

Directive 050 – Frequently Asked Questions (September 2012)

Advanced Gel Chemical Drilling Wastes

Question

Are approvals for advanced gel chemical drilling wastes still required pursuant to *Informational Letter 2001-3: Management of Drilling Wastes Associated with Advanced Gel Chemical Systems*?

Answer

No. *IL 2001-3* was rescinded with the publication of the 2012 edition of *Directive 050*. As of May 2, 2012, drilling wastes from advanced gel chemical mud systems must be managed following the requirements of the 2012 edition of *Directive 050* (refer to Sections 1.1 and 1.5).

Question

What is an advanced gel chemical drilling waste?

Answer

It is a drilling waste resulting from a water-based drilling mud system in which a significant primary component such as a salt or polymer has been added to aid in the drilling program (refer to the definition in Appendix 7). Should there be any question as to whether a mud system is an advanced gel chemical system, handle it as one and follow the new requirements. Note that all requirements within the 2012 edition of *Directive 050* are effective November 1, 2012.

Disclosure of Sites Used to Manage Drilling Wastes

Question

Regarding Section 1.5.2, is disclosure required for pits that have had the drilling wastes removed and managed by mix-bury-cover or landspreading, or is it just the active, open pits that require disclosure?

Answer

Refer to points 1(a) and 1(b) in the section. Disclosure is not required if

- the sump is on a remote site and the drilling waste was removed and managed appropriately prior to May 1, 2013, or
- as of May 1, 2013, the time period from first use of the remote site to manage drilling waste has not exceeded five years.

Note: If the five year duration has been exceeded, disclosure is still not required if the reclamation process for the site has been engaged or completed prior to May 1, 2013.

Disclosure is required if

- the sump is on a remote site and on May 1, 2013, it will have contained drilling wastes for a period exceeding 18 months, or

- as of May 1, 2013, the time period from the first use of the remote site to manage drilling waste (including storage) will have exceeded five years and the reclamation process for the site has not been engaged or completed.

Question

Do the disclosure requirements in Section 1.5.2 apply to only remote sites or any site used to manage drilling wastes?

Answer

The section only requires disclosure of remote sites. The intent is to obtain an inventory of remote sites that are outstanding respecting drilling waste management and to get the sites closed and reclaimed or if applicable, approved as an oilfield waste management facility.

Question

If a cleared site has been used consecutively for three to five years, with a new sump dug every fall followed by a spring mix-bury-cover of the drilling waste, would this site need to be disclosed by May 1, 2013 if the reclamation process has not been either started or completed by this time? Or is it possible to consider sump/mix-bury-cover as an independent site?

Answer

Disclosure pursuant to Section 1.5.2 is not required if the site has not been in use for longer than five years, provided there is not an open sump on it for which the drilling waste storage duration has exceeded 18 months from rig release of the first well that contributed drilling waste to the sump. While Section 6.2(8) sets out the timing for removal of drilling waste from a sump and physical a closure of the sump, the number of years that the site is being used for drilling waste storage/management also needs to be tracked as the site can only be used for five years.

Need for Directive 058 Approval of Sites Used to Manage Drilling Wastes

Question

If a drilling waste storage site is used for five years, does the licensee require ERCB approval for continued usage?

Answer

A site can be used for up to five years for drilling waste storage/management under the requirements of *Directive 050*. A site in use for longer than five years requires approval as an oilfield waste management facility pursuant to *Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry*; refer to the note under Section 6.6(23).

Drilling Waste and First Nations Land

Question

Have there been any discussions with IOGC related to management of drilling wastes and consent for First Nations Lands?

Answer

The ERCB did consult with Indian Oil and Gas Canada, and the results of the discussions related to consent for management of drilling waste on First Nations Lands and reclamation of the sites are set out in Sections 1.6 and 1.7.

Drilling Waste Analysis and Related Soil Endpoints

Question

What are the drilling waste and soil nitrogen testing requirements, as there is some confusion between ammonia and ammonium?

Answer

The third footnote on Table 3.1 identifies nitrogen as being total mineral nitrogen and includes ammonia-nitrogen, nitrate-nitrogen, and nitrite-nitrogen. Respecting the ammonia-nitrogen testing requirement, some parts of *Directive 050* print out the chemical formula for the ammonium-nitrogen form ($\text{NH}_4\text{-N}$), but not the ammonia-nitrogen form ($\text{NH}_3\text{-N}$). While ammonium and nitrate are the forms of nitrogen that plants take up from soil, many forms of nitrogen exist in soil, and the forms easily change from one to another. In addition, standard reference methods typically target both the ammonium and ammonia species by converting them to one form and analyzing both species as one and reporting the results as total ammonia-nitrogen or total N. Therefore, to meet the ammonia-nitrogen testing requirements, test for total ammonia-nitrogen ($\text{NH}_3 + \text{NH}_4^+$).

