THE MELTMINDER

A PUBLICATION BY BENTON FOUNDRY, INC.

Web Site: http://www.bentonfoundry.com

1st Quarter 2021

Benton Foundry Then and Now

Benton Foundry has made dramatic changes since 1975. At the time, a cupola was used to melt iron with coke. Coke is a product of coal that is heated then quenched with water to use as fuel to melt the iron. The coke came in different sizes and Benton Foundry used a (4" x 6") size. This was used to line the cupola bed. This consisted of several hundred pounds that was pre-lit before loading into the cupola. You had to know when to load and know when to tap out. The bed the coke sat on was sloped, so the iron would go downhill. There was air introduced through what are called tuyeres. The evenly spaced tuyeres forced air into the cupola to help promote the combustion and melting. The slag would rise to the top of the liquid iron and be extracted via a slag notch into a 400 lb. thimble of slag. The color of the slag would be somewhat indicative of how the day's melt was going. These slag pots had to be emptied several times a day, but you had to be sure they cooled so as not to catch anything on fire. The key to good cupola operation was to operate in a steady even flow, as you only had storage for several ladles of iron in the fore-hearth. In today's operation, the fore-hearth would be similar to the tundish ladle. There were several variables you had to allow for, such as the humidity that day since moister air would require more coke for the same temperature iron. Also, if the coke got wet, you would have to drive off the moisture before melting could occur.

There was a large overhang by the cupola to keep the crew out of the rain and snow and also to keep some of the melt material dry. There was a three-man crew that wheeled gates and coke into a charge bucket. The scrap was rolled into the bucket along with a large shovel full of limestone. The limestone came from the York, PA area, as it had to have certain elements in it to promote the fluidity of the slag. The green, glass-like appearance of the slag differs from what we see from the electric furnaces. The cupola was controlled by a wet scrubber system that was developed under PA Health Commission regulations of the late 1960s. These regulations were later superseded by the original startup of the Environmental Protection Act which gave us the PA Department of Environmental Protection. The shell of the cupola was not water cooled as most efficient cupolas are. As a result, the coke to metal ratio was extremely low. It was less than a 5 to 1 ratio. So 400

Then and Now

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lbs. of coke for every ton of iron melted.

Roger Green did this job for years (having to come in the middle of the night and reline or what was called putting up the furnace). This job was cold, wet, unpleasant, and had to be done or we did not run that day. We never missed a day due to Roger's tireless performance. Just ask him sometime about having to blow clay on the cupola shell to keep it from turning orange from heat.

There was a 50 ton per day goal. Since the cupola was not water cooled, the unit would heat up. On occasion we would try to pour 55 tons a day. This required keeping hoses nearby to cool down hot spots on the shell. At the end of the day, the remaining iron would be drained onto the floor in handmade pigs. These would be re-melted the next day. Also, a sled was placed under the cupola along with a prop that was used to support the bottom of the cupola. At the end of the shift, the prop

was hooked onto and pulled out, so that the doors would open, and the remaining coke would fall out onto the sled. Then a 150 pound ball of cast iron was sent up the charge bucket and dropped down the center of the cupola to clear any obstructions. This marked the end of production for that day. The hot material would be hosed down and the sled would be pulled out from under the cupola for safety reasons.

In the mid 1980's, Benton Foundry made the decision to pursue electric melting in a methodical, incremental fashion. This started by installing (2) four metric ton furnaces to supplement the cupola. This was completed in 1991, which was a time of extreme foundry consolidation. Benton Foundry's capacity needs were well in excess of the 55 tons/day of our cupola production. The vendor choice came down to Inductotherm and another vendor who never took the project seriously, given the economic downturn of the time. The four-ton furnaces featured dry coolers on the roof. This closed-loop poly-glycol system was somewhat ahead of its time and eliminated the need for process water and discharge cooling water. The large copper piping located by our scrap bins was well designed and continue to meet the purpose to this day with very little change. The (2) ten-ton furnaces followed in 1996. This project was completed

