

**Cameco Resources  
Crow Butte Operation**



**86 Crow Butte Road  
P.O. Box 169  
Crawford, Nebraska 69339-0169**

**(308) 665-2215  
(308) 665-2341 – FAX**

July 8, 2016

**CERTIFIED MAIL  
RETURN RECEIPT REQUESTED**

Attn: Document Control Desk, Director  
Office of Nuclear Material Safety and Safeguards  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

Commercial Evaporation Pond #1  
Corrective Action Report  
Source Materials License SUA-1534  
Docket Number 40-8943

Dear Director:

On June 8, 2016, water level readings from the northwest and southwest underdrains on Cameco Resources – Crow Butte Operation (CBO) Commercial Evaporation Pond #1 indicated a potential liner leak. Samples were obtained from the underdrains and analyzed for alkalinity, chloride, conductivity, sodium, and sulfate. Upon verification of the potential liner leak, CBO notified Ron Burrows by phone on June 9, 2016 in accordance with License Condition 11.6. As required by License Condition 11.9, the following corrective action plan is being submitted for NRC review.

**Actions Taken**

June 9, 2016 – Began transferring water into Commercial Evaporation Pond #3 to lower the pond level to eliminate the liner leak. Inspected the liner for damage. Several patches on the west side of the pond were identified as potential sources of the liner leak. These patches are long in length and extended well below the water level.

June 22, 2016 – Underdrain readings during the weekly inspection indicate that the underdrain levels have stabilized. This indicates that the breach in the liner is above the current pond level of 8.7'. The liner patches were not sufficiently exposed to allow for a full assessment of the patches. Transfer of water into Commercial Evaporation Pond #3 continued. Began pumping the northwest and southwest underdrains.

July 6, 2016 - Transfer of water into Commercial Evaporation Pond #3 continued in order to lower the water level below the suspected patches. When the pond water level is low enough to provide full access to the patches (approximately 1 foot below the current level of 8.4'), the site will repair the damaged areas.

Attachment #1 contains copies of the Weekly Evaporation Pond Underdrain Analysis for the period of June 8, 2016 to July 6, 2016.

NM5520

# CROW BUTTE OPERATION



## Water Quality in Affected Underdrains

Attachment #2 contains copies of the water chemistry of the affected underdrains for the period of June 8, 2016 to July 6, 2016. The affected underdrains will continue to be sampled until the liner has been repaired, then for an additional two weeks following permanent repair of the liner.

## Commercial Pond Monitor Wells

In addition to analysis of the affected underdrains, CBO also obtained samples from pond monitor wells CPM-1 and CPM-2. The two monitor wells are completed in the first aquifer and are located at the fenced restricted area boundary and down gradient of Commercial Evaporation Pond #1. The samples were obtained and analyzed for the indicator parameters for the period of June 8, 2016 to July 7, 2016. Analytical results, contained in Attachment #3, were consistent with historical sampling results indicating no breach has occurred to the secondary liner.

## Impact to Waste Disposal Capacity

On July 6, 2016, the water level in Commercial Evaporation Pond #1 was at 8.4 ft. and Commercial Evaporation Pond #3 was at 9.1 ft. CBO continues to transfer water into Commercial Evaporation Pond #3 to lower the pond below the apparent liner tear so that the area maybe repaired

Current waste flow from the plant to the pond is 5 GPM, transfer from the pond to the Pond Water Treatment circuit for disposal down the deep disposal wells is 15 GPM, and evaporation is estimated at 30 GPM. From these values it is estimated that the pond level is being lowered at a rate of 40 GPM.

Current waste flows, deep disposal well capacity, and the capacity remaining in Commercial Evaporation Pond #3 will allow CBO to repair the liner in Commercial Evaporation Pond #1 with minimal impact to the total waste disposal capacity.

If you have any questions, please feel free to contact me at (308) 665-2215 Ext 112.