Question

If a drilling waste contains amines, do the nitrogen testing requirements need to be expanded to include amines?

Answer

No. Continue to test for total mineral nitrogen, but ensure all other requirements for the disposal method being used are followed including toxicity testing.

Question

Can the hydrocarbon and metal concentrations set out in Tables 3.3 and 3.5 be recalculated and expressed as dry weight numbers?

Answer

Yes. Both tables have been expanded to express the concentrations in both dry weight and wet weight numbers. The expanded tables are located at the end of the FAQ.

Question

Are the units for dry bulk density in footnote 1 of Table 3.5 mistaken?

Answer

Yes. The dry bulk density should be 1.54 Mg/m³, which is megagram per cubic metre and not milligram (mg) per cubic metre. To avoid confusion and to be consistent with the units used for dry bulk density in other sections of *Directive 050*, updates to the table will present dry bulk density as 1540 kg/m³.

Question

Is a horizontal gas well considered a hydrocarbon flag?

Answer

It is not identified as one in the definition of hydrocarbon flags (refer to Appendix 7). However, the drilling waste from a horizontal gas well needs to be checked for the identified hydrocarbon flags before ruling out the presence of hydrocarbons.

Question

If a drilling waste disposal area did not meet the required soil endpoints, but the licensee remedied the issue, can the same area of land be used again for drilling waste disposal?

Answer

It depends on the drilling waste disposal method being used. Section 13.3(12)(a) and Section 14.3(14)(a) do not allow mix-bury-cover or landspreading of drilling waste on an area of land that has been previously used for drilling waste disposal.

The landspray, landspray-while-drilling, disposal onto forested Public Lands, and pump-off disposal methods can be used on areas of land that previously received drilling wastes using these methods, provided the licensee has landowner consent and the receiving soil does not exceed the initial soil salinity criteria and the maximum allowable changes from background (initial) soil conditions as set out in Table 3.1. In addition, the soil hydrocarbon and metal endpoints set out in Tables 3.2 and 3.4 can not be exceeded.

Question

Is a licensee required to demonstrate compliance with all soil endpoint criteria even when testing the drilling waste for all of the parameters was not required, or is compliance assumed on the premise that the soil endpoint criteria is met due to the absence or low concentration of the parameter(s) in the drilling waste?

Answer

Compliance would involve being able to demonstrate that testing the drilling waste for the parameter (e.g., metals, hydrocarbons, or nitrogen) was not required and hence, the need to test the soil of the disposal area for the endpoint parameter was not required. Should there be compliance issues, licensees may be required to test the soil for any or all of the endpoint parameters and conduct further work, as necessary, in the event of finding soil endpoint

exceedances. In addition, should a landowner have a concern with a disposal area, the licensee responsible may be required to conduct work to assess whether the concern is related to the disposal event (e.g., a drilling waste disposal requirement was overlooked or not met) and implement remedial measures if necessary.

Question

Is the flashpoint in the note under requirement 3 in Section 17.2 correct?

Answer

No. The flashpoint should be 60.5°C as set out in the *Waste Control Regulation* and not 61.5°C.

Drilling Waste Storage / Sump Construction

Question

Regarding C-rings for surface mud, can a 12 mil liner be used instead of a 30 mil liner or would it depend on the nature of the waste being stored?

Answer

The ERCB uses the term “aboveground synthetically-lined wall storage system” (AWSS) to address storage systems sometimes referred to as “C-rings.” Note that the ERCB only allows AWSSs to be used to store cement returns and water-based hydraulic fracturing fluids and flowback fluids. For storage of cement returns, Section 7 of the 2012 edition of *Directive 050* allows the liner of the AWSS to be 12 mil. Refer to *Directive 055 – Addendum 2011-10-11* for more information about the use of AWSSs.

Question

For existing sumps, when do the new requirements of the 2012 *Directive 050* take effect?

Answer

Sumps that are in use prior to November 1, 2012, must meet the 1996 edition of *Directive 050*, which requires sumps to be closed within 12 months of rig release. These sumps can continue to be used for the remainder of 12 month duration allowed under the 1996 edition of *Directive 050*. As of November 1, 2012, any new sump or a sump that is being reused will need to meet the 2012 edition of *Directive 050* (refer to Section 6.6 for requirements for reuse of a sump).