during a slower period since the new furnaces had to sit where the cupola was located. This follows the longstanding Benton tradition of putting equipment where it makes the most logistical sense, not convenience or short-term cost. The timing of this project and our inability to quote new work at the time, required our salespeople to basically be off the road for an extended period. One of our salesmen, John Bowen, became a tour bus driver on Nantucket just to stay busy. The ten-ton furnaces were the focal exhibit at AFS 100th show in Philadelphia where the first AFS show was held. Buying the floor model was like buying the car salesman's demo car, as it had all the bells and whistles. The furnaces were designed for both batch and heel melting operations, which was not generally done at the time. The layout of the furnaces was very compact; the scrap bins were next to the preheater, the transfer car was close to the vibratory feeder, which in turn fed directly into the furnace. This took the melting crew from 6 people for a 55-ton per day operation to 6 people on a two-shift operation easily producing 175 tons per day. In addition, the pollution control equipment on the furnaces only required a baghouse vs. the hard to maintain wet scrubber required for the cupola. The baghouse bags have a lime addition system that coats the bags to resist penetration and degradation of the bags. Also, the same dust collection system includes the moisture off the mullers and the exhaust off the preheaters. This system has worked better than designed with respect to environmental testing by a considerable amount. The heat off the furnaces also eliminates freezing problems often caused by the moisture off the muller. This was a traditional foundry issue. The layout of the furnaces so impressed Inductotherm, the New Jersey based firm that built the furnaces, that they dubbed the design concept "The Foundry of the Future." This has resulted in many potential Inductotherm customers coming to Benton for a tour. As we enter this decade, the furnaces are scheduled for further operational updates to stay current with modern technological advancements within the industry. This is just one of the projects that is being pursued by our new full-time electrical engineer, Colton Young. Colton has a BS degree in electrical engineering from Grove City College. Benton is committed to the future with its 300 tons per day furnace capacity which matches the design capacity of other departments.

Benton Foundry Breaks Ground for New Core Room

Beginning in April 2021, Benton Foundry will break ground on the largest expansion project in our history. New construction plus renovated space will total 71,600 square feet. In the core room, the bulk products will come into the South end of the facility; the sand will get prepared and distributed to the core making machines; then the cores will be assembled, dipped and staged closer to the molding machines. The goal is to streamline the core room, add capabilities, design protect for future resin systems and alternative materials and increase capacity from roughly 5,000 tons of core per year up to 10,000 tons of core per year. We will also design protect for the possibility of using reclaimed sand for the production of core. The process engineering was subcontracted through MT Systems.

This project will also include a new shipping room. The existing shipping room will get repurposed for auto grinding. The existing grinding room will be for cleaning and manual grinding. The circa 1975 cleaning machine fleet will be replaced as part of this project. BCT will be the vendor of choice. A 21 cu. ft. barrel drum, two 34 cu. ft. tumble blast units and a monorail system are all planned. We currently have 6 Vulcan robotic cells. We anticipate taking this to 10-12 cells, with the aim of robotically grinding 70-75% of all product shipped. We also anticipate the use of trim dies for the smaller, higher volume jobs. This should reduce the number of labor hours required. The manual grinding area is being designed by Monarch Industries. The architectural and civil engineering firm is Borton Lawson.

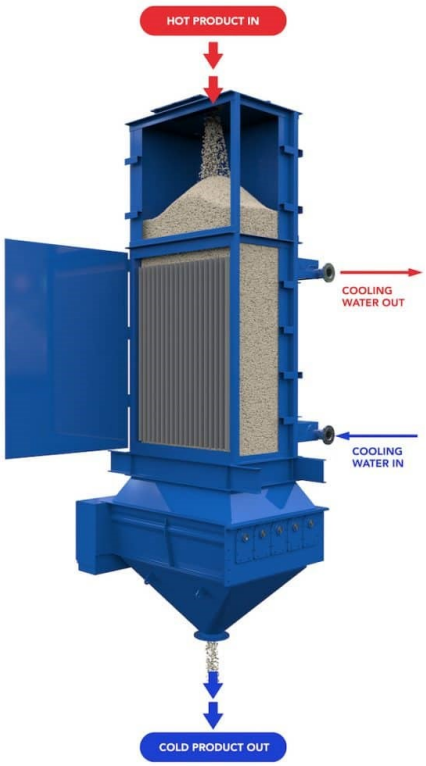
The advantages of the design not only improve capacity, but increase our capabilities, improve the control of the process, add functionality, and improve efficiency. One of the many improvements involves how we control the temperature of our core sand. The following article explains our new approach.

Progress in Metalcasting:

Conditioning Sand by Using Indirect Plate Heat Exchangers

In various regions of the United States there are swings in seasonal temperatures that can cause 70-degree Fahrenheit changes to core sand temperature in foundries. Consistent temperature control of sand in the core process is a challenge. The problem is further magnified when the sand delivery system is running intermittently or disruptions occur in the foundry process that results in the over-cooling or over-heating of sand. Not having this control can result in productivity loss, core scrap and casting scrap and rework. There is no doubt that these temperature variations cause inefficiencies in the core making process and reduce the core quality impacting the bottom-line profitability of the foundry operations.

