(text in red added in 1-7-2014 revision)

FMC in the Kanawha River Valley

The Indians knew about the salt. In 1755, they drug Mary Ingles down the Kanawha River right past where the Elk River joined it, and she noted the salt licks they used. In 1788, Daniel Boone lived across the river from the salt licks. Early settlers drove hollow logs into the soil within sight of the river and dipped out brine solution to boil off and make rock salt. They ignored the natural gas that sometimes came out of their salt wells. The combination of salt, natural gas, and coal, all within 50 miles of the Ohio River, made the Kanawha river valley a logical location for the industries birthed by WWI and boomed by WW2.

In FMC's 1960 pamphlet titled "***Salt Industry in the Kanawha Valley***" (attached), the history of salt and the FMC chlorine production in the Kanawha valley is discussed. The predecessor to the FMC chlorine plant was a chlor-alkali plant in the valley that was started by the Warner-Klipstein Company in 1915. By the 1920s, the Westvaco Chlorine Products Corporation took over the Warner-Klipstein production. The pamphlet states: "By the end of the 1920's, the plant had become the largest chlorine producer in the world". (This is a significant claim since thru WWI, Germany dominate world production of chlorine.) In the 1920s, the salt brine for the chlorine plant was pumped out of brine wells on the plant property but those would prove insufficient. Also during the 1920s, the Carbide and Carbon Chemicals Company (eventually "Union Carbide") started their South Charleston plant adjacent to the Westvaco plant. Carbide used chlorine from Westvaco to produce antifreeze they had developed and named "Prestone."

In 1948, Westvaco Chlorine merged with the Food Machinery Corporation. The new company was renamed Food Machinery and Chemical Company (aka "FMC") and the South Charleston plant was initially operated as FMC's Westvaco Chlor-Alkali Division. By 1960, it was simply called FMC's Chlor-Alkali Division.

The pamphlet says that, by 1960, FMC was producing a long list of chemicals in the valley: Chlorine, Caustic, Dry Caustic, Carbon Disulfide, Carbon Tetrachloride (first US production), Ammonia, Fumigrants, Potash, Bromine, Ethylene Dibromide, Hydrogen Bromide, and, ***our favorite material, Dichlorocyanuric Acid*** (aka "Dry Bleach", "Di-Chlor", or "56"). Missing off this list is hydrogen peroxide (when did the hydrogen peroxide unit start-up?) (1/7/14 comment from Harless: FMC's Peroxide plant started up in late 63'. FYI: I went to work the 16th of Dec.63' that Friday evening I was drafted to work overtime doing the first Alumina Change…. 'Alumni' was a catalyst filter that was submerged in oil to clean the product during processing and had to be periodically discarded.. maybe monthly.)

Another source (Romano) stated that the Bechtel Corporation built the Bleach plant in the early 1960s. Harless states that Bleach plant started in 1963. Since Di-chlor is listed as a product in the 1960 pamphlet, did FMC produce Di-chlor somewhere else in the valley before 1960? (Harless comment in 1/7/14 email: FMC's early Dry Bleach....It was produced in the East Plant just east of a building called 28-3 (99% Caustic production). It shut down after 64'.) Also, does anybody have a history of the bleach plant expansions?

In the early '60s thru the early 70s, FMC also started producing armored vehicles like the M110 Howitzer, the M113 Armored Personnel Carrier and its variants, along with trying to build railroad cars, in the main Ordinance Center. (Romano).

By any measure, FMC ran a huge complex and had large employment (thousands) within South Charleston from 1960 thru the early 1970s.

A couple of other interesting web links provided by Ben Paschall:

http://en.wikipedia.org/wiki/Interstate_64_in_West_Virginia

http://www.wvencyclopedia.org/articles/1107

Excerpt from an 11/2012 Article by Herman Harless:

"In the late forties the Chlorine Plant was sold from Westvaco to FMC. It had been on the books to be scrapped as there was very little market for Chlorine and almost none for Caustic. FMC increased the use in Agri-chemicals and produced a product "Tri-Chloride" to use in DDT. Post War II and the Korean War times saw a rising demand in all chemicals. FMC poured in new funds with a new Hooker Cell Room and began working on Hydrogen as a by-product and ended up producing hydrogen based solid rocket propellants for the first space programs.

They did a joint venture with Diamond Chemical to produce Carbon Tetra Chloride for refrigeration and fire extinguishers and tripled it in size in a very few years.

In 1958 Robert Byrd was able to secure the old Naval Ordinance Plant for a pittance for FMC and the rush was on. With the Ordinance Plant building Armored Personnel Carriers…APCs, the north side of R. 60 was given to the Chemical works as well as the area of the Peroxide Plant and Main Office.

The New Bleach Plant was built in 1963 inside Bdg. 302 and Bdg. 304 was used as storage. (Update via 1/7/14 e-mail from Harless: "that should be 305 for storage….In explanation and because of that impact: In Feb. 1968 Bdg 305 burned 13 million pounds of stored bleach. It was the largest building north of Rt 60. I worked the next 99 days at 16 hrs per day and then dropped back to 14 hr days for two months without a day off. Many of us feared the community impact would shut down FMC then.) The Mill Water intakes and the Sewage lift station were manned by the FMC Power Department. They also manned the DC Power conversion and distribution for the Ordinance Overhead Cranes and the Fire Water Pumps in a substation at BDG 312 on the south side.

Lots of money was invested in expansion then. The pipelines down the river to take Steam to an expanding Carbide Plant on the hill, Fly Ash to the newly acquired Beaver Pond, Clearing the Naval Housing area for in a City Park, and major additions to C&O RR switching and siding yards along the old Kanawha Turnpike. (Later some of them gave way to the interstate.)

IN 1960 FMC ramped up and started serious numbers of hiring. In the fall after high school graduation I took lengthy tests for employment along with several hundred others across several months. The initial hires in '61 were a group of 25+ that were destined to be supervisors. Steve Matthews was in that group. Over 20 of them finally were foremen. The hiring was continuous in small groups over the next several years. I went in '63 in a group of ten, over the remainder of the year there were probably two more groups.

The Bleach Product was a failure then….it lumped and became solid in the drums and could not be sold. In Aug. 64 they shut down Bleach, kicked 28 union employees back to the Labor Pool and initiated the start of Lay-offs that reached to 50 men and that recall was not for over a year.

In the early '70's Chemicals began to wane in the valley. I spent a week's vacation locally and in driving up and down the entire length it was very obvious that it was 'moving out' and leaving big vacant areas.

The small chemical Companies sold and closed. Elk Refinery was the start then small ones in Nitro then the joint venture like Barium Reduction at the So. Chas. location inside Carbide. Carbide and FMC gobbled up some of them for their patents or technology.

FMC was able to convert American Viscose into a major production plant for Vinyl Chloride used as a mastic base and paint base and a major money maker until the process produced a serious carcinogen and they lost a major law suit to that effect.

That was the Death Knell to the Chemical Industry in the Valley. They became liable to the strengthening EPA and Government Regulation and began moving out of the cities and into the wilderness and even out of the country to avoid the restrictions.