Sincerely,  
CAMECO RESOURCES  
CROW BUTTE OPERATION

Bob Tiensvold  
Restoration Manager

cc: NRC Deputy Director  
Marty Link – NDEQ Water Quality Division Administrator  
CBO - File  
ec: Nancy Harris – NDEQ Program Coordinator  
Kory Winters – NDEQ Field Office  
CR – Casper Office

**CROW BUTTE OPERATION**



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**Attachment #1**

**Weekly Evaporation Pond Underdrain Analysis**

622

**CAMECO RESOURCES/CROW BUTTE OPERATION  
WEEKLY EVAPORATION POND UNDERDRAIN ANALYSIS**

COMMERCIAL PONDS		UNDERDRAIN WATER DEPTH / INCHES	METER READING	TEMP °C	CONDUCTIVITY µmhos/cm	LAB RESULTS µmhos/cm
Depth = 17 feet POND # 1	POND LEVEL	10.2'				
	*FREEBOARD	6.8'				
	NE UNDERDRAIN	3"				
	NM UNDERDRAIN	4"				
	NW UNDERDRAIN	7"	81.5ms	15.2°C		
	SE UNDERDRAIN	1"				
	SM UNDERDRAIN	4"				
SW UNDERDRAIN	10"	82.7ms	15.1°C			
Depth = 17.5 feet POND # 3	POND LEVEL	8.5'				
	*FREEBOARD	9.0'				
	NE UNDERDRAIN	4"	51.2ms			
	NM UNDERDRAIN	10"	51.2ms	10.9°C		
	NW UNDERDRAIN	2"				
	SE UNDERDRAIN	0"				
	SM UNDERDRAIN	5"	71.1ms	10.6°C		
SW UNDERDRAIN	8"	86.6ms	13.69°C			
Depth = 17.5 feet POND # 4	POND LEVEL	7-50'				
	*FREEBOARD	16.5'				
	NE UNDERDRAIN	13"	52.0ms	24.4°C		
	NM UNDERDRAIN	5"				
	NW UNDERDRAIN	7"	9.72ms	24.1°C		
	SE UNDERDRAIN	10"	22.70ms	24.0°C		
	SM UNDERDRAIN	6"	11.91ms	19.1°C		
SW UNDERDRAIN	12"	14.03ms	25.2°C			
<b>R &amp; D POND LEVELS (Depth = 15 ft)</b> EAST LEVEL: 7.1' **EAST FREEBOARD: 7.9' EAST UNDERDRAIN: 0" WEST LEVEL: 7.5' **WEST FREEBOARD: 7.5' WEST UNDERDRAIN: 0'			<b>REMARKS:</b> Pond sprays look good Potential leak in Pond #1  *COMMERCIAL POND FREEBOARD = 5 FT MIN ** R&D POND FREEBOARD = 3 FT MIN  SAMPLER: W. Nelson DATE: 6/8/16			

**CAMECO RESOURCES/CROW BUTTE OPERATION  
WEEKLY EVAPORATION POND UNDERDRAIN ANALYSIS**

COMMERCIAL PONDS		UNDERDRAIN WATER DEPTH / INCHES	METER READING	TEMP °C	CONDUCTIVITY µmhos/cm	LAB RESULTS µmhos/cm
Depth = 17 feet POND # 1	POND LEVEL	9.1'				
	*FREEBOARD	7.9'				
	NE UNDERDRAIN	3"				
	NM UNDERDRAIN	5"				
	NW UNDERDRAIN	9"	88.7ms	18.1°C		
	SE UNDERDRAIN	2"				
	SM UNDERDRAIN	4"				
	SW UNDERDRAIN	12"	86.9ms	16.0°C		
Depth = 17.5 feet POND # 3	POND LEVEL	9.3'				
	*FREEBOARD	8.2'				
	NE UNDERDRAIN	4"				
	NM UNDERDRAIN	12"	51.3ms	11.9°C		
	NW UNDERDRAIN	6"	59.4ms	13.9°C		
	SE UNDERDRAIN	0"				
	SM UNDERDRAIN	7"	75.8ms	11.1°C		
	SW UNDERDRAIN	13"	90.9ms	15.0°C <del>15.0°C</del> <sup>15.0°C</sup>		
Depth = 17.5 feet POND # 4	POND LEVEL	7-80'				
	*FREEBOARD	16.5'				
	NE UNDERDRAIN	2"	39.54ms	25.3°C		
	NM UNDERDRAIN	4"	51.70ms	20.0°C		
	NW UNDERDRAIN	7"	6.87ms	25.4°C		
	SE UNDERDRAIN	7"	23.61ms	25.2°C		
	SM UNDERDRAIN	6"	12.91ms	20.3°C		
	SW UNDERDRAIN	2"	14.07ms	21.4°C		
<b>R &amp; D POND LEVELS (Depth = 15 ft)</b> EAST LEVEL: 7.0' **EAST FREEBOARD: 8.0' EAST UNDERDRAIN: 0" WEST LEVEL: 7.4' **WEST FREEBOARD: 7.6' WEST UNDERDRAIN: 0"			<b>REMARKS:</b> Pond #3 liner repaired 6/19/15 Pond sprays o.k. Performed monthly inspection. *COMMERCIAL POND FREEBOARD = 5 FT MIN ** R&D POND FREEBOARD = 3 FT MIN SAMPLER: W. Nelson DATE: 6/15/16			