Question

Do all storage systems have to be closed by the end of 18 months?

Answer

Yes, for any storage systems put in use following the 2012 edition of *Directive 050*; closed means that the storage system must be emptied of drilling waste and physically closed within 18 months of rig release of the first well that contributed drilling waste to it. For storage systems in use following the 1996 edition of *Directive 050* (prior to November 1, 2012) the closure must occur within 12 months.

Question

Is it possible to demonstrate that soils are suitable for sump construction using permeability testing as opposed to testing for plasticity index (PI) and liquid limits (LL)?

Answer

No. Section 6.3(10)(b) sets out the soil testing requirements to determine suitable soil characteristics for sump construction and includes testing for fines and clay content in addition to PI and LL.

Question

If a sump is closed within 18 months but does not meet post disposal endpoints, what must a licensee do?

Answer

The licensee must remedy the situation. Section 6.2(8)(b) identifies that physical closure of a drilling waste storage system (e.g., sump) includes removal of the drilling waste, decontaminating (if needed) the area beneath and surrounding the sump, and backfilling/contouring the area. The objective is to close the sump in a manner that will allow the site to be restored to equivalent capability. Exceedances found after sump closure could be the result of

- breach of sump containment and failure to decontaminate the area beneath and around the sump,
- not having removed all of the drilling waste prior to backfilling/contouring area, or
- in the case of managing the drilling waste using MBC in the area of the sump, inappropriate mixing or use of inappropriate mix ratios.

Licensees must handle the situation as an exceedance of soil endpoints and follow the notification procedure set out in Section 3.5. (The notification must include a plan to remedy the exceedance, which is a noncompliance event.)

Question

Can multiple licensees deposit drilling waste into one sump, conduct mix-bury-cover (MBC) disposals on one site, or use one remote site to store/manage drilling wastes?

Answer

No. Section 6.4 states that multiple wells contributing drilling waste to a storage system/sump must have the same licensee. If the storage is occurring on a remote site, the licensee must have a written agreement with the landowner for the site, and the remote site must be tied back to the licence of the well that first contributed drilling waste to the sump/storage system. MBC disposal of drilling waste can only occur on the generating well site or a remote site on which the drilling waste is stored (refer to Section 13).

Cement Returns

Question

What is an acceptable containment system for cement returns being classified for landfill disposal? Would a three sided shale bin be acceptable?

Answer

Requirements for containment of cement returns are set out in Section 7.2(1)(a) and (b); requirement (b) allows for use of aboveground portable rigid structures that will adequately contain the cement returns and prevent release into the environment. Depending on the fluid content of the cement returns, a three sided shale bin may not meet this requirement.

Question

What is the effective date for the requirements in Section 7: Management of Cement Returns, including the landowner consent requirement?

Answer

November 1, 2012. However, note that Section 2.1 of *Directive 055 – Addendum 2011-10-11* has been replaced by Section 7.2(1)(a) of *Directive 050* respecting use of aboveground synthetically lined wall storage systems (AWSSs) for containment of cement returns. When using AWSSs, licensees can follow either *Directive 55 – Addendum 2011-10-11* or *Directive 050* requirements up to November 1, 2012; after November 1, 2012, *Directive 050* requirements must be followed.

Water Body and Drilling Waste Management

Question

What is the complete definition of a water body?

Answer

Definitions for *Directive 050* terms, including one for a water body, can be found in Appendix 7. This definition is consistent with that in *Directive 056: Energy Development Applications and Schedules*.

Question

Does the ERCB consider muskeg to be a water body?

Answer

It is identified in the definition of water body (refer to Appendix 7).

Question

Are drilling waste disposals permitted on well pads constructed otop of muskeg in situations where the berm soils and receiving soils meet the required conditions?

Answer

No. In addition to needing to adhere to the water body setback, information from ESRD identifies that most pads are about 2 m thick, and at abandonment time, the clay pad must be removed (clay is to either be reused or replaced into the borrow pit). ESRD preference is to avoid any potential to compromise the clay and to not allow drilling disposal on the pads.

Question

Are earthen berm storage systems required to meet the 100 m setback from an offsite water body?

Answer

Yes. Earthen berm storage systems are subject to the general drilling waste storage requirements set out in Section 6.2; requirement 6.2(5) addresses setback distances. Hence, the setback requirements set out in Section 6.5(19) (which is missing the 100 m setback from a water body) are redundant and will be removed in the next update to *Directive 050*.