The integration of Solex heat exchanger technology helps foundries ensure the sand is delivered at an accurate and consistent temperature. The indirect heat exchanger is essentially a temperature-controlled sand conditioning system ensuring core sand temperature can be controlled (even with ambient temperature fluctuations) within 1-degree F. This drastically improves on many current conditioning technologies where sand temperatures that may vary by as much as 20 degrees F.



The Solex advanced heat exchanger design keeps the working fluid separate from the sand and conducts the heat indirectly through the sand bed. This results in a very accurate and consistent temperature of sand delivered to the sand mixing operation. In addition, this temperature is maintained even when the sand capacity is intermittent, running continuously or stopped for a long period of time.

It consumes less energy in operation since it is a gravity fed, vertical column heat exchanger with material flowing in a uniform mass through a bank of hollow steel plates. The plates are fully welded ensuring the heat transfer fluid (HTF) is kept separate from the sand. The HTF and product flows are counter-current to gain greater thermal efficiency. A vibratory feeder or mass flow cone feeder ensures the sand flows with a uniform velocity and residence time through the heat exchanger. The feeder can also deliver precise rate or batch control. The picture to the left shows the indirect plate heat exchanger design.

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Indirect Plate Heat Exchangers

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Indirect Heat Exchanger Advantages

To further prove the system performance, Solex provided a closed loop heating/cooling fluid temperature module (FM). In the cold months when core sand is below ideal process temperature, the FM is heating water in the closed loop and when the sand is above ideal temperature it is cooling the water. In the core process, sand is blended with a small amount of ingredients including chemical binders, catalyst, and dry additives in a high-speed mixer. The ingredients begin a chemical reaction hardening process when discharged from the mixer to the sand hopper. An important step in this process is to maintain consistent temperature of the sand before it is blended with the ingredients. If the sand is too hot or too cold, the amount of ingredients added needs to be adjusted, which can create inconsistencies in casting quality, as well as wasting of raw materials.

An added advantage of the indirect plate heat exchanger design is that it will maintain consistent sand temperature even when the casting process is interrupted or shutdown. Some foundries could shut down over the weekend. With the Solex system the TCM can maintain the sand temperature during the shutdown period and the process can restart without delay or casting quality issues caused by inconsistent sand temperatures.

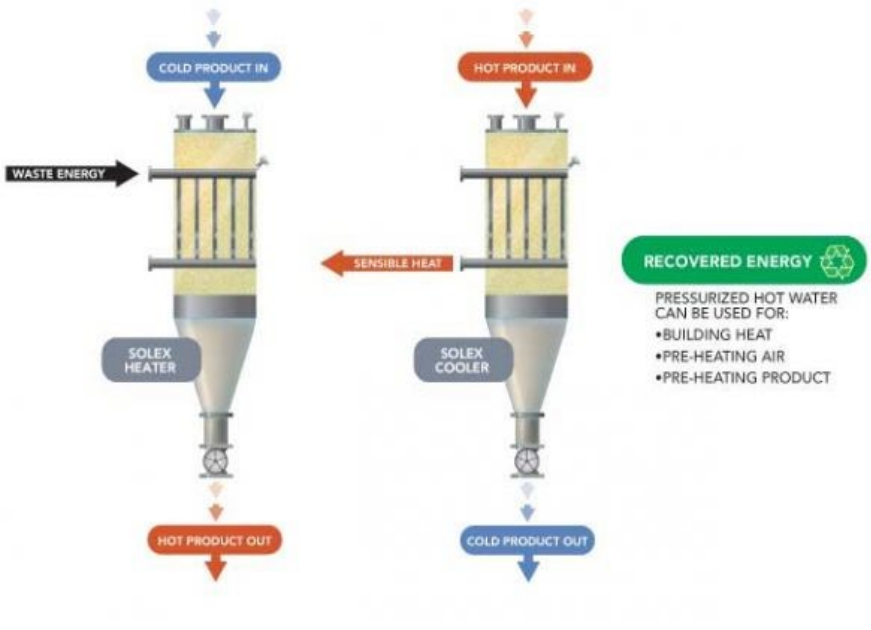
Existing shell and tube technology struggle with providing even and consistent temperature as it is a challenge to get even flow-through.