**CAMECO RESOURCES/CROW BUTTE OPERATION  
WEEKLY EVAPORATION POND UNDERDRAIN ANALYSIS**

COMMERCIAL PONDS		UNDERDRAIN WATER DEPTH / INCHES	METER READING	TEMP °C	CONDUCTIVITY µmhos/cm	LAB RESULTS µmhos/cm
Depth = 17 feet POND # 1	POND LEVEL	8.7'				
	*FREEBOARD	8.3'				
	NE UNDERDRAIN	3"				
	NM UNDERDRAIN	5"				
	NW UNDERDRAIN	10"	90.8ms	19.7°C		
	SE UNDERDRAIN	1"				
	SM UNDERDRAIN	4"				
	SW UNDERDRAIN	12"	89.7ms	18.5°C		
Depth = 17.5 feet POND # 3	POND LEVEL	9.1'				
	*FREEBOARD	8.4'				
	NE UNDERDRAIN	5"				
	NM UNDERDRAIN	2"	26.17ms	11.3°C		
	NW UNDERDRAIN	6"	67.8ms	15.7°C		
	SE UNDERDRAIN	0"				
	SM UNDERDRAIN	3"	60.4ms	11.6°C		
	SW UNDERDRAIN	1"	81.4ms	17.0°C		
Depth = 17.5 feet POND # 4	POND LEVEL	T-90'				
	*FREEBOARD	16.5'				
	NE UNDERDRAIN	3"	66.2ms	25.7°C		
	NM UNDERDRAIN	5"	54.10ms			
	NW UNDERDRAIN	7"	7.68ms	27.3°C		
	SE UNDERDRAIN	4"	22.19ms	26.5°C		
	SM UNDERDRAIN	2"	10.94ms	21.8°C		
	SW UNDERDRAIN	10"	15.3ms	29.3°C		
<b>R &amp; D POND LEVELS (Depth = 15 ft)</b> EAST LEVEL: 7.0' **EAST FREEBOARD: given 8.0' EAST UNDERDRAIN: 0" WEST LEVEL: 7.2' **WEST FREEBOARD: 7.8' WEST UNDERDRAIN: 0"			REMARKS: Pond #1 & #3 sprays - OK  *COMMERCIAL POND FREEBOARD = 5 FT MIN ** R&D POND FREEBOARD = 3 FT MIN SAMPLER: W. Nelson DATE: 6/22/16			

200

**CAMECO RESOURCES/CROW BUTTE OPERATION  
WEEKLY EVAPORATION POND UNDERDRAIN ANALYSIS**

COMMERCIAL PONDS		UNDERDRAIN WATER DEPTH / INCHES	METER READING	TEMP °C	CONDUCTIVITY µmhos/cm	LAB RESULTS µmhos/cm
Depth = 17 feet POND # 1	POND LEVEL	8.5'				
	*FREEBOARD	8.5'				
	NE UNDERDRAIN	3"				
	NM UNDERDRAIN	1"				
	NW UNDERDRAIN	5"	89.8ms	19.2°C		
	SE UNDERDRAIN	2"				
	SM UNDERDRAIN	2"				
	SW UNDERDRAIN	2"	43.55ms	18.4°C		
Depth = 17.5 feet POND # 3	POND LEVEL	9.0'				
	*FREEBOARD	8.5'				
	NE UNDERDRAIN	4"				
	NM UNDERDRAIN	0"	41.77ms	12.3°C		
	NW UNDERDRAIN	4"	51.6ms	15.7°C		
	SE UNDERDRAIN	0"				
	SM UNDERDRAIN	3"	59.7ms	13.0°C		
	SW UNDERDRAIN	6"	75.4ms	12.0°C		
Depth = 17.5 feet POND # 4	POND LEVEL	7-60'				
	*FREEBOARD	16.5'				
	NE UNDERDRAIN	9"	67.1ms	24.9°C		
	NM UNDERDRAIN	11"	64.6ms	26.4°C		
	NW UNDERDRAIN	6"	8.21ms	27.5°C		
	SE UNDERDRAIN	8"	21.43ms	27.0°C		
	SM UNDERDRAIN	8"	26.84ms	21.8°C		
	SW UNDERDRAIN	10"	11.78ms	27.6°C		