Drilling Wastes from Pipelines

Question

Can multiple licensees use one parcel of land for storage or MBC disposal of drilling waste from a pipeline construction project?

Answer

No, if storage or MBC of the drilling waste is occurring on a site remote from the pipeline right-of-way (ROW), the licensee must have a written agreement with the landowner for the remote site, and the remote site must be tied back to licence and line number of the pipeline that generated the drilling waste. In addition, the licensee is obligated to reclaim the remote site. Multiple remote sites could be located on a parcel of land with one licensee being responsible for one remote site.

Note that MBC of the drilling waste can also occur on the pipeline ROW provided the surface of the pipeline ROW is disturbed (top soil removed, ROW is under construction, or has been disturbed for pipeline work) and the drilling waste is generated from the construction of the pipeline associated with the ROW (refer to Section 8).

Landspray and Landspray-While-Drilling (LWD)

Question

For landspray and LWD, what is meant by “prepare the disposal area so that the drilling waste is applied to the surface of disposal area and not onto snow accumulation?”

Answer

There have been situations where drilling waste has migrated from the disposal area as a result of it being applied to snow accumulation. Complete removal of all snow is not expected; a reasonable approach to prepare the site to prevent migration of the drilling waste should be used (e.g., remove snow until sufficient vegetation or stubble is visible to aid with retention of the drilling waste on the disposal area).

Disposal onto Forested Public Lands (DFPL)

Question

For the DFPL method, does not the requirement to blade 10 to 15 cm of surface soil contradict with the term “minimum ground disturbance (MGD)”?

Answer

Yes. The ERCB has discussed this with ESRD and ESRD has clarified that blading of soil should not be done in MGD areas. Therefore, licensees are not to follow requirement 3(a) under Section 11.2.

Question

Regarding the DFPL method, does requirement 12 within Section 11.3 contradict requirement 11 (c), (d), and (e)?

Answer

No. Requirement 11 allows DFPL to be conducted in a manner similar to LWD (e.g., opportunity to conduct sumpless drilling), but with higher drilling waste application rates. Should there be any hydrocarbon, metal, or toxicity issues, requirement 12 allows DFPL to continue to be a viable disposal method provided the waste is stored, sampled, and tested and the results comply with the direction set out in requirement 12.

Mix-Bury-Cover (MBC)

Question

Section 13 does not specify a soil texture requirement for MBC. Is it possible to conduct MBC disposals in soils that do not meet the soil characteristics for sump construction?

Answer

Yes, provided all requirements within Section 13 are met. Note that there are hydrocarbon and nitrogen soil endpoints specified for coarse and fine soils. Remember MBC is limited to occur on the well site that generated the drilling waste, a pipeline-right-of way that has a disturbed surface (provided the drilling waste is from construction of the associated pipeline), and a remote drilling waste storage site (provided the drilling waste is stored at the remote site).

Landspreading

Question

Is there a one metre maximum waste disposal onto land for landspreading?

Answer

The maximum drilling waste application rate for the landspreading disposal method is 1000 m³/ha or an applied thickness of 10 cm. The drilling waste is spread on the shallow subsoil of the lease and incorporated into the subsoil to a maximum depth profile of 1 m (refer to Section 14).

Remix

Question

When submitting a drilling waste remix notification, is it possible to use calculations to show that the 3:1 remix will meet the required endpoints, or can only 3:1 predictive lab mixes be used?

Answer

Section 20 requires predictive lab mixes to be used to determine the soil-to-waste mix ratio that will meet the soil endpoints set out in Tables 3.1, 3.2, and 3.4. Note that it identifies that the mix ratio must not exceed 3 parts soil to 1 part drilling waste.

Notification of Drilling Waste Disposal

Question

Is notification to the ERCB required prior to disposal of drilling waste, or is the notification now only required after disposal?

Answer

ERCB *Directive 045* eliminated the paper notifications and introduced the requirement to electronically submit predisposal information through the ERCB Digital Data Submission (DDS) system, Field Surveillance Inspection System (FIS) Drilling Activity Notification Form. This requirement has been retained in the 2012 edition of *Directive 050*. In addition, the 2012 edition introduced the requirement to electronically submit postdisposal information (refer to Section 21.3 and 21.4).