DuPont quietly enlarged and produced a variety of new chemicals that took the market by storm…nylon and polyester bases for the clothing industry's boom in the '70's. But the same concerns and a major release of Ammonia which killed several ponies in a field west of the Plant got public resistance started against them.

Business Management Philosophy changed and Corporations began selling off small units and expanding large ones. Small ones continued to be gobbled up or closed. Goodrich Gulf Rubber was bought by Carbide Institute for the land and the production unit closed and scrapped.

FMC began losing ground in the '70's with problems with Carbon Tetra Chloride and pollution. The Asbestos and Lead problems loomed and their infrastructure was blatantly in violation of new standards. The highly experienced work force was approaching retirement and replacement began early.

By late '77 the National economy was down and sales were down profits were bad and so units were shut down and the layoffs of '78 began. Many, with one to five years seniority, were let go and the units scrapped. Lots of units ran minimum production to just stay online.

Retirements caught up and in 1983 FMC offered its first incentive package and 1200 years of experience exited the plant in one day.

Those of us left struggled with the gaps in the unwritten systems. Nothing got done on time and the mood became depressive and negative. When FMC came up with a video and a campaign for employees to give back wages and benefits as an effort to keep things going it was rejected.

When the local employees asked if the Plant was for sale the corporate rep replied that "we were unique, like an antique car sitting there all shiny, everyone came along wanted to buy it but didn't want to pay the price it was worth. We are not trying to sell it…" A year later Olin bought it.

All those things were superficial; the real issues were the EPA and liability. There they sat on a hundred tons of asbestos and a whole infrastructure painted with red lead. They were the state's largest consumer of electricity from a coal fired power plant that only promised rising costs in every direction. They had dumped scrap chemicals over a mountain for over fifty years and the bottom of the river showed two feet of nearly pure raw chemicals and a large part of that was Carbon Tet and Carbon bi-Sulfide.

To legally remove that liability FMC reorganized the remainder and renamed it the Spring Hill Plant so that FMC So. Charleston and its liability were forever gone.

I am working on a list of who went to MIC at Institute when we split in 85. There were about 25 that manned that unit for several years. When it closed up some of those employees kicked back to Peroxide until retirement there.

Another half dozen went to 'Carbolic" a CO2 plant at Bell. And another group went to a refinery at Applegrove down on the Ohio River.

Note of people interest: It was common knowledge among the citizenry of the valley during the '50's' , '60's and '70's that South Charleston, WV was number four on the "hit list" for total destruction by Nuclear bombing should the cold war escalate or a full fledge war break out due to the major resources of the chemical industry for war efforts."

Excerpts from Judy Romano 11/2012 E-mails (volunteer for the South Charleston Museum):

"According to an article written by the WV Historical Society Volume XVIII No. 2 dated April 2004: FMC in 1978 employed over 1300 people and was noted as the 28th largest chemical producer in the US in 1986 (MIT 1989).

I worked at Bechtel Corporation and they built the bleach until for FMC Inorganic in the early 60's and in 1962 started working for FMC Ordnance we had several thousand employees and made M110's M113',xm578's and flame throwers and dappled in railroad cars. They closed in 1969 and then Ray Park bought the facility in 1970. The interstate was completed in our area in 1975 and they demolished the Red Roof Inn and a home under the I 64 bridge was moved out on Pennsylvania Avenue in St. Albans they also demolished several homes one belonging to Bob Anderson our CVB director he then moved up next to the gold course.

The history of the Ordnance site is as follows:

1917-Naval Ordnance opened, then Carnegie Illinois Steel Company-1940 US Government-1962 FMC Ordnance then Ray Park in 1970."

Excerpts from 1st Qt 1985 "Pipeline" (FMC Newsletter - attached):

"Several years ago each of you were shown a video film that outlined problems in the South Charleston plant. I am sure most of you remember the dramatization of two employees discussing the shutdown of the FMC Avtex plant in WV and thought that it might happen here. Well, through those tough times and recession FMC South Charleston is still operating. In 1984 we had the best safety year in recorded history; top flight environmental performance, also the best on record; increased reliability; an all-time production record in one department and the best in five years in another; another restricted only by the market; and teamwork supreme. We are viewed as having the best labor relations in WV and stand as a national example….. Woody Wayland."

Sounds great, doesn't it? Those words were not very prophetic and seem optimistic beyond reason. Five months later the Bleach plant was sold and the main production plant was closed. Hundreds of people lost their jobs. Only the Peroxide unit and the Powerhouse remained in operation by FMC in South Charleston after Q4, 1985.

(Olin had a completely different concept about what "having the best labor relations in WV" meant. There was a clear legacy of FMC allowing intimidation, lack of respect, and failure to follow well understood

workplace standards, This resulted in FMC suffering suits from employees, and they encouraged those suits by large, out-of-court settlements. When Olin took over the plant a few months later, the strategy was to have both personal and business needs met by requiring people to work safely, to treat each other with respect, and to follow common sense work rules. After hearing of what had happened to people under FMC in the bleach plant, Olin was not going to tolerate such behavior. Union or non-union, strikes or no strikes, Olin was not going to allow people to behave the way they had in the past in the Bleach plant. But, I am jumping ahead of the story…..)

Leading Up to the Sale

Olin produced phosgene which was a raw material used to produce TDI (Toluene diisocyanate). TDI was then used to produce urethane foams which in turn are used in furniture cushioning, automotive seats and carpet padding. Olin first made toluene diisocyanate (TDI) at a plant in Ashtabula, OH, in the early 1960s. They quickly built a much larger TDI facility in Lake Charles, where they also made phosgene. In the late 1970s, Olin poured money into the Ashtabula plant trying to make it more competitive. About 1980, Olin decided to shutdown the Ashtabula plant, and depend on its Lake Charles TDI facility for TDI production.

In 1981 or early 1982, Olin bought the TDI portion of the Allied Chemical plant located just outside of Moundsville, WV, on the Ohio River. (The entire complex produced a long list of nasty chemicals, and the site is now being administered as an EPA Superfund clean-up site. Link: http://www.epa.gov/reg3hwmd/npl/WVD024185373.htm) The complex also had had a mercury cell, chlorine plant that Olin did not purchase. According to Zappitelli. the chlorine plant was not running when Olin went into the Moundsville complex. Olin shipped chlorine to Moundsville via railcar while Olin was there.

The Ashtabula facility had shutdown a year or two before Olin purchased Moundsville. One of Zappitelli's last roles at Ashtabula was finding jobs for Ashtabula employees at other Olin plants. The shutdown of the Ashtabula plant, like all plant shutdowns, was catastrophic to the local community and employees. But, it was done, as much as possible, in an employee friendly way. Olin was paternalistic about taking care of Olin employees and worked hard to cushion the loss of jobs.

