

DATE: February 28, 2008

TO: David Little, President  
Randy Moore, Director of Operations

FRFOM: Tom Schwing, Network Operations Superintendent

RE: Lake Darby WTP – Salt Depletion Event

Sometime during Thursday morning February 21, 2008 the bulk salt supply in Brine Maker #2 at the Lake Darby WTP was depleted. The bulk salt supply is required to generate the brine solution required to recharge the ion exchange water softeners to achieve ion exchange water softening.

As a result of the salt depletion, the LDWTP water softeners were not recharged and could not soften the water to produce finished water hardness within the specified hardness range of 120 mg/L to 150 mg/L.

### Findings

- 1) Salt for the LDWTP was last received on February 5<sup>th</sup>. 24.38 tons of salt were delivered.
- 2) On February 8<sup>th</sup> the brine day tank overflowed because of a failure of the brine day tank's level monitoring system. This caused an unknown volume of brine solution to dump into the sanitary sewer system. The result of the discharge of this unknown volume of brine was that the Brine Maker had to create more brine at a higher salt utilization rate which increased salt usage.
- 3) The operator "normally" orders salt every 15 days and then receives delivery 17 days from the previous salt delivery.
- 4) The increased use of salt was not considered by the operator when using his normal 15 day salt reorder time.
- 5) There is a procedure which specifies that the operator inspect the salt supply each day. The operator failed to visually inspect the salt supply.
- 6) Because the plant had obtained a reasonable stable operating system, the operator had ordered salt based on elapse days, not volume of salt used or remaining.
- 7) There is a written procedure requiring the Network Operations Superintendent to be notified immediately anytime the finished water hardness is above 150 mg/L. Although measured out of acceptable range Thursday morning at approximately 7:30 AM, the Network Operation Superintendent was not notified until Thursday afternoon at approximately 2:30 PM.
- 8) Salt was ordered on February 19<sup>th</sup> at 11:48 AM for delivery on February 22<sup>nd</sup>.
- 9) A load of salt was delivered at the LDWTP at 00:30 AM on February 22<sup>nd</sup>.
- 10) The softeners were regenerated and returned to service. By Noon on February 22<sup>nd</sup> all water distribution system samples had returned to within acceptable hardness range of 120 mg/L to 150 mg/L.

## Conclusions

- 1) While the failure of the Brine Day Tank level sensor resulting in an overflow of an unknown volume of brine solution contributed to the higher than normal salt utilization rate, a higher salt depletion rate should have been noticed had visual inspection of the salt been performed.
- 2) The operator failed to visually inspect; failed to determine the volume of salt remaining in the Brine Maker #2; and then failed to determine the need for ordering salt in a shorter time period.
- 3) The operator failed to follow written procedure on notification of the finished water hardness above 150 mg/L.
- 4) The cause of the salt supply exhaustion was due to operator error.

## Recommendations

- 1) A Job Aid (copy attached) has been developed and provided to the operator for use in assisting the operator to properly evaluate and inventory the salt supply.
- 2) Job coaching on the importance of record keeping; following procedures for process control and monitoring; and importance of job duty performance will be performed with the operator.
- 3) Discipline action will be issued to the operator who failed to follow established written procedures.

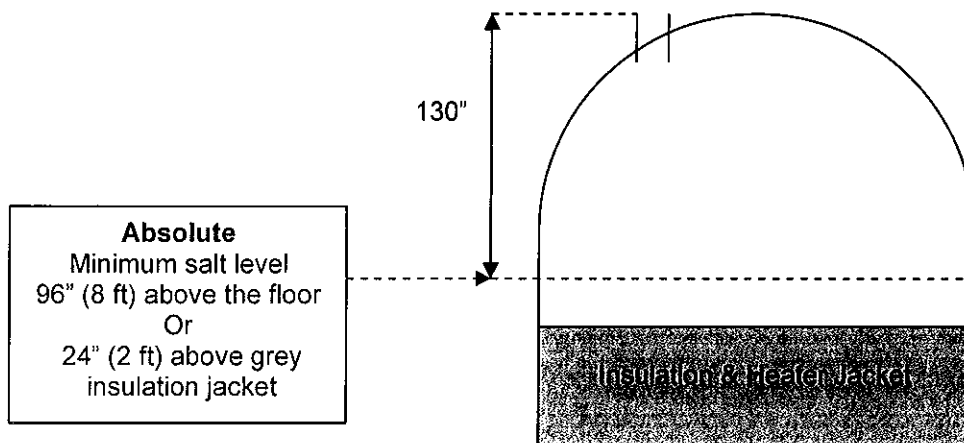
If there are any questions or if additional information is needed, please do not hesitate to contact me.

A handwritten signature in black ink, appearing to read "Thomas Schwing". The signature is written in a cursive style with a large, sweeping flourish at the end.

