Any iron metalcaster who has lived through a changeover from one type of melting facility to another type, has found it necessary to make changes in his control practice.

If one tries to affect a major change in sand additives, it will be found that the circumstances will be similar to that of changing a melting facility, i.e., all laboratory tests take on new meanings.

Before trying a seacoal replacement, a sand system must be under control or the potential benefits will never be realized. The conclusion therefore will be—"It's not for our foundry."

**Differences in Sand Systems**

No two foundry sand systems are alike, even in a given foundry, because of a number of factors:

1. **Type of metal being melted and type of castings being made.**
2. **The selected pouring temperature range.**
3. **The type of gating system and pouring rates used.**
4. **The type or types of molding equipment and practice being used.**
5. **The sand handling facilities being used.**
6. **The mulling equipment available and attendant controls.**
7. **The amount of cores and the core practices and material being used.**
8. **The sand testing facilities available.**
9. **The economics and availability of sand and sand additives.**
10. **Personal preferences and control practices.**

Respect for the carbon equivalent test has become well established as an operating tool, especially in melting gray and ductile irons.

**Compactability Test**

Have you considered the compactability test as a similar operating tool in your sand control? The carbon equivalent and compactability tests can both be taken quickly and in the area of operations, that is, at the melting unit and at the muller or molder's hoppers respectively. They both indicate whether, under normal circumstances, the iron and/or sand is usable.

Neither test eliminates the need for other tests which indicate directions of trend and provide the data necessary for determining if adjustments need to be made in additives in the metal charge and/or to the sand going into the muller. Both tests give operators an opportunity to operate.

When adjusting a given sand system by increasing or decreasing the level of seacoal or replacing the seacoal with a dry or liquid petroleum derivative, by adding or removing cellulose, wood flour, and cereal, the desirable compactability range does not seem to change. In other words, the molders and automatic molding machines still seem to want to work in the same temper range.

The compactability test has put numbers on the terms "too dry" and "too wet," or "just right." However, if any adjustments are made in a sand system, as suggested above, and the compactability range is maintained, the result will be a change in the moisture to green compression ratio.

This means any foundry controlling the sand system by just moisture and green compression that makes an adjustment in their sand additives, will immediately run into
Our Foundry

Grande Foundries, Inc., Milwaukee, WI

Many times the statement is made that a new process or material "is not for our foundry". Is this always true? Before this statement can be made it is necessary to have the process in which the material is to be used under control. In this particular case the sand system is under scrutiny as new materials are tried and tested.

Complaints that the sand is "too wet" or the sand is "too dry". The tendency is to back away from the change before the sand can be evaluated, again with the feeling "it's not for our foundry."

Once the compactability test is accepted as a control tool for molding sand, a set of charts can be used that further enhance our ability to control the system sand.

The two existing compactability charts can be used to get three very useful numbers.

1. The relationship between compactability and green compression off of these charts gives us a number and as we become acquainted with these numbers, we can begin to put values on such terms as: brittle sand, too weak or too tough, etc. This relationship hereafter will be referred to as "working bond".

2. The relationship between moisture and green compression off these charts gives us another number and as we become acquainted with these numbers, we begin to realize that they represent the amount of moisture absorbing material present in our system sand. This relationship hereafter will be referred to as "available bond".

3. If the compactability versus green compression number is divided by the moisture versus green compression number from these charts, a percentage is obtained which becomes the third useful number. This percentage will hereafter be referred to as "muller effectiveness".

These three numbers do not eliminate the need for periodic loss on ignition, volatile, dry compression, screen analysis, methylene blue clay or any other tests which help to evaluate the total sand system properties. They do represent very effective control tools.

Compactability, Control

With the compactability control within process control range and the sand system stable through control of sand additives, the working bond, available bond, and muller effectiveness will each have their normal ranges.

Some examples of these numbers moving out of their normal ranges are:

1. No change in working bond, a decrease in available bond
and an increase in muller effectiveness, usually indicates a decrease in sand to metal ratio, or bond not going in as programmed. The latter will be more abrupt and very likely the next cycle of the sand system will be accompanied by a drop in working bond and a further drop in available bond if the cause is not checked. A sand to metal ratio change is usually self-correcting, unless there is a major change in the normal mix of work being scheduled.