When they bought the Moundsville facility, several people from Olin, who had gone to other plants from Ashtabula, relocated to the Moundsville purchase. (All of these individuals eventually came to the Bleach plant in 1985). Participating in the purchase and operation of a chemical plant was a new experience for the Olin personnel who went to Moundsville from Ashtabula. Long term Olin employees who went to the Moundsville plant included:

- Gene Zappitelli, HR,
- Larry Matson, Production Management
- John Grandbouche, Maintenance
- Grant Offenberg, Maintenance
- Jim York - Production
- Dick Brendler, Chemical Engineer

It seems as if Olin's strategy for the Moundsville plant was to evaluate its potential, then, take its productive capacity out of the marketplace if it was not a "home run." By 1984, Olin must have decided it was not a "home run" and abruptly shut down the plant with no notice. Zappitelli said "Fred Smallwood (Corporate HR) came to the plant and just told us ***Olin is shutting it down so pack up and go home***". According to Zapp, production was stopped immediately and people were immediately escorted out of the

plant. If they left personal property in the plant, they did not get a chance to go back in and retrieve it. There was little consideration or effort made to help the plant employees. It was like, since the 150-200 employees were mostly from Allied, Olin had no obligation to take care of them.

Almost none of the original Allied employees found a job within Olin. Some of the Olin employees also found themselves without jobs, but, many were "parked" at other locations (primarily Lake Charles).

One of the Allied employees who lost his job was an area manager at Moundsville named John Trouts. Ironically, Trouts eventually became the VP of manufacturing for the swimming pool side of EcoLabs. EcoLabs was a primary competitor of Olin in the swimming pool chemical business and probably participated in complaints to the Federal Trade Commission that claimed Olin's purchase of the Bleach Plant was a violation of anti-trust rules. (In 1968, FMC burnt down a warehouse of bleach adjacent to MacCorkle Ave. Later, both Olin and EcoLabs had spectacular fires within warehouses that stored swimming pool chemicals. Both of their fires occurred within miles of I-75. The EcoLabs fire in Atlanta, and the Olin fire at their Charleston, Tn, plant. Because it was a strong oxidizer, dry bleach is a dangerous fire hazard). Trouts left EcoLabs and became a plant manager for a couple of locations of Arizona Chemicals (wholly owned by International Paper). I ended up working for Trouts at the Dover, Ohio, Arizona Chemical plant.

Trouts characterized the Olin shutdown of their portion of the Moundsville plants as abrupt and cold. "They just came in and said, "You're laid off, effective immediately". People were stunned beyond words and I saw full sized men cry." Zapp said the same thing. "Many employees just sat down, put their heads in their hands, and cried."

Everybody I spoke to recognized that the Moundsville plant was probably unsustainable and would not be competitive in the long term. I think people probably recognize that there was a strong business reason for shutting down the plant. But, most involved were caught by surprise when they were told to go home. The abrupt shutdown of the operations blindsided most of the employees. The lack of help or support by Olin for the employees and the community left people angry. Any Olin employee left in the community was, by default, held responsible for the Olin action. All long term Olin employees moved away from the Moundsville area as soon as they could.

Richard Campbell later reflected that, "Shutting down the Moundsville plant was good for the Lake Charles TDI business. It took the capacity off the market, and, eventually the Lake Charles TDI plant had to expand. They told Matson and me we could stay living in the Moundsville area until they found something for us to do. That wasn't going to work so we both immediately relocated back to Lake Charles".

When Olin took over the Moundsville plant, Olin's Richard Campbell was the new plant manager with only a few of his staff being Olin employees. Many Allied managers remained in key positions. The pros and cons of keeping key, incumbent, managers after a take-over, has resulted in three broad strategies companies can apply:

1. If no major change is required, and the take-over firm is satisfied with performance, it is common to retain many if not all incumbent managers. This is also problematic if the take-over company cannot provide adequate staff to replace incumbents. An example of this strategy is what happened when Israel Chemicals purchased the Bleach Plant from Olin.
2. Many times, a few key managerial positions are filled with take-over personnel, and the rest filled with incumbents. The risk is that, if major change is required, the incumbents are resistant and sometimes counterproductive to implementation of the new company philosophies. When Dow

purchased Union Carbide, they told incumbents in the valley that the new managerial staff would be half Dow and half UCC. The UCC incumbents either would get on board or be replaced quickly. Dow then did it that way. I saw an excellent manager (by Olin standards) from UCC resist the "Dow way" and get replaced for not conforming. This was the general strategy Olin used when they took over the Moundsville plant.

3. The last option is to do what Olin and Campbell did at the Bleach plant during the 1985 take-over. The Moundsville experience seemed to have convinced Campbell and Olin to have their own people in all key, staff, positions, for the 1985 take-over by Olin of the bleach plant. So, in 1985, all of Campbell's direct reports were all from Olin. That decision was a key strategy for implementing the change that was about to occur at the Bleach Plant.

The Moundsville experience also prepared Olin well for the labor and business law environment within West Virginia. They formed a relationship with a WV attorney named Bob Steptoe, of Steptoe and Johnson. Steptoe was a related to the founder of the firm and concentrated on labor law, primarily within West Virginia. He was used for legal actions such as WV Human Rights Commission hearings and civil actions against the company. I am not sure if he was used for arbitration meetings for Union contract resolution at Moundsville. Since we were non-union at the Bleach Plant, he was not involved with arbitration with Olin at South Charleston.

Olin continued to use Bob Steptoe for the Bleach plant requirements. Gene Zappitelli once told me, "Olin never lost a case with Bob Steptoe".

Many years after the Olin takeover, I was involved in a WVHRC hearing with Bob Steptoe representing Olin. We had been hiring hourly employees, using incremental steps where applicants had to sequentially go past testing, interviewing, reference checks, and then chemical plant operator training before they would be hired. One applicant, during interviewing, claimed he had "retired" from the Institute plant as an operator. During reference checks, I found out that his references thought he had been terminated in some fashion. As usual, when I found discrepancies between what was said in an interview and reference checks, I called up the applicant to ask him to explain the discrepancy. The applicant explained how supervision at the Institute plant had been "pushing him" and how he had suffered a mental break down due to work induced stress. He had applied for and been denied worker's compensation for his "illness" but his attorney thought he had a good case. He then asked me, "This won't affect my chances of getting a job at Clearon, will it?" I explained to him that we used all aspects of the hiring process to determine who went forward to the next step. When the hiring committee (made up of hourly and salary) reviewed the results of his interview and reference checks, we decided not to let him go forward towards being hired. It is tough to hire someone who misrepresents why he left another company during an interview because it feels like he was not being truthful.

A few months later, the applicant filed a claim with the WVHRC that we had discriminated in not hiring him due to his "medical disability, ie, mental illness". Fully prepared, Steptoe told me, "Don't say a word in the hearing unless I ask you a question or tell you to answer, even if the administrative judge asks you." Before the applicant showed up, Steptoe had a nice, long, and friendly conversation with the HRC administrative judge. They spoke about common friends, about their kids, and even about some function they both might attend. I thought to myself, "Boy, Steptoe knows this judge pretty well."

The applicant showed up without legal representation. I sat through the hearing without saying a word. Steptoe gently made a fool out the applicant. The ruling resulted in the charge being dismissed.

How the Plant Made "Bleach"

Before getting into the details of the Olin takeover, I want to describe the Bleach plant process for making its products, and provide some details about the building itself. This will give you a better understanding of terms that will be used in this paper.