In a sand-casting foundry, it is critical to maintain the consistency of AFS-GFN (American Foundry Society Grain Fineness Number). Fluidizing heaters can change the AFS GFN of the sand before going to mold. Great care needs to be taken when designing equipment to prevent and eliminate sand segregation. Indirect plate heat exchange technology offers this advantage since there is neither abrasion nor segregation occurring within the equipment.

Sand is an abrasive product so there is always concern of wear to process equipment. The Solex indirect plate heat exchanger equipment is designed to form a pile of material above the leading edge of the plates. This ensures no impingement between the product and the plates. The bed of sand can then slowly flow past the plates alleviating the chance for wear. In addition, for processes that undergo several fill/empty cycles per day, plate caps can be used to protect the plate leading edges.

Maintenance is almost zero with no moving parts, low energy input and thus no wear parts to replace. The HTF cooling water is enclosed by the plates and kept fully separate from the ambient air and core production sand product. This virtually eliminates any build-up of material that could interfere with efficient and reliable operation. Water contamination and downstream drain and pipe blockages are also eliminated.

The system maintains the highest obtainable efficiency using water indirectly as the heat transfer medium. Fluidized beds require blowers, ducting, and cleaning equipment.



The Solex heat exchanger has a compact design and footprint with easy access to heat exchange plates with no moving parts or pinch points for safety.

Other Challenges in Metal Casting

Metal casters experience other challenges aside from consistent temperature control, which we have already discussed. Other notable challenges are inefficient binder usage and silica dusting. Precise sand temperature control is vital to binder optimization. Lack of accurate sand temperature control results in excessive use of expensive binders to compensate. This is a costly and inefficient way to deal with sand control issues in the core-making step of the process.

The current use of fluid bed technology for sand temperature control introduces direct contact between the air heat transfer fluid and the sand product. This highly energetic, blowing air results in silica dusting that contributes to safety risks to personnel from the exposure of respirable crystalline silica. Indirect heat exchange technology reduces the risk of silicosis due to the gentile handling of sand fugitive silica. The silica dusting is reduced and ultimately contributes to a safer and healthier work environment. *Source: https://www.solexthermal.com/resources/case-studies/foundry-sand-conditioning-usa/*

What is Your Carbon Footprint?

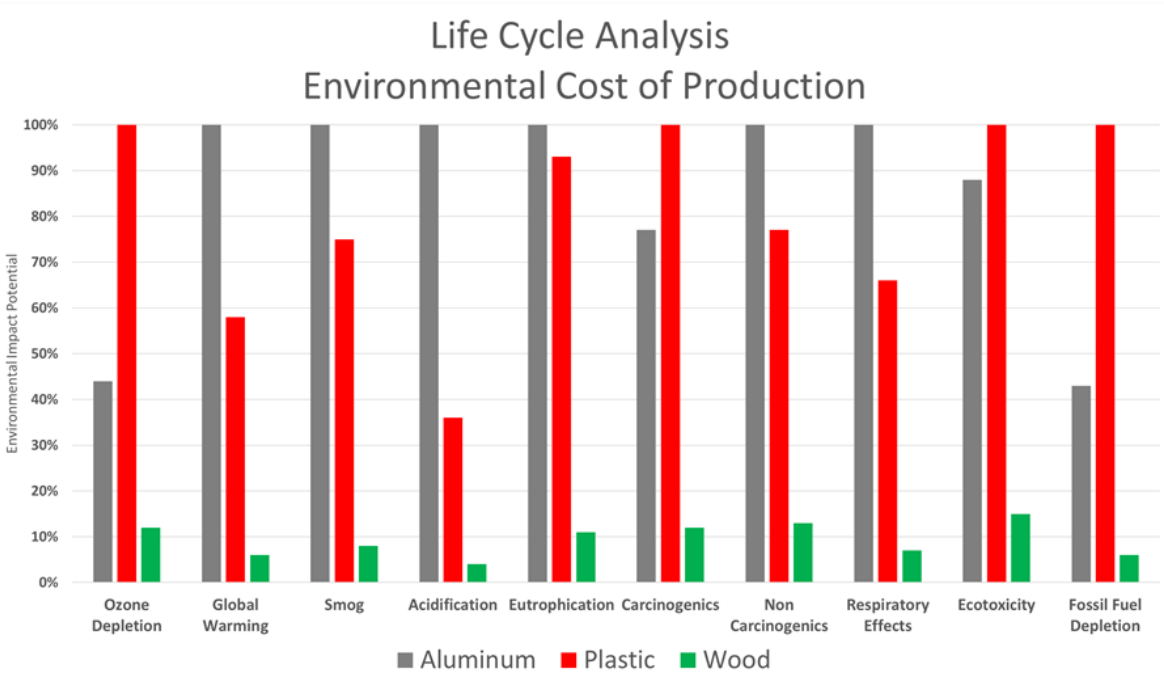
A carbon footprint is the amount of carbon dioxide released into the atmosphere because of one's own energy needs. The choices we make every day and how we decide to live affect our carbon footprint. When determining one's carbon footprint transportations, electricity, food, clothing, and many other everyday products need to be considered.

