
LIME KILN OPERATION IMPROVEMENTS

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Section D

LIME KILN OPERATION IMPROVEMENTS

Improvements in lime kiln operation have contributed to increases in TASC0 slicing capacity from 25,000 tons/day to 37,000 tons/day over the past 15 years without additional lime kiln installations. Significant improvement in performance of mixed feed lime kilns was achieved. Percent Available CaO was increased from approximately 75 percent to 90 percent. Ignition loss was reduced from 5 percent to 2 percent or less. Production of lime was also increased where needed. These improvements were achieved primarily by implementation of basic principles of kiln operation. Most significant was the improvement in rock quality including tighter rock and coke classification. Also significant was the improved mixing of rock and coke and equipment modifications to achieve that.

The goal for improved performance of the existing lime kilns is to provide the necessary quantity of quality lime for juice purification to permit maximum beet slice and extraction.

As a measure of burned rock quality TASC0 has relied primarily on percent Available CaO analysis. This test was originally used to indicate the reactivity of lime for use in the Steffens process since it measures the ability of lime to react with sugar to form a saccharate. Percent ignition loss is also an indicator of lime

quality and there is a good correlation of the two tests. Percent Available CaO is felt to be a better measure of lime quality since it accounts for overburned lime or clinker. It reflects the proportion of the lime going to the slacker which will contribute to juice purification in carbonation. Tons of available CaO and Available CaO on raw juice non sugars are also monitored to determine if lime production is sufficient.

With a given mixed feed kiln, quality of the rock and coke and uniform operation are the basic factors contributing to kiln performance.

Prior to 1983, rock for the two eastern TASC0 factories was from a quarry near Logan Utah. Typical analysis was 95% CaCO₃. The rock for the two western TASC0 factories has been from a quarry at Durkee, Oregon. It is typically 98% CaCO₃. Both rocks have good strength. Prior to 1973 when the use of salt was begun at Nyssa, the Utah rock was considered better for Steffens operation. Salt has a significant effect on the Durkee rock and has been used extensively since 1973.

In the mid 1960's the classification of rock from the Providence quarry near Logan Utah had been broadened to reduce rock quarrying costs. Rock size for Twin Falls was 2 1/2" x (4 3/4" x 5 1/4") Mini Cassia rock was 2 1/2" x (4 3/4" x 5 1/4") for the mixed feed Belgian kiln and 1 1/2" x 2 1/2" for the Union Carbide gas

fired kiln. Studies in 1979 indicated that the classification should be tightened for the mixed feed kilns. The rock size was changed to 2 1/2" x 3 1/2" in 1980 for all mixed feed kilns except at Nyssa which is 3 1/2" x 4 1/2". A program was implemented with TASC0 laboratory personnel testing rock classification at the quarry. With increased attention on rock and coke size and classification and kiln operation, the Available CaO increased from 78% to 83% at Twin Falls in 1980.

Further studies and negotiations made it cost effective to switch to Durkee Oregon rock at all locations in 1983. Available CaO jumped to 86% at Twin Falls in 1983, still short of the 90% level demonstrated at Nyssa.

Observations at Twin Falls indicated that mixing of rock and coke was insufficient. Looking into the top porthole in the smaller South kiln it was possible to observe a high concentration of coke on top of the charge after it came to rest in the kiln. Typically, the product from that kiln would have overburned rock and rock with significant unburned core coming out simultaneously. It was impossible to eliminate the core by adjusting the coke/rock ratio without overburning or having significant clinkers. Close examination showed that the rock and coke were still segregated in the skip. When the skip was dumped down the chute into the South kiln, significant quantities of coke would lag behind the rock and enter the kiln segregated on top of the rock. Mixing was better

into the North kiln since the rock would tend to override the coke as it proceeded down the chute into the kiln and thus provided additional mixing. However, there was still significant overburned lime and underburned core.

Space in the kiln area was not available to provide a really good design for mixing of rock and coke. During the 1983 campaign the coke scale at Twin Falls was raised and a separate chute was provided to spread the coke over the rock chute as the rock and coke scales were discharged into the skip. Mixing was greatly improved and the results were very apparent. By the end of the 1983 campaign 90% Available CaO was being achieved and has been since that time.

It is interesting to note that the daily production of Available CaO peaked out at Twin Falls in 1986. That was the last year the Steffens process operated. Also, the juice purification process was improved in 1987 with the addition of a DDS designed prelimer, cold mainlimer and hot mainlimer. With an 18% increase in slice it was possible to operate with 30% less lime. This has continued even with the implementation of the TASCO molasses separator at Twin Falls since non sugars are not recycled to the beet end. Lime and slicing capacity are not diverted to aid molasses desugarization processes.

There have been similar experiences at all TASC0 factories where improvements in rock and coke quality and uniform operation have been significant. Mixing problems at Nampa have been a problem. Vibrating feeders which control the weighing of rock and coke in the scales and mixing on the belt into the skip were replaced with Kinetic feeders. Much more precise control of weighing and mixing was achieved and resulted in improvement in kiln performance. All factories have improved their screening of fines from both rock and coke to provide a more uniform kiln operation and to minimize clinker formation.

