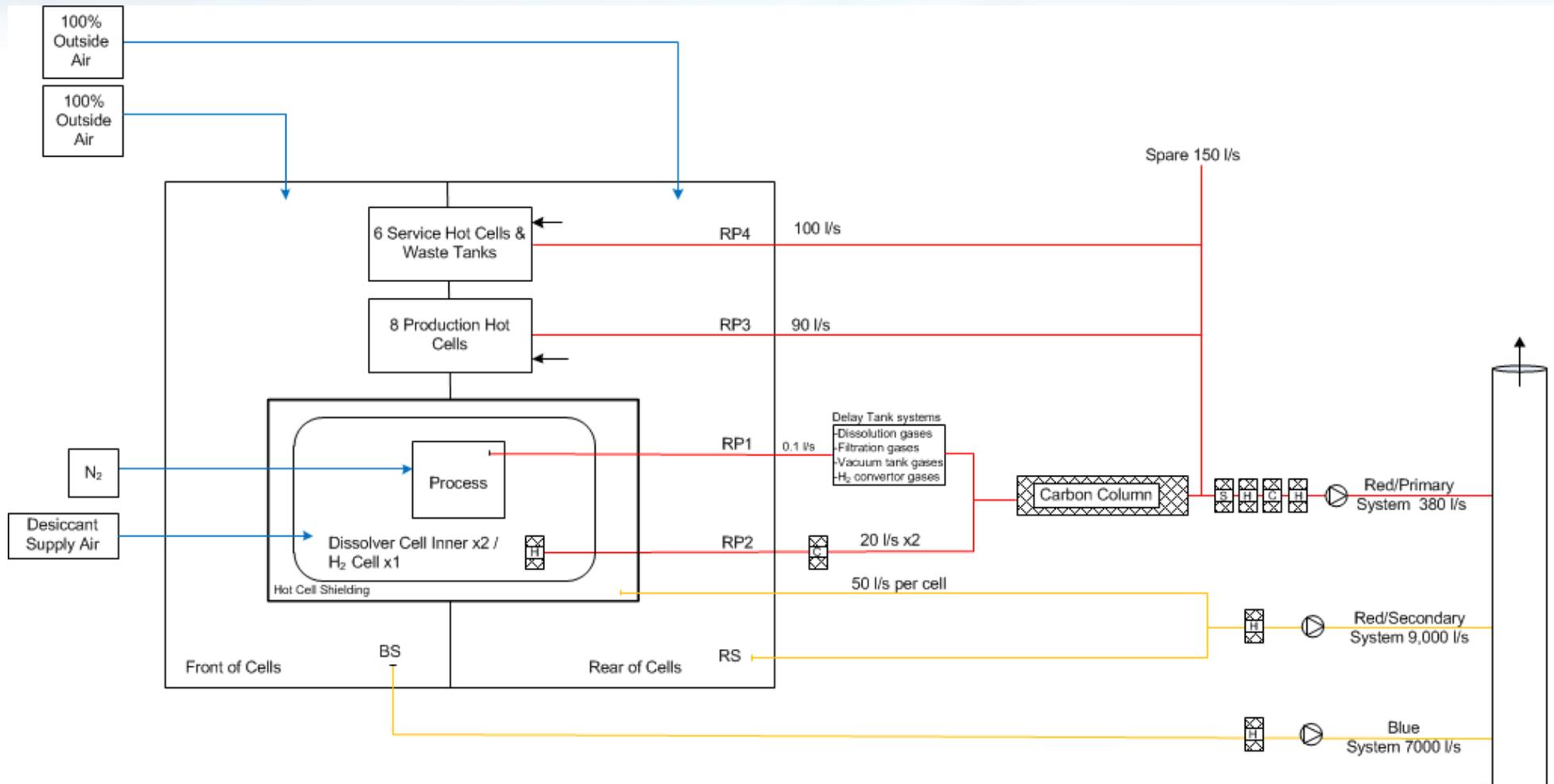
7-10 days

1 day



Increasing yield

ANM Mo99 Emission Control



ANM Ventilation Configuration

ANM Mo99 Emission Control

Emission Design Criteria

The emission limits design criteria for the ANM Mo-99 off-gas system are as follows:

1. **Essential:** Anm-Moly99 URS Section 6.2.6: “The facility shall incorporate an off-gas management system so that gaseous emissions from the plant shall not exceed 2012 levels.”