**Ohio American Water Company  
Franklin County District**

**Lake Darby WTP - Salt Measurement**

- 1) The depth of salt in each Brine Maker tank shall be measured each day.
- 2) The depth of salt shall be measured from the lower lip of the access hatch (top "zero" measurement point) down to the salt level and recorded in "inches from top".
- 3) Operator shall verify the water level in the Brine Maker each day. The water level shall cover the salt.
- 4) Assuming a two (2) day delivery after date of ordering, salt shall be ordered when the salt level is measured **more than 130 inches below** the top "zero" measurement point.
- 5) The Plant's Salt Management Data Sheet shall be completed each day in ink.



- 6) **AS A GENERAL RULE** - It takes approximately 2,400 lbs salt per regeneration. Assuming two (2) regenerations per average production day, then 4,800 lbs or 2.4 tons of salt will be used every two (2) days. Assuming the typical salt delivery volume is 25 tons or 50,000 lbs, then salt should be delivered every 11 days. If there is more than 11 calendar days between salt deliveries you are using **reserve salt capacity!**
- 7) Anytime a salt order has not been delivered within two (2) days of it being ordered, a supervisor shall be notified by close of business on the second day.
- 8) Normally salt deliveries will be between 8:00 AM and 3:00 PM Monday through Friday.

Ohio American Water Company  
Franklin County District  
Lake Darby WTP  
Salt Management Data Sheet

Month: \_\_\_\_\_  
Year: \_\_\_\_\_

Date	Brine Maker #1			Brine Maker #2			Date		Date		Filled Brine Maker (1 or 2)
	Operator	Salt Remaining (lbs)	Salt Remaining (tons)	Salt Depth (inches)	Salt Remaining (lbs)	Salt Remaining (tons)	Salt Ordered (MM/DD/YY)	Salt Delivered (MM/DD/YY)	Salt Delivered (lbs)	Salt Delivered (tons)	
1											
2											
3											
4											
5											
6											
7											
8											
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10											
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Ohio American Water Company  
Franklin County District  
Lake Darby WTP  
Brine System Data

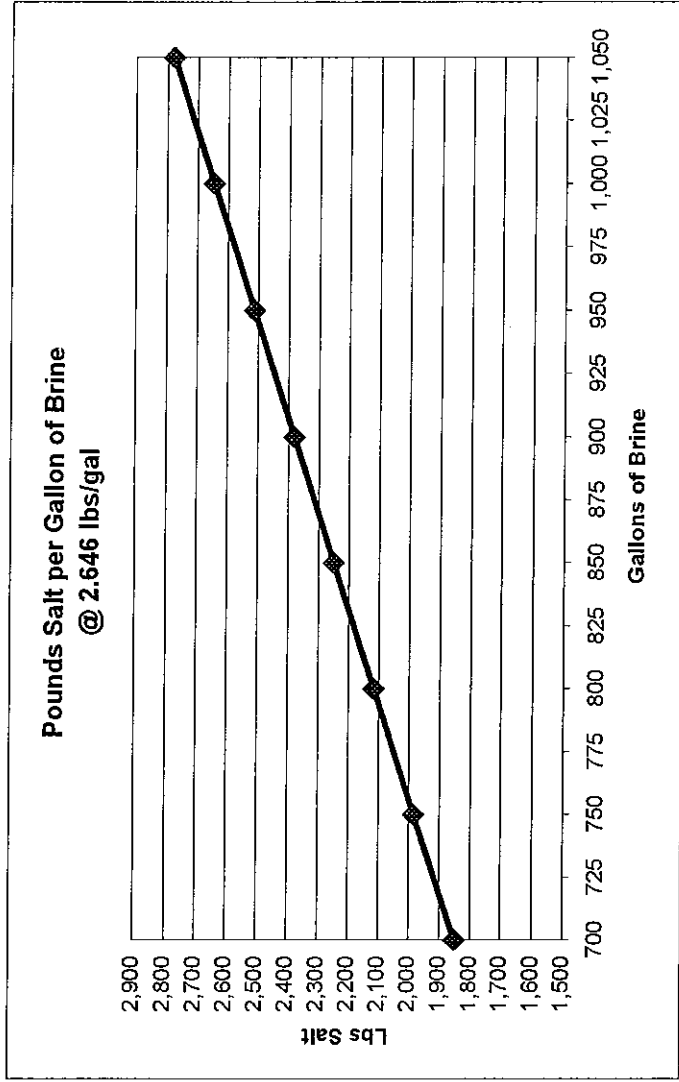
Constants	
Salt	0.036 tons/cf
Brine	2.646 lbs/gal
Volume of Water	7.48 gal/cf
Weight of Water	8.34 lbs/gal

Brine Maker #1	
Diameter	11 feet
Usable Height	11 feet
Area	95 sf
Volume	998 cf
Volume per foot	95 cf/ft
Salt Inventory	3.42 tons/ft
Salt Inventory	6,840 lbs/ft
Max. Capacity	32 tons