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Expanded Table 3.3 Hydrocarbon Concentration in Drilling Waste

		Concentration of hydrocarbon fraction in drilling waste (wet and dry weight in mg/kg) correlated to specific gravity (SG) of drilling waste¹							
	Parameter	F1	F2	F3	F4	Benzene	Toluene	Ethyl-Benzene	Xylenes
Waste SG									
1.1	Wet Wt.	104	565	1304	12169	0.20	2.13	0.48	52
	Dry Wt.	714	3870	8930	83345	1.37	14.59	3.27	357
1.2	Wet Wt.	99	535	1235	11529	0.19	2.02	0.45	49
	Dry Wt.	369	2000	4615	43072	0.71	7.54	1.69	185
1.3	Wet Wt.	94	510	1177	10989	0.18	1.92	0.43	47
	Dry Wt.	254	1377	3177	29648	0.49	5.19	1.16	127
1.4	Wet Wt.	90	489	1128	10525	0.17	1.84	0.41	45
	Dry Wt.	197	1065	2457	22936	0.38	4.01	0.90	98
1.5	Wet Wt.	87	470	1085	10123	0.17	1.77	0.40	43
	Dry Wt.	162	878	2026	18909	0.31	3.31	0.74	81
1.6	Wet Wt.	84	454	1047	9771	0.16	1.71	0.38	42
	Dry Wt.	139	753	1738	16224	0.27	2.84	0.64	70
1.7	Wet Wt.	81	439	1014	9461	0.16	1.66	0.37	41
	Dry Wt.	123	664	1533	14306	0.24	2.50	0.56	61
1.8	Wet Wt.	79	426	984	9185	0.15	1.61	0.36	39
	Dry Wt.	110	597	1379	12868	0.21	2.25	0.51	55
1.9	Wet Wt.	77	415	958	8939	0.15	1.56	0.35	38
	Dry Wt.	101	546	1259	11749	0.19	2.06	0.46	50
2.0	Wet Wt.	75	405	934	8716	0.14	1.53	0.34	37
	Dry Wt.	93	504	1163	10854	0.18	1.90	0.43	47
2.1	Wet Wt.	73	395	912	8516	0.14	1.49	0.33	36
	Dry Wt.	87	470	1085	10122	0.17	1.77	0.40	43
2.2	Wet Wt.	71	387	893	8333	0.14	1.46	0.33	36
	Dry Wt.	82	442	1019	9512	0.16	1.66	0.37	41
2.3	Wet Wt.	70	379	875	8166	0.13	1.43	0.32	35
	Dry Wt.	77	418	964	8996	0.15	1.57	0.35	39
2.4	Wet Wt.	69	372	859	8013	0.13	1.40	0.31	34
	Dry Wt.	73	397	916	8553	0.14	1.50	0.34	37
2.5	Wet Wt.	67	366	843	7873	0.13	1.38	0.31	34
	Dry Wt.	70	379	875	8170	0.13	1.43	0.32	35

¹ Calculated using Alberta Tier 1 de-minimus guideline values, a soil:waste mix ratio of 3:1, and a soil dry bulk density of 1540 kg/m³

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Expanded Table 3.5 Metal Concentration in Drilling Waste