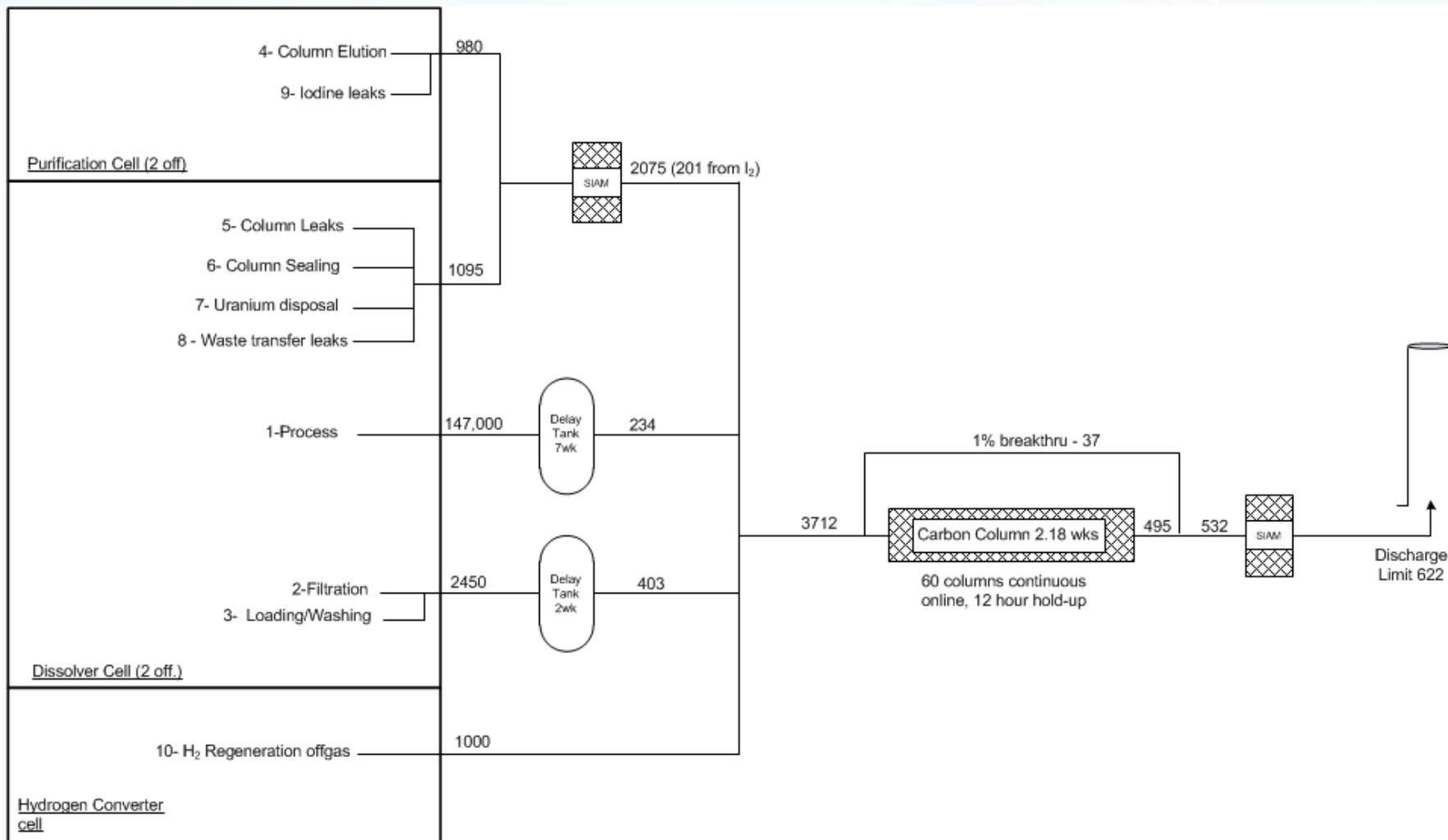
Daily B54 ASERMS data	Xe-133	Kr-85m	Kr-88	Xe-135	Kr-87	Xe-135m	I-131	I-132	I-133
2012	GBq	GBq	GBq	GBq	GBq	GBq	GBq	GBq	GBq
2012 Total	668,100	15.3	0	160,203	10.2	16,800	2.79	1.08	0.165
Daily Mean	1,825	-	-	438	-	54	-	-	-
Daily Median	1,634	-	-	254	-	9	-	-	-
Daily maximum	33,942	11	-	2,528	-	2418	-	-	-