This process for "Making Bleach" is described by a mechanical engineer, who never understood the chemistry….. (Here is an opportunity for someone to write a better, yet still simple, description to replace this one):

You take "crude" Isocyanuric acid (CA) (did I even spell it right?) and dump it into a large, gas fired, rotating, kiln. The crude CA is mostly a white, marble-sized ball, but there is dust and larger pieces within the crude. In the kiln, you spray a high strength urea on the crude, and the high temperatures cook the crude-urea into more crude. Ammonia is generated, captured, and burned. This crude manufacturing is essentially a stand-alone process that can either be fed directly downstream, or, stored-accumulated.

Since you have to have crude CA to charge the kiln to make more crude CA, there use to be a rhetorical question: ***where did the original crude come from?***

Removing impurities out of the crude to make it pure is the next step. The crude is put into a reactor with strong sulfuric acid and boiled-reacted to remove impurities. The resultant slurry is centrifuged in large, batch, centrifuges. This purified CA step is also essentially a stand-alone process where the pure CA can either be stored-accumulated, sold as a product, or sent forward to be chlorinated.

By chlorinating the pure CA, you make the two, major types of chlorinated dry bleach the plant produces If you attach two chlorine atoms to the CA molecule, you make "Di-chlorocyanuric acid". This was called "56" because of its 56% available chlorine value. 56 was usually used in household cleaners such as dishwashing machine soaps and "Comet". If you attached three chlorine atoms to the CA molecule, you make "Tri-chlorocyanuric acid". This was called "90" because of its 90% available chlorine value. The 90 was usually used in swimming pool chemicals like Olin's "PACE" or FMC's "Clearon" brand.

To chlorinate the pure CA, it goes into a reactor where liquid chlorine is introduced and reacts with the CA to make the bleach product. The resultant chlorinated dry bleach then goes through extensive material handling for drying, sizing, and packaging.

I'm not sure about the actual construction date of the main process building (Bldg 302). It clearly was in use in WW 2. It still had the black-out curtain beams along its north and south sides where they would "close-up" the building at night to prevent enemy bombers from seeing its lights. I do know that the drawings we had for the building were incomplete, especially in terms of foundations. Concrete becomes harder as it ages, and any concrete busting that had to be done in the any of the building floors was a chore since it would only break apart in small splinters. Howard Rice, Maintenance Engineer, use to say "*Don't go busting concrete up in those buildings. There's dead Indians buried under there and you just don't know what you will find*." There were stories of concrete floors being busted up only to find large holes underneath that had to be poured full of concrete. There was also a legend that there was a tunnel between the main Naval Ordinance complex on the south side of MacCorkle Ave that came over to Bldg 302. It was said that the naval gun barrels could be transported between the main complex and Bldg 302 in that tunnel without spies making a count and using the information to guess at what ships the navy was building.

The raw water inlet building, the Maintenance shop building, and the unit substation building were clearly constructed in WW 1. The shop had an overhead crane that actually used DC voltage with lever stabs

(think Frankenstein style) that you had to open and close to move the crane. Every time a mechanic would open or close a stab, it would arc and flash just like in the movies. The building in the substation contained three, large, copper-wound, paper wrapped wire, transformers dating from 1911. Each one was for a single phase step down to provide 480v, 3-phase electricity to the plant. They were still in service when I left in the late 1990s. If they are still service today, they are over 100 years old and still providing critical service to the plant.

Now, back to the sale of the plant to Olin……

Before the Sale of the Bleach Plant to Olin

I met with Richard Campbell in late fall, 2012, in Sweetwater Tennessee. His 97 year old father had fallen and broken a leg, and was convalescing in a Sweetwater nursing home so we talked for an hour or so in his father's room. As I drove up into the parking lot, the single, Ford F250, stood out when compared to the sedans and mini-vans parked alongside. Richard was back on the family farm. The University of Tennessee engineer was now running cattle and driving a ¾ ton pick-up. He looked thinner than the Bleach days; sturdy; wind burned; comfortable in his retirement. He still had his slow, Tennessee drawl. We had not seen each other for almost 25 years when he had left to become the Lake Charles plant manager sometime around 1990, but, it was easy to discuss the purchase of the Bleach plant. Campbell was able to describe the business strategy of Olin related to the Bleach plant, and provide details about other items related to the sale and subsequent operation by Olin.

After closing Moundsville, Olin had said he could stay located in the Moundsville area until his next assignment, but, he obviously wanted to move away from the area. He and Larry Matson moved back to Lake Charles, where they spent a few months (less than a year) before going on the team investigating and doing the "due diligence" for the purchase of the FMC Bleach plant.

Olin wanted two things out of the FMC situation in South Charleston: the "CA" production and, taking the FMC chlor-alkali plant out of the marketplace. Olin had a "90" plant in Lake Charles they felt was more competitive than making "TriChlor" at South Charleston. Problem was: Olin had failed miserably in their process for making CA and was buying purified CA in the marketplace as a raw material for the Lake Charles 90 plant. In the mid-1980s, the chlor-akali business was going through one of its traditional low points. Olin was a long term, "merchant" producer of chlorine and caustic (which meant they sold more to other companies than consumed internally.) Olin's chlor-alkali facilities were competitive and Olin had experience at surviving economic downturns and then hitting the jack-pot in terms of chlor-alkali during economic upturns. The proposed sale of both facilities by FMC could potentially provide CA to Olin's Lake Charles 90 plant, while firming up the chlor-alkali market by shutting down the FMC chlorine plant.

After evaluating the FMC chlorine plant, which used an old, asbestos-diaphragm, Hooker cell technology, Olin quickly came to the conclusion that there was absolutely no economics associated with buying that facility. In fact, it was clear to Olin that nobody would buy that plant. Therefore, Olin had to do nothing to make that capacity close down. When the chlorine market firmed back up, there would be a few hundred tons/day less capacity competing in the market against Olin.

The Bleach Plant had a proven process for making the CA that Olin desperately needed for their Lake Charles plant. The "nameplate" CA capacity was sufficient for what Olin wanted both plants to produce, but, the Bleach Plant was actually producing much less CA than "nameplate". Olin felt that, with some investment and good old fashioned manufacturing management, they could get great economic benefit

out of the purchase. In addition, the sale would include the Livonia, Michigan, Tableting and Packaging facility which Olin could put to good use, along with the 56 production that came with the Bleach Plant.

Tableting and packaging the "90" product in Lake Charles had proven troublesome to Olin. FMC seemed to have a proven tableting process. If Olin could relocate the Livonia tableting facility to the south (to save shipping costs) it could greatly improve the cost structure of selling "90".

Campbell summarized Olin's business strategy as:

1. Make enough CA to feed the Lake Charles tri-chlor plant.
2. Get 56 production up to speed.
3. Leverage FMCs tableting and packaging facility in Livonia, MI.