  

<b>R &amp; D POND LEVELS (Depth = 15 ft)</b>	
EAST LEVEL:	7.0'
**EAST FREEBOARD:	8.0'
EAST UNDERDRAIN:	0"
WEST LEVEL:	7.2'
**WEST FREEBOARD:	7.8'
WEST UNDERDRAIN:	0"

  

<b>REMARKS:</b> Pond Sprays OK
<b>*COMMERCIAL POND FREEBOARD = 5 FT MIN</b>
<b>** R&amp;D POND FREEBOARD = 3 FT MIN</b>
<b>SAMPLER:</b> M. Nelson
<b>DATE:</b> 6/29/16

WJ

**CAMECO RESOURCES/CROW BUTTE OPERATION  
WEEKLY EVAPORATION POND UNDERDRAIN ANALYSIS**

COMMERCIAL PONDS		UNDERDRAIN WATER DEPTH / INCHES	METER READING	TEMP °C	CONDUCTIVITY µmhos/cm	LAB RESULTS µmhos/cm
Depth = 17 feet POND # 1	POND LEVEL	8.4'				
	*FREEBOARD	8.6'				
	NE UNDERDRAIN	2"				
	NM UNDERDRAIN	2"				
	NW UNDERDRAIN	2"	81.0ms	21.3°C		
	SE UNDERDRAIN	2"				
	SM UNDERDRAIN	1"				
	SW UNDERDRAIN	2"	89.0ms	20.2°C		
Depth = 17.5 feet POND # 3	POND LEVEL	9.1'				
	*FREEBOARD	8.4'				
	NE UNDERDRAIN	5"				
	NM UNDERDRAIN	9"	46.72ms	17.3°C		
	NW UNDERDRAIN	4"	54.17ms	17.5°C		
	SE UNDERDRAIN	0"				
	SM UNDERDRAIN	5"	50.7ms	13.4°C		
	SW UNDERDRAIN	9"	84.6ms	18.1°C		
Depth = 17.5 feet POND # 4	POND LEVEL	7-60'				
	*FREEBOARD	16.5'				
	NE UNDERDRAIN	8"	81.9ms	25.2°C		
	NM UNDERDRAIN	12"	31.94ms	21.6°C		
	NW UNDERDRAIN	8"	8.23ms	26.8°C		
	SE UNDERDRAIN	8"	21.26ms	26.8°C		
	SM UNDERDRAIN	9"	30.84ms	22.3°C		
	SW UNDERDRAIN	11"	15.35ms	27.8°C		
<b>R &amp; D POND LEVELS (Depth = 15 ft)</b> EAST LEVEL: 7.3' **EAST FREEBOARD: 7.7' EAST UNDERDRAIN: 0" WEST LEVEL: 7.3' **WEST FREEBOARD: 7.7' WEST UNDERDRAIN: 0"			<b>REMARKS:</b> Pond sprays OK Monthly inspection. *COMMERCIAL POND FREEBOARD = 5 FT MIN ** R&D POND FREEBOARD = 3 FT MIN <b>SAMPLER:</b> Walt Nelson <b>DATE:</b> 7/6/16			



# **CROW BUTTE OPERATION**

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## **Attachment #2**

### **Water Chemistry of the Affected Underdrains**

6/8/2016

<u>Sample ID</u>	<u>Cl mg/L</u>	<u>ALK = CaCO3</u>	<u>COND microseimen/cm</u>	<u>Na mg/L</u>	<u>SO4 mg/L</u>
POND 1	45380	2950	108400	29270	6045
POND 1 NORTH WEST UNDERDRAIN	41125	2600	101100	27390	5631
POND 1 SOUTH WEST UNDERDRAIN	45380	2675	103700	28020	5810