2. **Essential:** The plant shall operate within the current licenced ARPANSA notification levels for B54.

B54 Notification Levels	Xe-133	Kr-85m	Kr-88	Xe-135	Kr-87	Xe-135m	I-131	I-132	I-133
Annual	GBq	GBq	GBq	GBq	GBq	GBq	GBq	GBq	GBq
Current levels	280,000	65,000	6,000	400,000	350	400,000	28	240	15

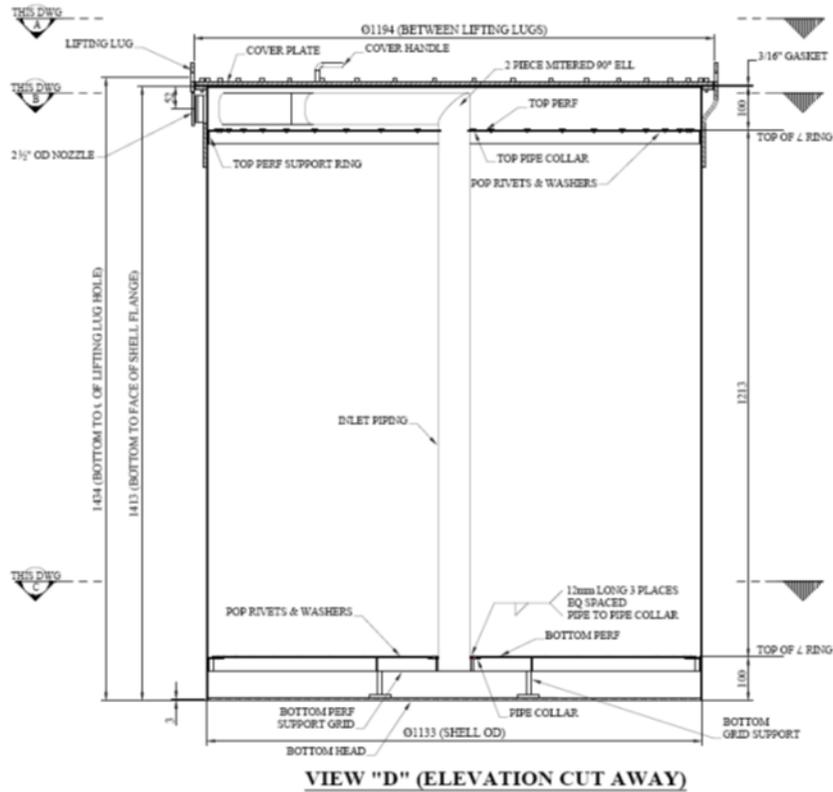
The dominant design criteria for the ANM off-gas treatment system is the requirement for limiting the Xe-133 annual emissions to below the current notification level of 280,000 GBq. This translates to an average minimum of **622 GBq** per run based on 450 production runs per annum.