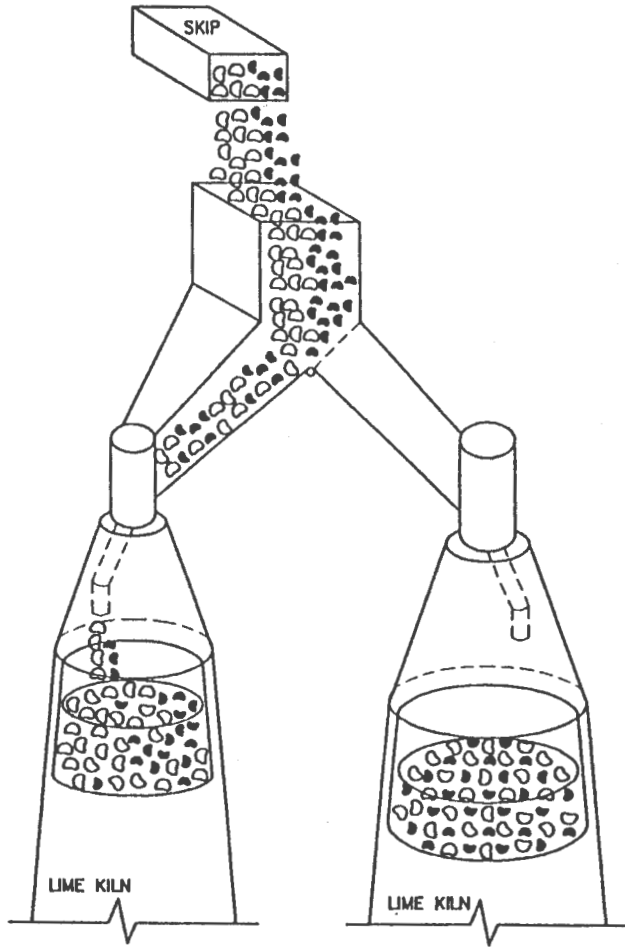
Uniform distribution into the kiln is also important as is maintaining a constant level, uniform draw and draft from the kiln. Some equipment has been implemented to aid in more uniform operation and making the kilns easier to control. PC controllers have replaced relays in most TASC0 kilns. This has improved reliability and has had a side benefit from rethinking the control scheme. The end result is a more uniform operation. The replacement of vibrator chutes with Kinetic feeders has greatly improved the mixing of rock & coke and draw from the kilns at Nampa. The use of a retractable plumb bob type level monitoring and recording device has been helpful at Nampa. It permits better control of kiln level. It can also indicate a failure of the distributor to the kiln. Ultrasonic level indicators are currently being investigated to minimize the maintenance required for the plumb bob type. An excellent temperature monitoring system has

helped kiln operation at Mini Cassia and a similar system is being installed at Nampa. Upgrading the gas compressor at Nyssa resulted in better control of kiln operation and both improved quality of lime and thru put resulted. Quality maintenance is also significant. If equipment is well maintained, the operators can concentrate on optimizing the operation rather than trouble shooting problem equipment.

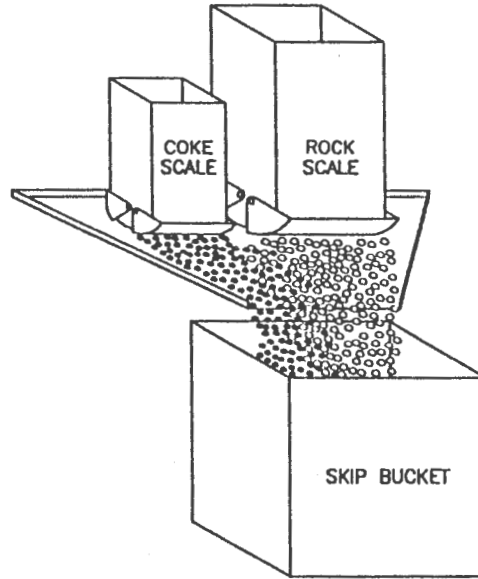
The people factor must also be addressed. It is important that capable and dedicated people be attracted to the lime kiln operation. In many cases the working conditions such as noise and dust must be improved not only due to OSHA requirements but to attract capable people as foremen and operators. It is important that the kiln operators be in the line of progression so that when people become end foremen and supervisors they are capable of supervising the kiln operation.

Attention to the basics of kiln operation is worthwhile. Significant improvements in kiln operation have resulted from improved rock quality and classification, improved mixing of rock and coke and improved equipment and control to provide a more uniform operation.

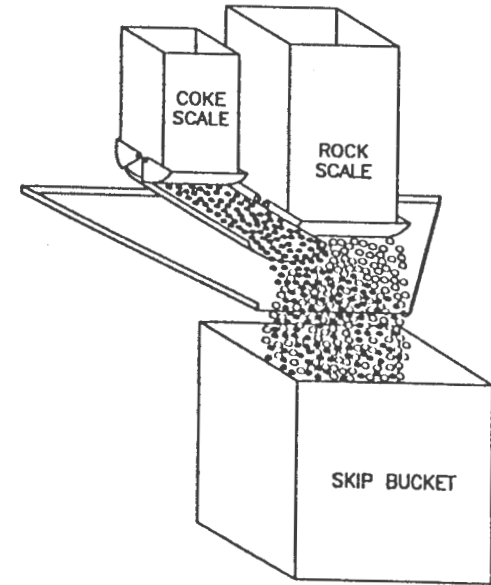
With some thought and care kiln performance can be improved.



COKE SEGREGATED INTO KILN



COKE SEGREGATED INTO SKIP



IMPROVED MIXING AFTER RAISING SCALE & ADDING CHUTE