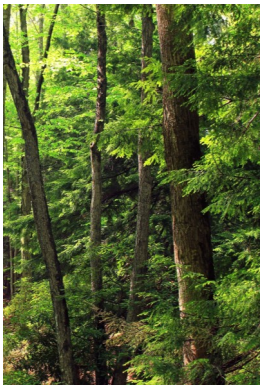
There are many ways to reduce one's carbon footprint. Some of the most recognized ways are to use energy efficient lightbulbs, to turn off lights and electronics when not in use, and to carpool or use public transportation. A very practical, yet less recognized, way of reducing one's carbon footprint is to use more wood products. Since wood products store carbon, choosing them over alternatives such as plastics and metal helps to reduce one's carbon footprint. Wood products can be utilized in many different applications: construction lumber, furniture, flooring, cabinets, utensils, etc. Wood can also be used for heating needs; choosing to burn firewood or wood pellets for heat compared to oil and coal can significantly reduce one's carbon footprint.

Ways To Reduce Your Carbon Footprint:

- Choose more wood products for your home
- Use wood building materials instead of alternative choices
- Use biofuel such as firewood and wood pellets
- Choose locally grown/manufactured items
- Swap out old light bulbs for new energy efficient LED bulbs
- Turn off lights, television and electronics when not in use
- Walk, bike, carpool, or use public transportation
- Choose paper bags over plastic
- Reduce, reuse, and recycle

Another way to help reduce one's carbon footprint is to consider the environmental costs of products that you are looking to purchase. For example, lets look at the lifecycle analysis and environmental impact of a chair. Lets compare the environmental cost of producing a chair in plastic, wood and metal. Considering the ozone depletion, global warming potential, smog, acidification, eutrophication, carcinogenic, non-carcinogenic, respiratory effects, eco toxicity, and fossil fuel depletion. Compared to wood, the environmental costs of producing plastic and aluminum are astronomically high. Wood is by far the "greenest" building material! Choosing the wooden chair over the plastic or aluminum chair is an environmentally conscious decision that is conducive to a low carbon lifestyle. ***Choosing WOOD makes a difference!***





Central Pennsylvania Forestry, Posted by David R. Jackson July 21, 2020 Source: Haviarova, Associate Professor of Wood Products at Purdue University

Congratulations - Employees of the Quarter

Congratulations to **Ryan Keeler** (above), Benton Foundry's 1st shift Employee of the Quarter. Ryan works in our Core Room as a Core Machine Operator. He has been employed since January of 2020. Ryan lives in Benton with his wife Miranda, and their two children. He enjoys hunting, fishing and spending time with his family when he is not at work. Ryan was nominated for this honor due to his consistent production levels and his dedication.

Way to Go!

Congratulations to **Dave Straub** (below), Benton Foundry's 2nd shift Employee of the Quarter. Dave has been employed at the Foundry since 2010. He works in our Molding Department as a Machine Operator. Dave resides in Watsontown and he has won this award in the past. Dave enjoys spending time with his son Marshall, his granddaughter Macie, and his cat Chubbs. Dave was nominated for his consistent production levels. Dave has also been willing to offer a hand in the Grinding Room and the Melt Department when he is not molding.

Good Job!

Gate Crusher

Last spring, Benton Foundry installed a Viking Technologies ALP 1200 hydraulic gate crusher that breaks the large stringy gates into smaller pieces that are easier to handle and provide a denser charge. The density of our returns for remelt doubled. This resulted in a 40% reduction in charge time, fewer picks by the crane operator and a lower KWH/ton. The denser charge material also reduces the risk of furnace bridging from interlocked and stringy charge material. PPL approved ACT129 funding for the project and in their final analysis confirmed savings of 906,281 kWh/yr and provided a rebate of $54,376.86. The project was spearheaded by Ed Gill with support from Colton Young.

Awesome Job!

Thank you!