In the United States, there were two major chemicals used as a source of chlorine for swimming pool sanitizing. In the northern tier of the country, people tended to use "high test" dry, calcium hypochlorite. In the southern tier of the US, people tended to use "trichlor" or "90". The calcium hypochlorite had a lower cost, but would decompose so quickly in strong southern sunlight that the "90" was preferred in the south. Olin's "HTH" brand of "cal-hypo" held the vast majority of the US market place. With the purchase of the FMC bleach plant, Olin would then have the majority of the Tri-chlor productive capacity in its "Pace" brand. Competitors quickly filed objections to the sale with the Federal Trade Commission (FTC), claiming an Olin purchase of the bleach plant would break anti-trust laws and give Olin a monopoly in the swimming pool chemical business. The FTC essentially said something like, "Olin can purchase the plant from FMC, but, must maintain the assets at their current locations until we have ruled on whether they can own the assets or must sell them". This became known as the "FTC Maintenance Agreement" and would take 10 years to resolve. (This ruling took away the Olin option of relocating the Livonia plant south.) Ultimately, the FTC ruled that the purchase did indeed violate anti-trust laws, and made Olin sell the business. But, in early 1985, this ruling was a green light to Olin to go ahead and buy the plant.

Campbell (strangely to me) did not remember the actual purchase price, but said, "It wasn't very much in terms of what Olin was going to get in return".

One thing Olin failed to purchase was the FMC park that was west of the Bleach plant. This was the land that the current Riverwalk Mall now occupies. Olin did not want to be in the real estate business and decided not to spend the additional $2MM price FMC was asking for the property. I think this was to prove a strategic mistake. Within 2 years, the property was developed into the RiverWalk shopping area. The Bleach plant continued to unload liquid chlorine from railcars just a few hundred yards to the east of the new shopping mall. Railcar unloading of liquid chlorine is recognized as a threat to public safety because of the number of large leaks related to this activity. We continued to unload the liquid chlorine with the mall next door.

Campbell's staff of department managers was a mix of very experienced people who were all use to Olin manufacturing. Following him from Moundsville was Larry Matson (Operations) and Steve Parsons (Engineering). Also from Lake Charles was Luis Morales (Purchasing) and Ron Thompson (Accounting). Jesse Williams (HR) was from Doe Run (KY) and Ray Ehnle (Safety) was from ????. Campbell said, "Jesse wanted to get away from Dave Waters at Doe Run, and Thompson had just married and wanted to get out of Lake Charles, So, some were escaping some situation in their previous job. But, I was lucky to get this level of Olin experience to help at South Charleston. Thompson was way too experienced to come to such a small plant, but, because of his personal needs, we got him." Campbell studious avoided discussing Ehnle with me.

Campbell did not exactly have a staff that was loyal to him. Matson and Parsons were his. A past history with Thompson would not help Campbell because Thompson was a typical accounting manager within Olin: trained to make sure that the plant manager protected company assets. In fact, after the McIntosh fiasco where 75% of the plant manager's staff, including the PM himself, got fired because of financial miss-doings, I seem to remember that the accounting manager did not report to the plant manager. Campbell could depend on Thompson to do an outstanding, professional job, but probably had to think that Thompson would throw him under the bus if required. Morales was new to his position and tended towards loyalty if not influenced by Williams or Ehnle. In all of my working with Morales, he presented himself as loyal to Campbell. Williams and Ehnle had a long history in their field, and had networked within their Olin disciplines to the point that they obviously considered themselves fairly independent from their boss. From my viewpoint, they were only as loyal as their positional relationship required.

(I was an "Olin" man. I knew no one at the plant so my loyalty was organizational. I reported to Larry Matson, so, I was loyal to him. I rarely interfaced with Campbell. I assumed that what Matson told me was what Campbell wanted accomplished.)

I have no understanding of the inter-personal relationships within Campbell's staff. After spending many years in plant manager meetings, I would have loved to have been in Campbell's meetings just to observe how they worked together. No matter how they related to each other, this experienced group of department manager's ***got it done.*** It is clear that their leadership was critical to the outstanding improvements and performance that was to happen over the first 2-3 years of Olin's ownership. Campbell had an experienced staff and he made it work; just look at the results.

With the management staff decided, and an agreement with FMC to make a purchase, Olin then started developing and implementing a strategy to staff the lower levels of the organization.

Hiring Process Before Take-Over

As part of the purchase agreement, Olin was obligated to staff the hourly positions out of the FMC pool of employees. I am not sure what obligation they had concerning the salaried ranks. For both hourly and salaried positions, FMC would have wanted Olin to use as many FMC employees as possible because it decreased severance and unemployment insurance costs.

It was critical for Olin to be able to hire technical staff that could actually run the plant. If I had been Olin, I would have made something like "***FMC, you have to let us hire who we want out of your employees as part of this purchase agreement***" as part of the deal.

I think there were three, 2nd level, management staff people, Olin wanted from FMC:

1. Rhondas Cavender (spelling?) was the FMC production manager at the bleach plant.
2. John Drew was the production superintendent at the bleach plant.
3. Rex Pauley was who Olin wanted to run Maintenance.

Both Cavender and Pauley somehow were able to decline the offer from Olin and remained working for FMC. Because Pauley was not going to go to work for Olin, they reached out within the Olin system and brought me up from the HTH/Chlor-Alkali plant in Charleston, Tn.,

A few weeks before take-over, Cavender and Drew met with Olin at the hotel Olin personnel were staying at. At this meeting, the FMC contingent recommended that Olin hire Dick Ely and Bill Fields as area, production, day supervisors. As I understand it, only Drew (Production Superintendent), Ely (Front End Day Production Supervisor) and Fields (Back End Day Production Supervisor) clearly understood that

they were to be employed by Olin well before the take-over. Most other FMC employees that became Olin employees did not become aware that they would be offered jobs with Olin until a day or so before take over.

Olin had some people from Moundsville they wanted to slot into positions at the Bleach plant. York became a production shift supervisor, with Offenberg and Grandbouche going into Maintenance. I also went into Maintenance as the 2nd level manager (superintendent). Otherwise, all other people in Production and Maintenance came from the FMC pool of employees and had to apply and interview with Olin.

The selection process was stressful for both the Olin people doing the hiring, and the FMC employees applying for positions. Olin made it clear they were going to hire based on qualifications, not seniority. The existing union labor contract FMC had with the Steelworkers did not have an "inheritance clause" so FMC could not dictate the hiring process to Olin via the existing union contract. There was no obligation for Olin to use the hiring processes FMC had contractually agreed to with their union. Seniority within FMC was going to play no role in Olin's decisions about who would be hired. Only work history, past performance, and qualifications would be used by Olin. For individuals who had worked under a union contract for their entire career with FMC, it was disheartening that someone with 10-20 years less seniority could be awarded a job before you would.