6/15/2016

<u>Sample ID</u>	<u>Cl mg/L</u>	<u>ALK = CaCO3</u>	<u>COND microseimen/cm</u>	<u>Na mg/L</u>	<u>SO4 mg/L</u>
POND 1	46089	3000	110700	30320	6015
POND 1 NORTH WEST UNDERDRAIN	42544	2600	102300	27250	5649
POND 1 SOUTH WEST UNDERDRAIN	43962	2750	105800	28460	5848

6/22/2016

<u>Sample ID</u>	<u>Cl mg/L</u>	<u>ALK = CaCO3</u>	<u>COND microseimen/cm</u>	<u>Na mg/L</u>	<u>SO4 mg/L</u>
POND 1	46059	3125	112000	30740	6384
POND 1 NORTH WEST UNDERDRAIN	43962	2600	102600	27770	6049
POND 1 SOUTH WEST UNDERDRAIN	45380	2750	106000	28970	6305

6/29/2016

<u>Sample ID</u>	<u>Cl mg/L</u>	<u>ALK = CaCO3</u>	<u>COND microseimen/cm</u>	<u>Na mg/L</u>	<u>SO4 mg/L</u>
POND 1	91469	3000	112000	30820	6223
POND 1 NORTH WEST UNDERDRAIN	41122	2550	102200	28130	5747
POND 1 SOUTH WEST UNDERDRAIN	41122	2400	100900	27520	5544

7/6/2016

<u>Sample ID</u>	<u>Cl mg/L</u>	<u>ALK = CaCO3</u>	<u>COND microseimen/cm</u>	<u>Na mg/L</u>	<u>SO4 mg/L</u>
POND 1	46089	3025	111500	30450	6179
POND 1 NORTH WEST UNDERDRAIN	40416	2275	98200	25860	5303
POND 1 SOUTH WEST UNDERDRAIN	40416	2500	100300	27010	5649

# **CROW BUTTE OPERATION**

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## **Attachment #3**

### **Commercial Pond Monitor Well Analysis**

6-8-16

MO

	<u>Alk</u>	<u>Cl</u>	<u>Cond</u>	<u>SO4</u>	<u>Na</u>
	mg/L	mg/L	umhos	mg/L	mg/L
<b>Commercial Pond Monitor #1</b>	201	11.5	459	15.53	16.36
<b>Commercial Pond Monitor #2</b>	184	6.6	420	14.78	14.38



6-14-16

MO

	<u>Alk</u>	<u>Cl</u>	<u>Cond</u>	<u>SO4</u>	<u>Na</u>
	mg/L	mg/L	umhos	mg/L	mg/L
<b>Commercial Pond Monitor #1</b>	201	11.9	463	14.93	17.93
<b>Commercial Pond Monitor #2</b>	185	6.7	433	14.45	15.65

6-22-16

MO

	<u>Alk</u>	<u>Cl</u>	<u>Cond</u>	<u>SO4</u>	<u>Na</u>
	mg/L	mg/L	umhos	mg/L	mg/L
<b>Commercial Pond Monitor #1</b>	201	11.4	465	14.99	14.82
<b>Commercial Pond Monitor #2</b>	184	6.5	423	14.73	13.64

6-29-16

MO

	<u>Alk</u>	<u>Cl</u>	<u>Cond</u>	<u>SO4</u>	<u>Na</u>
	mg/L	mg/L	umhos	mg/L	mg/L
<b>Commercial Pond Monitor #1</b>	199	11.7	470	15.33	16.19
<b>Commercial Pond Monitor #2</b>	183	6.6	424	14.65	15.75

7-7-16

MO

	<u>Alk</u>	<u>Cl</u>	<u>Cond</u>	<u>SO4</u>	<u>Na</u>
	mg/L	mg/L	umhos	mg/L	mg/L
<b>Commercial Pond Monitor #1</b>	201	11.8	470	15.26	14.45
<b>Commercial Pond Monitor #2</b>	184	6.6	422	14.51	14.40