		Concentration of metal in drilling waste (wet and dry weight in mg/kg) correlated to specific gravity (SG) of drilling waste ¹																						
	Parameter	Antimony	Arsenic	Barium	Barite-Ba	Beryllium	Boron (hot water-soluble)	Cadmium	Chromium (total)	Chromium (hexavalent)	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Tin	Uranium	Vanadium	Zinc	
Waste	SG																							
1.1	Wet Wt.	86	49	2500	43000	20	7.9	5.2	200	1.7	53	210	260	29	14	130	2.7	86	3.6	16	92	450	630	
	Dry Wt.	592	333	17147	292482	140	53.8	35.9	1358	11.8	365	1415	1796	196	99	855	18.3	587	24.6	109	627	3064	4285	
1.2	Wet Wt.	82	47	2400	40500	19	7.5	5.0	190	1.6	52	200	250	27	14	120	2.6	81	3.4	15	87	430	600	
	Dry Wt.	306	175	8948	151241	73	27.9	18.7	711	6.1	193	739	933	101	51	453	9.6	303	12.8	575	325	1597	2242	
1.3	Wet Wt.	78	45	2304	39000	19	7.1	4.8	180	1.6	50	190	240	26	13	120	2.5	77	3.3	15	83	410	580	
	Dry Wt.	211	122	6216	104161	50	19.3	12.9	495	4.2	135	514	645	705	36	318	6.8	209	8.9	404	224	1108	1562	
1.4	Wet Wt.	75	44	2200	37000	18	6.9	4.6	180	1.5	49	180	230	25	13	120	2.4	74	3.2	14	80	400	560	
	Dry Wt.	163	96	4849	80621	39	14.9	10.0	388	3.3	106	401	501	548	28	251	5.3	162	6.9	314	174	864	1221	
1.5	Wet Wt.	72	43	2200	36000	17	6.6	4.4	170	1.4	48	180	220	24	12	110	2.4	71	3.1	14	77	380	540	
	Dry Wt.	134	80	4029	66496	32	12.4	8.3	323	2.7	89	333	415	442	23	211	4.5	133	5.7	264	144	717	1017	
1.6	Wet Wt.	69	42	2100	34000	17	6.4	4.3	170	1.4	47	170	220	23	12	110	2.3	69	3.0	13	74	370	530	
	Dry Wt.	115	70	3483	57080	28	10.6	7.2	280	2.3	78	288	358	388	20	184	3.9	114	4.9	224	124	619	881	
1.7	Wet Wt.	67	41	2000	33000	16	6.2	4.2	170	1.3	46	170	210	22	12	110	2.3	67	2.9	13	72	360	520	
	Dry Wt.	102	62	3092	50355	24	9.4	6.3	249	2.0	69	256	317	348	18	165	3.5	101	4.4	209	109	549	784	
1.8	Wet Wt.	65	40	2000	32000	16	6.0	4.1	160	1.3	45	170	200	22	11	110	2.3	65	2.8	13	70	360	510	
	Dry Wt.	91	57	2800	45310	22	8.5	5.7	226	1.8	63	232	286	306	16	151	3.2	91	3.9	189	997	497	711	
1.9	Wet Wt.	64	40	2000	31000	15	5.9	4.0	160	1.3	44	160	200	21	11	110	2.2	63	2.8	13	69	350	500	
	Dry Wt.	84	52	2572	41387	20	7.8	5.2	208	1.7	58	213	262	285	15	139	2.9	83	3.6	179	906	456	654	
2.0	Wet Wt.	62	39	1900	31000	15	5.8	3.9	160	1.2	44	160	200	20	11	100	2.2	62	2.7	12	67	340	490	
	Dry Wt.	77	49	2390	38248	19	7.2	4.9	193	1.5	55	198	243	253	13	131	2.7	77	3.4	158	833	423	608	
2.1	Wet Wt.	61	39	1900	30000	15	5.6	3.8	150	1.2	43	160	190	20	11	100	2.2	60	2.6	12	66	330	480	
	Dry Wt.	72	46	2241	35680	17	6.7	4.5	182	1.4	51	186	227	243	13	123	2.6	72	3.1	147	783	397	571	
2.2	Wet Wt.	59	38	1900	29000	14	5.5	3.7	150	1.2	43	150	190	20	10	100	2.1	59	2.6	12	64	330	470	
	Dry Wt.	68	43	2116	33540	16	6.3	4.3	172	1.4	49	176	214	222	12	117	2.4	67	3.0	147	733	375	540	
2.3	Wet Wt.	58	38	1800	29000	14	5.4	3.7	150	1.2	42	150	180	19	10	100	2.1	58	2.6	12	63	320	470	

	Dry Wt.	64	41	2011	31729	15	6.0	4.1	164	1.3	47	167	203	21	11	112	2.3	64	2.8	13	69	356	514
2.4	Wet Wt.	57	37	1800	28000	14	5.3	3.6	150	1.1	42	150	180	19	10	10	2.1	57	2.5	12	62	320	460
	Dry Wt.	61	40	1921	30177	15	5.7	3.9	156	1.2	45	160	193	20	108	10	2.2	60	2.7	12	66	340	492
2.5	Wet Wt.	56	37	1800	28000	14	5.3	3.6	150	1.1	41	150	180	19	10	10	2.1	56	2.5	11	61	310	460
	Dry Wt.	58	38	1846	28832	14	5.5	3.7	150	1.2	43	153	185	19	104	10	2.2	58	2.6	12	63	326	472
Background metal value used		0.12	6	180	180	0.3	0.2 ²	0.2	19	0.002 ²	8	16	10	0.03	0.7	22	0.4	0.3	0.18	1.4	2	28	58

¹ Calculated using Alberta-specific metal background values (except CCME used for uranium), Alberta Tier 1 de-minimus guideline values, a soil:waste mix ratio of 3:1, and a soil dry bulk density of 1540 kg/m³.

² Median value used for background