ANM Mo99 Emission Control

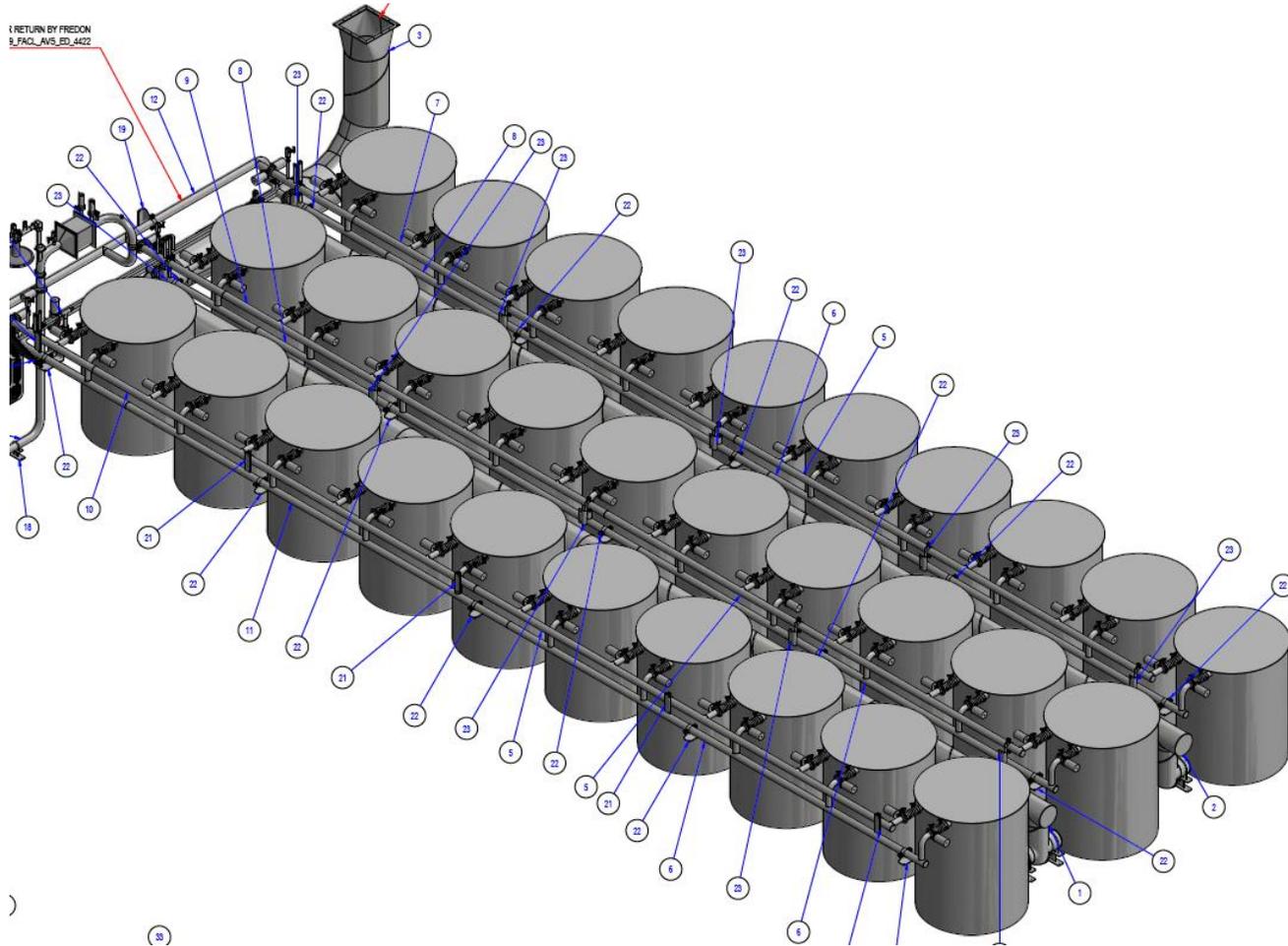


Estimate of Xe133 emission for ANM (GBq)

Carbon Columns



Carbon Columns



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Carbon Columns



Carbon Columns





