

**Full Metal Jacket:  
The Challenge of Meeting EPA  
Categorical Pre-Treatment Limits**



Industrial PWO Seminar  
April 11, 2014  
Andrea Bollinger, PE

**OLSSON**  
ASSOCIATES

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**Word association**

• Teddy                      • Bear  
  • Hard                      • Hat  
  • Ammunition              • Wastewater?





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**Outline**

• Existing System  
  • EPA Categorical Limits + Local Effluent Limits  
  • Treatment Options  
  • Testing  
  • Q&A

**ARIES CHEMICAL**  
Water Treatment Specialists

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## Existing Plant Background

MOLSSON<sup>®</sup> INDUSTRIES

- Ammunitions Manufacturer
- (2) 12 hour shifts, 6 days/week
- 3 operations
  - Bullet Wash
  - North Casing Wash
  - South Casing Wash
- Evaporation/Drum Dryers




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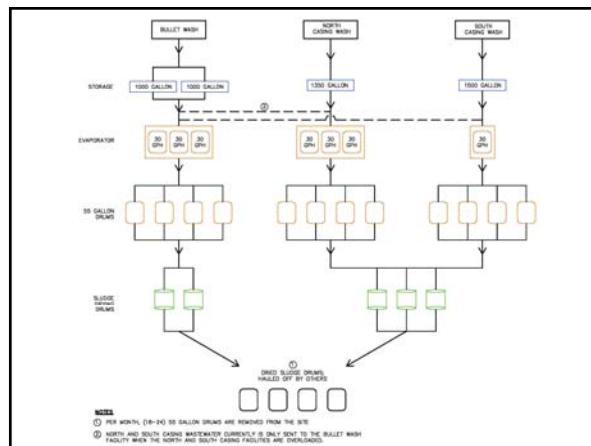
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## Existing Plant Background

MOLSSON<sup>®</sup> INDUSTRIES

	Storage Gallon	Low Production GPD	High Production GPD	Evap. Capacity GPD	Diff.	
					Low GPD	High GPD
Bullet	2,000	1,400	3,000	1,440	(40)	1,560
North Case	1,350	1,400	3,000	1,440	(40)	1,560
South Case	1,500	500	1,500	720	(220)	780
Total	4,850	3,300	7,500	3,600	(300)	3,900

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## Existing System

- Rising costs
  - \$80k - \$120k / year
  - Replacing evaporators
  - Hauling sludge
  - Breakdowns / lost production
  - Spills
- Limited capabilities of ext. system
- Politics => variable flows





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## Improvement Goals

- Optimize wastewater treatment
- Centralize the process
  - Combine the streams
- Reduce Costs \$\$\$



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	Units	Bullet Wash	North Casing Wash	South Casing Wash
<b>General Chemistry Parameters</b>				
Alkalinity, Total (CaCO <sub>3</sub> )	mg/L	1870	<5.00	<5.00
Hardness	mg/L	255	1020	510
Oil & Grease	mg/L	240	188	224
pH	pH units	8.7	4.2	1.2
Total Suspended Solids	mg/L	427	77.3	54
<b>Calculated Analyses</b>				
Hardness	mg/L	33.8	21.4	44.7
<b>Total Metals by EPA 200 Series Methods</b>				
Arsenic	mg/L	0.107	<0.0800	<0.0800
Barium	mg/L	0.106	0.0444	0.0365
Cadmium	mg/L	<0.0200	<0.0200	<0.200
Calcium	mg/L	10.7	6.33	15.1
Chromium	mg/L	<0.0200	0.0332	0.283
Copper	mg/L	30.5	87.6	478
Iron	mg/L	4.3	71.5	9.94
Lead	mg/L	105	0.925	1.97
Manganese	mg/L	0.205	0.573	0.0847
Mercury	mg/L	<0.0002	<0.0002	<0.0002
Nickel	mg/L	<0.05	4.09	0.26
Selenium	mg/L	<0.150	<0.150	<0.150
Silver	mg/L	<0.0200	<0.0200	<0.0200
Zinc	mg/L	6.57	20.2	1100

### Raw WW Analysis

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## EPA Categorical Limits

- EPA Categorical Limits
  - What is CFR Title 40?
    - Existing outfall or new
  - Discharge to POTW or Stream
  - Based on industrial process
    - Leather tanning,
    - Glass manufacturing,
    - Metal finishing,
    - Pesticide chemicals,
    - Al and Cu forming... the list goes one




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## EPA Categorical Limits

- EPA Categorical Limits for Ammunition Plant
  - Part 468: Copper Forming Point Source Category
  - Part 471: Nonferrous Metals Forming and Metals Powders Point Source Category
  - Production (Pounds / million off-pounds)
  - Know your process → avoid double dipping

