



## TECHNICAL MEMORANDUM

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**Reference No.** ORG161109-TM1

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### **NORM impact on drill cuttings from Origin wells in the Northern Territory Beetaloo-W1, Kalala-S-1, Amungee NW-1 & Amungee NW-1H**

This Technical Memorandum summarises the outcomes of a review of three technical notes prepared by Origin with regards to the disposal options of drill cuttings from the Beetaloo, Kalala and Anungee wells in the Northern Territory of Australia.

## 1 Exemption Criteria

The applicable legislation and regulations that is referred to is summarised below:

Legislation/Regulation	Description
Radiation Protection Regulations, 2012 (NT) Regulation 7	Radioactive material, to which the act does not apply: a) The sum of the fractions obtained by dividing the activity of each material present by the appropriate activity value from the National Directory, Schedule 4, does not exceed 1; or b) The sum of the fractions obtained by dividing the activity concentration of each material present by the appropriate activity concentration value from the National Directory, Schedule 4, does not exceed 1.
The National Directory for Radiation Protection, Part B, Section 3.2	The criteria to exempt radioactive material or practices from notification, registration and licensing are: (a) the radioactive material has an activity concentration less than that prescribed in Schedule 4 Table 1. Specifically: U-nat: 1 Bq/g Th-nat: 1 Bq/g K-40: 100 Bq/g

## 2 Summary of activity concentrations

For the determination of the activity concentration of the various elements, the specific activities of Uranium and Thorium (12 445 Bq/g and 4 090 Bq/g respectively) were used.

Substituting the original values with these specific activities, had a very slight effect on the outcome.

Specific Activities relevant to the Regulations			
Radionuclide (naturally occurring)	Natural Abundance (%)	Specific Activity (original)	Specific Activity (adjusted)
		Bq/g	Bq/g
Source		IAEA	IEAE
Potassium 40	0.012	258,900	258,900
Potassium (natural)	100	30	30
Thorium 232 (natural)	100	4,066	4,090
Uranium 238	99	12,460	12,445
Uranium (natural)	100	12,370	12,355

Applying the adjusted SA to the exemption calculations, is shown in the tables below:

Amungee NW-1

Activity Concentrations for Exemptions (original)					Activity Concentrations for Exemptions (Adjusted)				
<i>Dividing the activity of each material present by the appropriate activity value from the National Directory (Schedule 4)</i>					<i>Dividing the activity of each material present by the appropriate activity value from the National Directory (Schedule 4)</i>				
Activity values (Bq/g) (from ND schedule 4)		Calculated activity concentration			Activity values (Bq/g) (from ND schedule 4)		Calculated activity concentration		
		max	p95%	p50%			max	p95%	p50%
Uranium	1	0.286	0.192	0.044	Uranium	1	0.285	0.192	0.044
Thorium	1	0.183	0.118	0.071	Thorium	1	0.184	0.119	0.071
Potassium	100	0.015	0.012	0.008	Potassium	100	0.015	0.012	0.008
	<b>SUM</b>	<b>0.483</b>	<b>0.322</b>	<b>0.123</b>		<b>SUM</b>	<b>0.484</b>	<b>0.323</b>	<b>0.123</b>
Exemption threshold		1.0	1.0	1.0	Exemption threshold		1	1	1
Classification		Exempt	Exempt	Exempt	Classification		Exempt	Exempt	Exempt

Amungee NW-1H

Activity Concentrations for Exemptions (original)					Activity Concentrations for Exemptions (Adjusted)				
<i>Dividing the activity of each material present by the appropriate activity value from the National Directory (Schedule 4)</i>					<i>Dividing the activity of each material present by the appropriate activity value from the National Directory (Schedule 4)</i>				
Activity values (Bq/g) (from ND schedule 4)		Calculated activity concentration			Activity values (Bq/g) (from ND schedule 4)		Calculated activity concentration		
		max	p95%	p50%			max	p95%	p50%
Uranium	1	0.309	0.267	0.168	Uranium	1	0.309	0.266	0.168
Thorium	1	0.104	0.090	0.049	Thorium	1	0.104	0.091	0.049
Potassium	100	0.011	0.010	0.004	Potassium	100	0.011	0.010	0.004
	<b>SUM</b>	<b>0.424</b>	<b>0.367</b>	<b>0.221</b>		<b>SUM</b>	<b>0.424</b>	<b>0.367</b>	<b>0.222</b>
Exemption threshold		1.0	1.0	1.0	Exemption threshold		1	1	1
Classification		Exempt	Exempt	Exempt	Classification		Exempt	Exempt	Exempt

Beetaloo W-1

Activity Concentrations for Exemptions (original)					Activity Concentrations for Exemptions (Adjusted)				
<i>Dividing the activity of each material present by the appropriate activity value from the National Directory (Schedule 4)</i>					<i>Dividing the activity of each material present by the appropriate activity value from the National Directory (Schedule 4)</i>				
Activity values (Bq/g ) (from ND schedule 4)		Calculated activity concentration			Activity values (Bq/g ) (from ND schedule 4)		Calculated activity concentration		
		max	p95%	p50%			max	p95%	p50%
Uranium	1	0.229	0.081	0.024	Uranium	1	0.229	0.080	0.024
Thorium	1	0.133	0.094	0.055	Thorium	1	0.134	0.094	0.055
Potassium	100	0.015	0.012	0.007	Potassium	100	0.015	0.012	0.007
SUM		0.378	0.186	0.086	SUM		0.378	0.187	0.086
Exemption threshold		1.0	1.0	1.0	Exemption threshold		1	1	1
Classification		Exempt	Exempt	Exempt	Classification		Exempt	Exempt	Exempt

Kalala S-1

Activity Concentrations for Exemptions (original)					Activity Concentrations for Exemptions (Adjusted)				
<i>Dividing the activity of each material present by the appropriate activity value from the National Directory (Schedule 4)</i>					<i>Dividing the activity of each material present by the appropriate activity value from the National Directory (Schedule 4)</i>				
Activity values (Bq/g ) (from ND schedule 4)		Calculated activity concentration			Activity values (Bq/g ) (from ND schedule 4)		Calculated activity concentration		
		max	p95%	p50%			max	p95%	p50%
Uranium	1	0.338	0.222	0.040	Uranium	1	0.337	0.221	0.040
Thorium	1	0.103	0.096	0.071	Thorium	1	0.104	0.096	0.071
Potassium	100	0.011	0.010	0.007	Potassium	100	0.011	0.010	0.007
SUM		0.452	0.327	0.118	SUM		0.453	0.327	0.119
Exemption threshold		1.0	1.0	1.0	Exemption threshold		1	1	1
Classification		Exempt	Exempt	Exempt	Classification		Exempt	Exempt	Exempt

### 3 Conclusion

All drill cuttings from above mentioned wells, are exempt from regulation.

Changes to the activity concentrations of the actual material due to the adjustment of the specific activities were negligible.