The sale of the Bleach plant and shutdown of the main South Charleston FMC plant was a life changing event for a large group of FMC employees. With a pool of probably 600-800 FMC employees that were going to lose their jobs there were only 120 hourly and 20-30 salaried positions open within Olin. The vast majority of FMC employees in the pool were going to lose their long term employment in really "good" jobs. Some could probably retire, but, several hundred FMC employees were going to have to go find other work. It did not take much to figure out those type of high paying jobs were not available in the area. So, those several hundred people would either have to take a cut in pay or move out of the area. You either had to get a job with Olin or FMC, or, your life was going to change significantly. Compounding this stressful situation was the fact that you would not know that you had a job with Olin until the sale occurred. The only way an individual could influence the process is by not messing up the interview or testing with Olin. Your past performance and work history was available to Olin. You just had to hope that your skills and past work performance was good enough to get you hired on with Olin.

If I had found myself in this position, I would have been stressed out to the maximum.

Olin used "skills demonstration" testing, proctored by trainers out of their McIntosh, Alabama training center, to test craftspeople. Craftspeople were given repair tasks (such as tearing down and building a Durco pump or making a 6G position weld) and had to do the activity with the trainer evaluating their performance.

Herman Harless described how he faced the craftsman testing;
"I wasn't afraid of the testing because I had been doing the work for years. I was afraid of making some mistake and messing up my chance for a job. I didn't know how to prepare other than what others had told me about the testing. Making such a repair as part of a test was completely different than doing it every day. Having someone look over your shoulder and knowing that getting a job depends on how you do makes it completely, unbearably, stressful".

There was also a lot of stress for the Olin interviewers. Imagine interviewing hundreds of people, knowing that only one out of four will be hired. Many people you are talking to are desperate, some are

defiant, some are calm, some are sweating. You have already reviewed their work history with FMC, and know which individuals are not going to be hired because of their records, but, you still have to give them a full-fledged interview.

Before the takeover, Zappitelli was out with his wife, shopping, and wearing something with an Olin logo. A disgruntled FMC employee came up to him and his wife and aggressively said, “You’re one of those Olin Sons-of-Bitches doing the interviewing”.

Zapp told me, “That guy knew he wasn’t going to be hired, and, I learned not to wear an Olin logo out in public.”

Most of the actual “hiring” occurred just a few hours before actual takeover of the plant operations by Olin. The day of the sale, FMC employees were told by FMC “Take personal belongings because you may not be back in the plant tomorrow. Go home, and wait for a phone call from Olin to see if you work tomorrow”. (Of course, much more than personal belongings went out with employees that afternoon.)

Just imagine the stress of going home and waiting for a phone call from Olin. (Only land lines were in use. This was way before cell phones.) This is the ultimate job lottery; almost a cruel lottery; that was being played out by Olin.

The phone rings at 7:30pm and it’s a friend from the plant:
Friend: “Have you been called, yet?”
You: “No, what have you heard?”
Friend: “Johnson told me he got called and Olin wants him down at the training center at 9pm.”
You: “Let’s hang up. I don’t want to miss a call.”

At 8:15pm, the phone rings. It is a call for your daughter. You tell the friend of your daughter she can’t talk on the phone right now. (How are you going to be able to afford her college tuition if you don’t get the job?). You think to yourself: “If they want people down at the training center at 9pm, they have to be about done calling people. I bet I’m not getting called.”

At 8:25pm, the phone rings. The caller identifies himself: “Hello, this is Gene Zappitelli of Olin Corporation…..” Later in the conversation, you say, “Of course I can make it down to the training center by 9pm……” Your wife has heard your side of the conversation and has a big smile on her face. The phone call means you have a job.

At the training center, Olin told people their positions, when to report to work, and their rate of pay. Hourly rates had a token increase. Even the salaried supervision from FMC got their job offers the day before takeover. The meeting at the Training Center went on for 2-3 hours. Some people started work immediately on midnight shift. To my knowledge, not one person offered a job the day before the takeover turned it down. I was told that one hourly person had enough seniority that he could have gone to the Peroxide plant but he chose to work for Olin.

A very interesting strategy was implemented by Olin in the first meeting with their new hourly employees. After being offered and accepting their new jobs, Olin told them “We have heard from many of you that you do not want to be represented by the Steelworker’s Union (who represented them with FMC). We are going to take a “straw vote” right now.” Olin passed out sheets of paper and asked everyone present to vote “Yes” or “No” about if they wanted to be represented by the Steelworkers Union. The vast

majority at this meeting voted “No”. Olin announced to the group that they would not negotiate with the Steelworkers and that the hourly employees were “non-union”.

The next day, representatives from the Steelworkers showed up at the Olin offices within the training center and announced that they were ready to start contract negotiations. Olin told them that they did not represent the Olin employees, and that the Olin employees were union free. The Steelworkers would have to organize them like any other non-union facility. The Steelworkers filed an unfair labor claim against Olin, with the Nation Labor Relations Board (NLRB), for failure to recognize the union. The NLRB eventually ruled that Olin had no obligations to recognize the Steelworkers as representing the Olin hourly employees. The contract the Steelworkers had was with FMC. That contract did not obligate FMC to force any buyer to recognize the Steelworkers (aka “inheritance clause”.) The NRLB told the Steelworkers what Olin had told them: the law allowed them to legally organize the Olin employees, and that the Olin employees were protected by law in their right to be represented or not.

This move by Olin was critical to the change they wanted to implement at the plant. Olin was not “anti-union. (Most Olin facilities were unionized and Olin had a long history of effective negotiations and good working relationships with their unions.) But, the FMC contract with the Steelworkers, and how it was managed on a daily basis, had to be cut out of the new plant like it was a cancer. Olin was “Anti-FMC/Steelworkers”. If Olin had allowed the Steelworkers to represent their new employees, the new employees would have had expectations that business would continue as usual. Business was absolutely not going to continue as it had in the past. Olin expected the plant to be organized. When it was organized, Olin’s strategy was to start the contact negotiations with a “clean slate” with every line item being negotiated. (While being interviewed for the Bleach job, I had been told that chances were high that I would be locked in the plant during a strike). The “baggage” of the FMC-Steelworker’s contract, and how it was managed by FMC, would have caused both the employees and Olin considerable pain and threatened the viability of the plant.

To quote Jesse Williams: “There is no such thing as a bad union, just bad management. Bad unions are caused by bad management.”

I had no part with the hiring process and the decision to start the plant non-union but admired how it was done. I recognized that both the hiring and “straw” union vote were outstanding business strategies. While achieving my MBA, we use to do case studies using articles out of the Harvard Business Review. The hiring and union strategy Olin used at the Bleach Plant were worthy of being published in the Harvard Business Review.

Since the FMC employee Olin wanted to run Maintenance refused a job offer, Olin went internal and selected me. I came up from the Charleston, Tennessee, chlor-alkali and swimming pool chemical plant. I had been the Maintenance engineer in the swimming pool plant and knew the hardware used at the Bleach plant. I also had held several “superintendent” positions within the large Maintenance department and understood Maintenance management and systems.

I interviewed about a week before the takeover. After taking me out for lunch, Campbell said, “Let’s sit in the car at the main gate for a while so you can see what is going on.” As we sat there, we saw personal vehicles drive in through the gate. They’d drive back out 10-15 minutes later loaded up with things like welding machines, small air compressors, even a small lathe went out in the back of a pick-up.

Fred, “My God, they are stealing you blind! How can you let this go on?”
Campbell: “It doesn’t belong to Olin, yet. Until take-over, it belongs to FMC”.