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## EPA Categorical Limits

- EPA Categorical Limits for Ammunition Plant
  - Part 468: Copper Forming Point Source Category
    - Tumbling/burnishing
    - Pickling bath
    - Pickling rinse
    - 87,500 pounds/day
  - Part 471: Nonferrous Metals Forming and Metals Powders Point Source Category
    - Alkaline Cleaning Spent Bath
    - Alkaline Cleaning Rinse
    - 43,750 pounds/day




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		40 CFR, Part 468, Subpart A			40 CFR, Part 471, Subpart A			Combined Daily Limit (lbs/day)	Daily Facility Production:
Pollutant of Concern		Tumbling/ Burnishing 40%	Pickling Bath 25%	Pickling Rinse 35%	Alkaline Cleaning Spent Baths (35%)	Alkaline Cleaning Rinse 65%			
Antimony	Daily Max (lbs/day)				0.345	0.678	0.025		
	Monthly Avg (lbs/day)				0.005	0.019			
Copper	Daily Max (lbs/day)	0.746	0.148	0.748			0.052		
	Monthly Avg (lbs/day)	0.026	0.003	0.023			0.025		
Lead	Daily Max (lbs/day)	0.058	0.011	0.058	0.051	0.099	0.008		
	Monthly Avg (lbs/day)	0.002	0.000	0.002	0.001	0.003	0.005		

		40 CFR, Part 468, Subpart A			40 CFR, Part 471, Subpart A			Combined Daily Limit (lbs/day)	Daily Facility Production:
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Lead	Daily Max (lbs/day)	0.058	0.011	0.058	0.051	0.099	0.008		
	Monthly Avg (lbs/day)	0.002	0.000	0.002	0.001	0.003	0.005		

Permit Limits	EPA Limits				Local Agency Limits	
	3,300 gpd		7,500 gpd			
	Ibs/day	Monthly Avg	mg/L	Monthly Avg		
Antimony	0.011		0.398	0.175	nl	
Chromium	0.006		0.221	0.097	3.000	
Copper	0.025		0.903	0.397	1.000	
Lead	0.005		0.194	0.085	0.100	
Nickel	0.015		0.547	0.241	1.000	
Zinc	0.017		0.621	0.273	nl	
TTO	0.014		0.503	0.221	nl	
O&G (Alt)	0.409	14.846	6.532	100		
O&G (petroleum)		nl		25		
Arsenic		nl		0.050		
Barium		nl		1.000		
Cadmium		nl		0.100		
Cyanides		nl		2.000		
Manganese		nl		1.000		
Mercury		nl		0.005		
Selenium		nl		0.030		
Silver		nl		0.100		
Chloride		nl		230		
BOD		nl		250		

	EPA 7500 gpd mg/L Monthly Avg	Local Agency Limits mg/L	Combined Avg 40/40/20 mg/L
Antimony	0.175	nl	0.36
Chromium	0.097	3.000	0.04
Copper	0.397	1.000	158
Lead	0.085	0.100	27
Nickel	0.241	1.000	0.77
Zinc	0.273	nl	294
TTO	0.221	nl	0.05
O&G	6.532	100	216
O&G (petroleum)	nl	25	22
Arsenic	nl	0.050	0.06
Barium	nl	1.000	0.20
Cadmium	nl	0.100	0.002
Cyanides	nl	2.000	
Manganese	nl	1.000	0.24
Mercury	nl	0.005	0.0002
Selenium	nl	0.030	0.01
Silver	nl	0.100	0.01
Chloride	nl	230	38
BOD	nl	250	884
TSS	nl	nl	218
pH	5-10	6.9	5.4

## Treatment Options

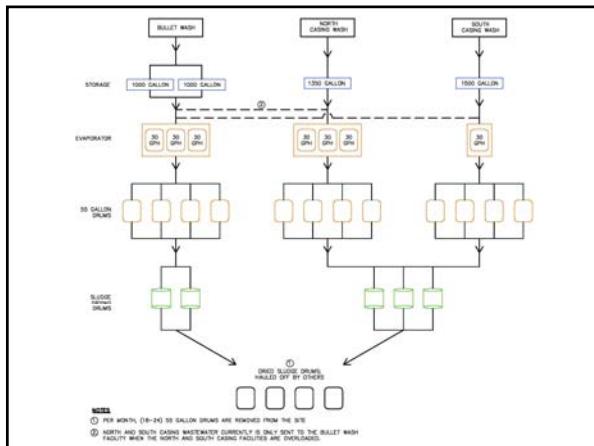
OLSSON + ASSOCIATES

- Heavy Metals
  - Reverse Osmosis
  - Ion exchange
  - Chem precip and filtration
- O&G
  - DAF
  - GAC
  - Organo-clay