2. A gradual decrease in working bond, little change in available bond, and a decrease in muller effectiveness can mean plows are getting out of adjustment. Very often the bond is increased to maintain the working bond so the available bond tends to increase and the muller effectiveness will continue to decrease.

3. An abrupt jump in both working bond and available bond, or just the available bond could indicate a dust collector over the muller is plugged or has stopped.

The point here is that the information from the compactability test and the above charts gives another dimension in which we can more quickly track down a cause, rather than just try to remedy a result.

It’s like having three known associated casting defects, which can point to a cause whereas having to try to establish the cause knowing only a given defect.

**8S Committee Report**

AFS Committee 80-A-2 Progress Report details the specific changes that have been found to occur when changing from seacoc to a liquid or dry petroleum derivative. **NOTE:** Tables I and II.

Rather than repeat these details, let’s analyze the results as they may affect our operations.

A. The bulk density of the system sand increases:

1. Several plants under study experienced a change in AFS Standard 2” diameter specimen weight from 155 grams to 165 grams. This represents a reduced sand density change from about 95 to 100 pounds per cubic foot.

2. Based on this change in density, a 5,000 pound muller load of sand would not produce the same number of molds. It would require about 5,000 pounds per muller load to maintain molding production.

3. By watching the amperage loading on the muller and being sure the plows are properly adjusted, it is possible to increase the muller load by this much. Also, because less additives are being used, the mulling time may be reduced by a few seconds.

4. If proper actions are taken, there is no need for a loss in production and an increase in production may be anticipated.

B. The muller effectiveness increases:

1. An increase in muller effectiveness from 50% to 60% or 55% to 65% has been noted in several plants being studied.

2. Let’s work the charts backwards and find out what this change means in regards to green compression and moisture if we momentarily fix compactability at 45% and available bond at 6.0:

   a. At 50% muller effectiveness, the working bond would be 3.0 (W.B. = A.B. M.E.). At 45% compactability, the green compression would be 17.0 psi, and the moisture 3.2% off the charts.

   b. At 60% muller effectiveness, the working bond would be 3.0 if available bond is at 6.0. At 45% compactability, the green compression would be 19.0 psi and the moisture 3.0%.

This change in the muller effectiveness is the result in a change in sand additives, in this case replacing seacoal with a petroleum derivative.

Now, if the bond addition is adjusted to drop the working bond and green compression back to 3.0 and 17.0 psi respectively, where the system sand was previously running, the mulling effectiveness will still hold at 60%.

This means the available bond and moisture drop to 5.0 and 2.4% respectively.

In other words, the moisture and available bond are reflecting the drop in bond addition, so it becomes impossible to duplicate all your old numbers.

Thus, the reduction in residuals in the system sand now forces some decisions to be made:

1. Seacoal replacements not for our foundry.

2. Hold the working bond and green compression as previously run and let the available bond and moisture drop.

3. Hold the available bond as previously run and let the working bond and green compression increase, with moisture holding approximately its old level.

4. Reduce the bond addition only slightly, to accommodate some increase in working bond with less drop in available bond and moisture.

Alternative #4 makes it possible to carry out a sand additive conversion, while evaluating its effect on making better castings more economically in an improved environment, and establishing new ranges for sand test properties for maintaining control.

**Premixed Additives**

Using premixed bond and combustible additives can be very helpful in the control of sand additives, especially if an additive is being replaced, raised, lowered, or eliminated.

1. It eliminates the variables of inventory shortage of one or two individual additives from time to time.

2. It eliminates unreported changes in the proportions of sand additives.

3. It reduces inventory space requirements.

4. It assists in the use of inventory control as a check on instructed or scheduled usage.

With the potential expansion or growth in the field of premixes, the suppliers are taking on greater responsibility for product reliability and metal casters must find a means of receiving inspection to minimize the potential hazards and achieve the positive benefits.

There can be definite environmental, economic, and process benefits attained in replacing seacoal with a dry or liquid petroleum derivative, such as:

1. A drop-in combustibles of 50 to 75% based on loss of ignition tests.

2. The sand system is cleaner as noted by molding, shakeout, and maintenance personnel.

3. The tendency for residual build-ups requiring periodic purging is reduced or eliminated, helping to maintain control over the system sand properties.

A new foundry material cannot be successfully evaluated without first having control of the process where it is to be tried out, and the desire on everyone's part to give it a chance to be evaluated.