Fred: “Can’t you get FMC to stop this from happening? Those are things you will need to replace.”
Campbell: “The management at FMC doesn’t care. Many of them are losing their jobs, also.”
Fred: “What about the guards? They’re just standing there, waving the people thru.”
Campbell: “The guards belong to the same union those guys belong to. They’re also losing their jobs.”

I had a visceral reaction to what I was watching. I had a strong personal belief that stealing was wrong. At Olin, you automatically got fired for stealing and I fully supported that standard. Here were portions of an entire organization, top to bottom, actively supporting stealing. Sure they were losing their jobs; but, how does that relate to doing what is right or wrong? I could not accept the logic I thought was occurring: “Everybody is losing their jobs, therefore, it is alright for me to steal thousands of dollars of goods. If I don’t steal it, somebody else will.” This ended up being a personification to me of FMC management and their inability or willingness to manage the workforce. I understood that it was a minority that was acting in this manner, but, I also understood that FMC management had to know what was happening and was ignoring it. Any respect I had for FMC management was lost that early afternoon. Later, as I listened to stories about what used to occur in the plant, it just confirmed in my mind that bad management made for a bad and ineffective organization. Ultimately, such management helped to shut the FMC complex down and contributed to a thousand employees to lose their jobs.

Ramblings About First Weeks and Months After Take Over

As an Olin manager I was charted to play an active role in the change process that Olin wanted to implement at the plant:

1. Treat others with respect and do not allow disrespect to occur at any time.
2. Expect people to work and minimize hours paid for hours not actually worked.
3. Avoiding a problem that FMC seemed to have, I was to allow no horseplay.
4. The hourly employees were raised in a strong union environment. Their fathers were union and most have only worked in a union environment. That is the only condition of employment they understand. Do not give up anything in terms of work rules and the expectation of full compliance with Olin’s requirements. We expect negotiations to occur with a Union, and any loosening of work rules will allow the union to claim that as a practice and already part of the agreement. Olin wants everything to be negotiated from a clean slate.
5. Expect performance.

The hiring process really worked for Maintenance. I found a shop of skilled craftspeople and experienced supervisors. All of the craftspeople were “journeymen” level in skills: no apprentices or “beginners”. Compared to the (non-union) workforce I had worked with in Charleston, Tn, this shop was an order of magnitude more skilled and effective. The department had three planners and two very good Maintenance engineers. The initial challenge was not about how to make repairs since the crews knew how to fix things. It was how to prioritize what to work on first because the equipment in the plant was in relatively poor shape. The first year or two I concentrated on implementing Maintenance systems: a computerized Maintenance information system; the storeroom; planning and scheduling the Olin way; etc.

I was concerned about the large number of people Olin had staffed the plant with. I remember people from FMC saying, "How can we run this plant with so few people". From my experience, I was saying, "How can we stay in business with so many people?" The Maintenance department had 40 GMs, 15 IEs, 8 supervisors, 3 planners, 2 engineers, a secretary, and me. In addition, the storeroom had about 5 technicians and a supervisor to begin with. At Charleston, Tn, we had half the headcount for the HTH plant which was similar in size. Clearly, Olin overstaffed the facility. From my perspective, they did so to increase the chances of success. Certainly, in terms of Maintenance, the additional staffing allowed

upgrades and reliability improvements to occur quickly. This high level of staffing probably helped the takeover be successful.

Another thing that made the takeover successful was the “can do” attitude of the Maintenance crews. They did not complain about the changes. Instead, they did a great job of concentrating on getting things repaired and improved. They had a strong desire to make the Bleach plant successful. I sensed they were doing this for their fellow employees and themselves. They wanted the plant to be successful, and worked as a group to make it so. Across the plant, you would hear employees say “We want to be able to retire from this place.” As the plant improved over the first couple of years, you would sometimes hear a revised version of this: “We are going to be able to retire from this place.”

I always suspected that this desire to corporately protect each other by making the plant successful was a big reason why the ex-FMC employees accepted the changes imposed by Olin. The pain of accepting the changes Olin was implementing was much less than the pain they had just faced and avoided: losing their jobs because the plant was not profitable. Olin was offering them a chance to continue a high standard of living, with retirement as the ultimate goal. The willingness of the ex-FMC employees to accept almost any requirement made by Olin was simply amazing. They quickly learned that working for Olin was completely different than working for FMC. They seemed to embrace the changes; eager to learn how Olin wanted it done. Even when they knew how to do something, they would bounce “next steps” off an Olin employee as if an “Olin check” was required.

After my first week at the plant, a Maintenance “GM” (general maintenance”) technician named Oscar Hensley, came up to me and spoke to me for the first time. “Fred, I like having a job here but it would really help if you guys would pay us.” Olin had “contracted” with FMC to have FMC continue to issue payroll checks for the first few weeks. Oscar and a few others had somehow “slipped thru the cracks” and did not get a paycheck for the previous (and first) week of work for Olin. I got with Ron Thompson and he said “find out how much he expected to clear in his check and we’ll cut him a cash advance check that he can pay back when the payroll system gets this cleared up.” Oscar and a few others got a check from Olin the next morning.

There was a GM (Richard Riling) that fixed a problem that really changed the production rates of CA. Batch centrifuges were required to extract purified CA and we just could not get the reliability and rates up to nameplate through those machines. This inability of the centrifuges to output the required rates was causing the Bleach plant to miss shipments to the Lake Charles “Pace” plant. Shortly after take-over, these centrifuges were a critical bottleneck to CA production.

Riling told us: “The factory is putting the wrong backpressure spring in the hydraulic pump that drives the centrifuge. They’re installing a 35psi spring and it tears the pumps up and won’t provide the torque required. I think we need to install a much higher backpressure spring, like 125psi. Can I try it out?” He had been working the problem with our Maintenance Engineer (Howard Rice) and they had discovered that the OEM had lost original design documentation and might be using the wrong spring.

Answer: sure, why not? Result: immediately the centrifuges were able to produce at capacity.

Campbell and Olin were ecstatic about the result. Campbell brought it up 30 years afterwards when I interviewed him in 2012. “That old mechanic just came up and told us how to fix the biggest problem we had at the time.”

Bill Fields told Riling, “I hate to think of the millions of dollars FMC spent on those centrifuges just because of a little spring.”

Riling got the first and only, individual performance bonus, I have ever seen given to an hourly employee in 40 years of working in the chemical business. I can’t remember how much it was, but, it was significant. When I told him that he was going to get a bonus for implementing his idea, I asked him if it would be alright for us to tell the plant about the bonus. He said, “No Fred, don’t do that to me. If these guys find about this bonus I won’t be able to work with them.” No good deed goes unpunished. Riling was stuck with being the dedicated centrifuge repairman for several years.

For those of you who know Riling, you know that he can ask a million questions and propose a thousand changes a day. He absolutely wears you out if you stop to talk to him. He is the best, natural, troubleshooter and problem solver I have ever worked with. I was lucky enough to talk him into working for me after he retired from the bleach plant. The price I pay is I have to listen to his questions and proposals every day.