## Bench Testing

OLSSON + ASSOCIATES

- Aries Chemical
- Started prior to final effluent limits
- 13 iterations to break "the code"

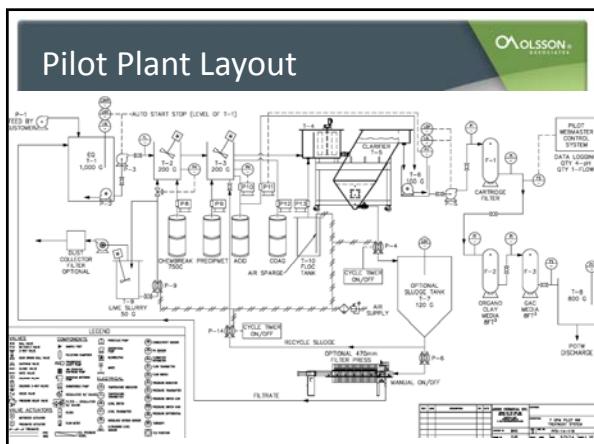
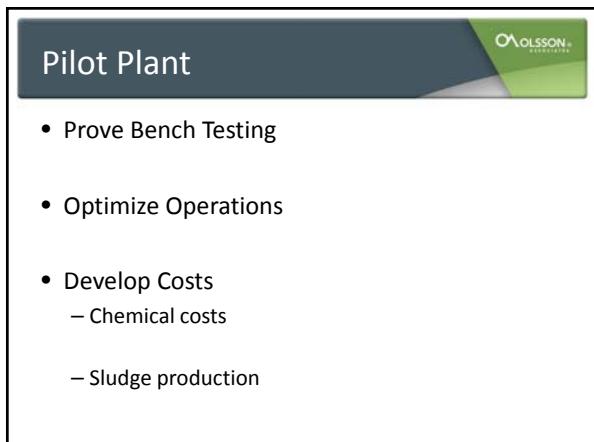


## Bench Testing

- Aries Chemical
- Started prior to final effluent limits
- 13 iterations to break “the code”
  - Changing targets
    - O&G vs. TTO
    - Chloride limits added
  - South Casing ‘problem child’

TEST	Source	Treatment	Antimony	Copper	Lead	Nickel	Zinc	Oil & Grease
		City Limits	nl	1	0.1	1.0	100 and 25	
		EPA limit at 7,500 gal/day	0.175	0.397	0.085	0.241	0.273	
Raw blend	Blend 40/40/20	Raw – Untreated	0.415	164	15	0.22	332	201 22 non-polar
A		Treatment # 3 (low chloride) Supernatant clarity only fair.	0.147 (3.2 sol)	7.8	0.26	< 0.1 (0.48 sol)	1.2	101 <8.0 non-polar
B	JAN 14-15 RESULTS	Treatment # 4 (low chloride, higher conc.) Supernatant clarity good, better than #3		1.3 (0.25 sol)	< 0.2	< 0.1 (0.2 sol)	0.25	78
C		Organic-clay filtration of Test A effluent		6.7	0.25	< 0.1	0.78	27 non-polar
D		GAC filtration of Test C filtrate		3.5	< 0.2	< 0.1	0.32	14 <8.0 non-polar
GAC X2	Jan 27 samples	2 x GAC filtration of Test C filtration		0.22			0.034	<12 <12 non-polar

TEST	Source	Treatment	Antimony	Copper	Lead	Nickel	Zinc	Oil & Grease
		City Limits	nl	1	0.1	1.0		100 and 25
		EPA limit at 7,500 gal/day	0.175	0.397	0.085	0.241	0.273	
Raw blend	Blend 40/40/20	Raw - Untreated	0.415	164	15	0.22	332	201 22 non-polar
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B	JAN 14-15 RESULTS	Treatment # 4 (low chloride, higher conc.) Supernatant clarity good, better than #3		1.3 (0.25 sol)	< 0.2	< 0.1 (0.2 sol)	0.25	
C		Organic-clay filtration of Test A effluent		6.7	0.25	< 0.1	0.78	78 27 non-polar
D		GAC filtration of Test C filtrate		3.5	< 0.2	< 0.1	0.32	14 <8.0 non-polar
GAC X2	Jan 27 samples	2 x GAC filtration of Test C filtration		0.22			0.034	<12 <12 non-polar



## Q&A



A cartoon illustration showing a woman with brown hair and a man with glasses engaged in a Q&A session. A large speech bubble contains the letters 'Q' and 'A', with dashed red arrows pointing from each letter to the respective speaker's mouth.

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