Fishing Creek Sportsmen's Association
P.O. Box 331
Benton, PA 17814

March 16, 2021

Benton Foundry,

The membership of the Fishing Creek Sportsmen's Association would like to express their sincere gratitude for the donation of the Bentonite material that we will use to help stabilize the raceway leading to our trout nursery. The past floods and tree loss, due to the tornado, have greatly weakened the banks in various spots and every substantial rain causes the banks to leak and erode. We have been working over the last year to correct the situation by using stone to fortify the bank and we will plant trees to stabilize the soil. The Bentonite material will be an added bonus to our efforts.

The Benton Foundry has always been a huge supporter of our club's activities and we appreciate your partnership in these projects. Thank You!

Sincerely,

Members of FCSA
Chuck Musitano (Secretary)
Rick Wilson (Membership Chairman)

Engis Corporation

Engis Corporation provides the super abrasives which are black diamond coated. We have switched all robotic abrasives over to this vendor. They provide great research and development. Presently, Ed Posluszny and Scott Vandine are trialing a 7"disk wheel on the floor in an Atlas Copco Turbo Grinder. Preliminary results look good. Engis' direct sales person, Rolland Smith, has been instrumental in giving Benton state-of-the-art abrasives. Engis recoats the wheels at a much lower cost than the original purchase price. Engis is a significant improvement over the previous vendor. Ordering is much smoother, as we now know where all orders stand and Engis carries the hubs for us. If a wheel cannot be recoated, a new wheel hub is coated and put with order so we are not short on wheels. We recently trialed and went to a courser diamond that made the wheel slightly more expensive, but had significantly better performance.

The US Secretary of Commerce Wilbur Russ, recently notified AFS member Engis that they were selected to receive the President's "E" Award for exports. This is the highest award a US company can receive for making a significant contribution to the expansion of US exports.

Good Job!

- **Job Well Done** to **Mike Mitchell** and **Teo Grigas** for helping out in the Molding Department.
- **Randy Kadtke, Chad Davis and Teo Grigas recently completed AFS Gating and Risering 201.** ***Way to Go!***
- **Thank you** to all the **grinding volunteers** and **a special thank you for those working the weekend shifts.**
- **Thank you** to **Colin Jandrasitz** and **Chris Newhart** for helping with the Laempe workload.

We are currently going through unprecedented times. On the heels of a global pandemic, we are seeing a rapid economic recovery in the manufacturing sector. This has required many employees to work extra hours and, in some cases, take on new responsibilities. **Thank you everyone for helping us get through this transitional period.**

The Lockhorns

By Bunny Hoest and John Reiner

Knoebels

Birthdays

May	June	July
Ed Posluszny	Brock Smith	Daniel Ide
Sam Henne	Glenn Cregar	Frank Packer
Cynthia Newhart	Jackie Showers	Albert Phillips
Tyler Johnson	Nicolas Wilson	Tyler Terkowski
John Hospodar	Tyler Kristoff	Steve Saxe
Cheryl Brown	Bob Houser	Ben Gonzalez
Cody Snyder	Xenia Ponce Contreras	Don Copeland
Edwin Zavala Vela	Colin Jandrasitz	Bobby Campbell
Bo Boston	Boyd Lore	Elizabeth Strauch
Gary McCoy	Chris Magliocca	Santino Capriotti
Travis Hayman	Brent Morphis	Theresa Kubasek
Lynn Miller	John Harvey	William J. Ferguson
Gary Younkers	Irving Wolfe Sr.	Tim Schechterly
Chad Davis	Mirna Rojas Amaya	Amanda
Matt Kittle	Rob Swigart	Carrasquillo Lopez
Rob Smith	Dave Eveland	William E. Ferguson
Deb Fagan	Jordan Winn	Fred Kessler
Justin Lloyd	Taylor Berkey	Kevin Trychta
Steve Farver	Joy Wolfe	Rob Bowman
David Emmett	Cody Bown	James Lechleitner
Crystal Applegate	Caroline Woodhead	Dave McLucas
		Deb Clocker

Happy Birthday!

Trivia Question???

Which US State has the longest cave system in the world?

Answer will be in 2nd Quarter 2021

Answer from 4th Quarter question:

What is the Ford Mustang named after?

World War II P-51 Mustang Fighter Plane

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Company Referral Plan

Refer a Potential Employee to Lou
(Before They Come In)
If Hired, After
6 Months of Employment
You Get $250.00

IRONY

Research Digest

"The Wisdom Well"

"The further a society drifts from truth the more it will hate those who speak it."

~George Orwell

BENTON FOUNDRY, INC.