Brine Maker #2	
Diameter	10 feet
Usable Height	19 feet
Area	78 sf
Volume	1,482 cf
Volume per foot	78 cf/ft
Salt Inventory	2,808 tons/ft
Salt Inventory	5,616 lbs/ft
Max. Capacity	48 tons

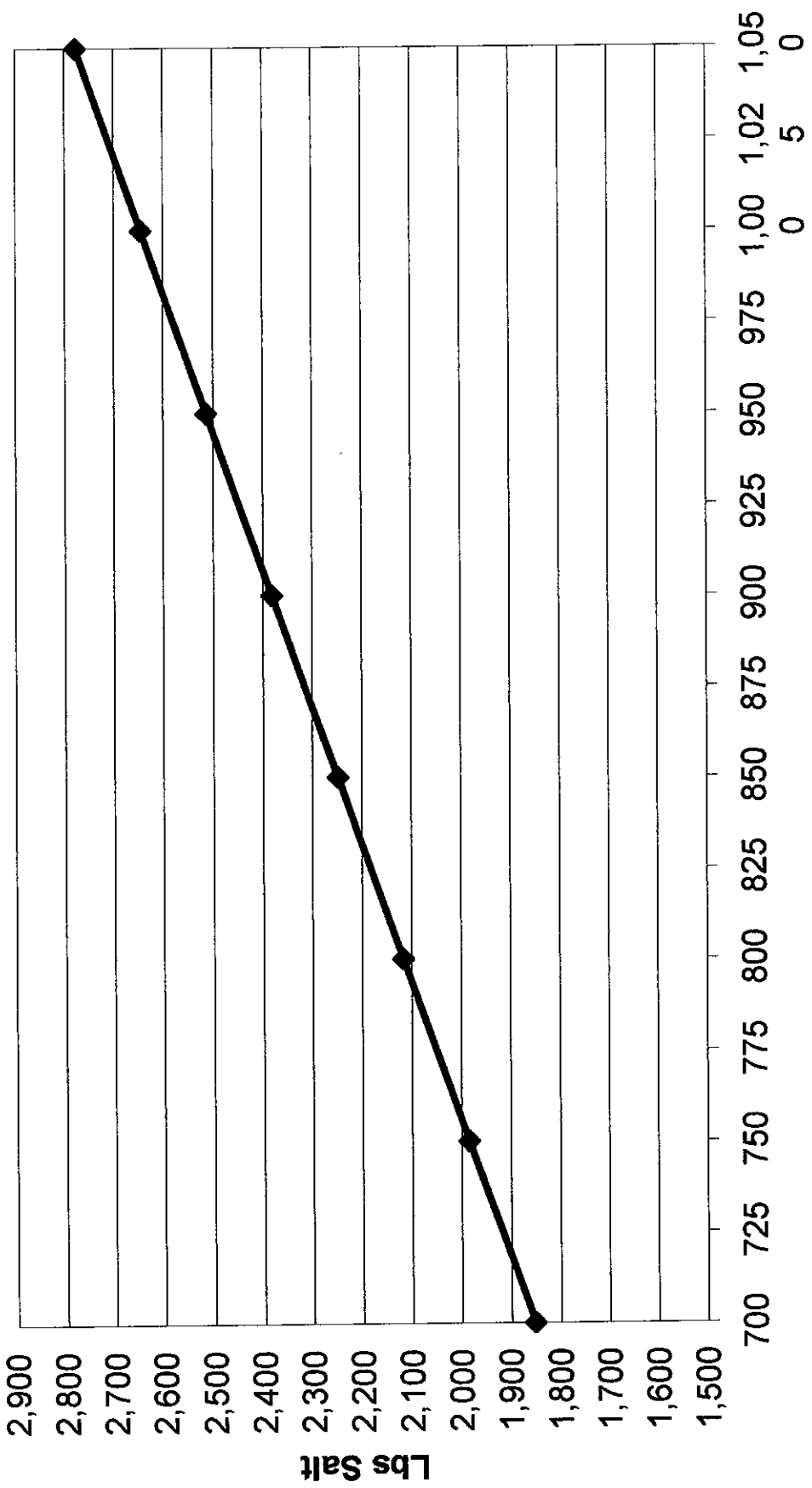
Brine Day Tank	
Diameter	7 feet
Usable Height	2.5 feet
Area	38 sf
Volume	95 cf
Volume per foot	38 cf/ft
Volume	710 gallons
Volume per foot	284 gals/ft
Salt Inventory	1,368 tons/ft
Salt Inventory	2,736 lbs/ft

Brine (gal)	Salt (lbs)
700	1,852
750	1,985
800	2,117
850	2,249
900	2,381
950	2,514
1,000	2,646
1,050	2,778



To determine salt inventory in Brine Maker #1, multiple height of salt in tank by 6,840 lbs/ft.  
To determine salt inventory in Brine Maker #2, multiple height of salt in tank by 5,616 lbs/ft.

**Pounds Salt per Gallon of Brine  
@ 2.646 lbs/gal**



**Gallons of Brine**