A combination of things caused me to fall into a trap that haunted me for years at the Beach plant. I was the lowest level manager that had been an Olin employee. I was assertive, and would always provide an answer and directions if someone asked me a question. I was also inexperienced as a manager and did not recognize my style was so “tell oriented”. As people faced problems, they would ask me “What do you (ie “Olin”) want us to do?” I was always ready to provide an answer, many times without listening to the real problems and exploring options to solutions with the person asking. Soon, you would hear “Fred said to do……..” This then morphed into a plant-wide saying whenever some sort of minor decision had to be made: “Fred Said”. Eventually it became a joke used across the plant; “Have you asked Fred what to do?”

Compounding my frustration over the “Fred Said” issue was watching Richard Campbell as he discussed similar issues with hourly employees. They would tell him “Fred Said…”, or, “Fred had us do it this way…” as they complained to him about some issue. He would sagely shake his head and say something like “Fred had you do it that way, did he?” without actually answering them directly or telling them his own position. He would end the conversation with something like “Well, I’ll discuss that with Fred.” Afterwards the individual would leave smiling, happy to have had a chance to express himself to my boss without recognizing that what “Fred had said” was exactly what Campbell and Matson wanted done. I was frustrated by incorporating things as directed by plant management, and him not directly supporting me when hourly employees discussed it with him. I named his approach “the Campbell shuffle.”

As I watched these Campbell interfaces over “Fred Said” incidents, the light bulb went off in my head. If Campbell could get away with just listening and never really debating or answering the question, maybe I should try the same strategy. I didn’t recognize it at the time, but, Campbell had taught me the most important thing he could have ever taught me: “Listen first to understand before trying to be understood.”

Shortly, a GM, named Steve Lowery, asked to discuss a complaint with me. I can’t remember what the issue was about, but, I can remember the results. As he came into my office, I studiously listened to his problem. I did not debate it. I did not answer his questions or propose solutions. I did ask non-threatening questions that helped me better understand his position and concerns. After I had listened, I paraphrased what he had said and what I thought his concern was back to him and he confirmed I understood his issue. I then told him, “Let me think about this for a day or so before we make a decision. You think about it also, and we’ll talk about it tomorrow.” He left the office relaxed and comfortable with

his visit. This was a totally uncomfortable approach for me to take. I had seen it work for Campbell and was determined to try to make it work.

The next day, in the hallway, Steve came up to me and proposed a solution I could easily accept. I told him "thanks, let's do it that way." The very first time I tried the "Campbell shuffle" it worked!

Federal Trade Commission Ruling

Shortly after Olin announced their planned purchase of the FMC dry swimming pool chemical business, other manufactures filed a claim with the FTC stating that the purchase was monopolistic and should not be allowed. The FTC ruled that the purchase could go forward under a "Maintenance Agreement". This required Olin to maintain (or improve) the assets as and where they were purchased, while the FTC would review the case. No timetable was given for the review, but Olin guessed it would take 2-4 years.

I was amazed that the FTC let Olin purchase the business. Olin dominated the dry "hyper-chlorate" business with their HTH brand. Now, with the combination of their Pace and FMC's "Clearon" brands, they would dominate the dry "chlorinator-iso" side of the business. They would be the number one manufacturer, with 2-3x the market-share compared to any competitor, for both types of dry chlorine used in swimming pools in the United States. If that wasn't limiting competition, what would?

The ruling put a very dark cloud over the plant. How long would Olin get to own and operate the facility? Would a new owner be buying the plant within a couple of years? Would Olin try to "steal" the manufacturing capability of the Bleach plant, shut the Bleach plant down, and move the capacity to Lake Charles (like they did in the TDI business?) It was sure easy to guess what the FMC employees were thinking: "Am I busting my butt to help Olin make the plant profitable, just to go thru another change in ownership? Worse yet, so they can run the plant down where nobody else will buy it?"

The Maintenance Agreement stopped any potential of Olin relocating the Livonia Tableting and Packaging (T&P) facility down to South Charleston. The opportunity to save shipping costs by having the T&P packaging done in South Charleston was one of the opportunities Olin saw with the purchase. Only after Olin was forced to sell the business to Israeli Chemicals was the relocation finally done about a dozen years after the Olin purchase.

Eventually, after 10 years, the FTC finally ruled that Olin had to sell the assets. For the first couple of years after the Maintenance Agreement ruling, the potential of Olin having to sell the plant was always on the minds of employees. As Olin poured money into the facility, and greatly improved safety and production rates, the fear of Olin "short timing" the plant decreased greatly. As the FTC process ground it way thru rulings, court case, delayed hearings, over years and years, the potential became somewhat like the threat of heart attack. Yes it was possible, but, nothing seemed to ever be on the threat horizon. After 3-5 years, the FTC potential to have Olin sell the business was just part of working there and rarely came up in discussion or the thoughts of people. The singular exception was related to pensions.

The Pension Fiasco

FMC employees had the expectation that Olin would purchase their pension funding from FMC. With that being done, their pension accumulation based on years of service would go on without having to re-start in the Olin pension plan with no years of service. Somehow, as the sale was consummated, one or both sides decided that this would not occur. For years both Olin and FMC pointed the finger at the other for blame on why this did not happen. Bottom line, after a few weeks of working for Olin, past FMC

employees found out that their pension plan would have to start new in Olin. (I can't remember if they were automatically vested in the Olin pension, or, if they had to work 5 years with Olin to get vested. I think they were not immediately vested within Olin's pension at takeover). Their FMC pension was effectively frozen at their 1985 FMC salary and ending years of FMC service. If they had 15 more years of work ahead of them, their pension would be much larger if they got to use their ending salary instead of whatever they were making in 1985.

Compounding the situation was the "Maintenance Agreement" and the threat of being sold before achieving vesting in Olin's plan, and having to start in even another pension plan.

A Production Supervisor, Joe Lively, started a lot of contacts within both companies to get information out to ex-FMC employees and to try to get some relief from either side. I know that Olin put a lot of work into this issue, and made some concessions, especially about if they had to sell the plant. I have all of those communications and resolutions in files and hope to be able to get those documents scanned and posted later in this web site. (Joe, if you are reading this, it would be handy if you authored your view and take on this so I can include it in this web page.)

"If you don't like working here, stand on the Mound and look north!" – Jesse Williams

I cannot describe the change process FMC employees had to go through without discussing the HR department. Leading HR was Jesse Williams as the HR Manager. Reporting to him were two experienced "HR Supervisors": Gene Zappitelli (aka "Zapp") and Thom Crimans (aka "the Criminal" as a somewhat cruel play off his last name). Administrative support was provided by Jeanne Horsfield and Vicky McNeil. Supporting them from the Chemicals Group HR was Mike Bentley and numerous other group HR members. Like other departments, the HR department was clearly overstaffed at the beginning but the additional HR support was critical in supporting the takeover.

The role these HR professionals played in supporting the success of the plant cannot be overstated. High levels of experience, great connections and interface with Chemical group resources, and plain old interpersonal skills helped guide the plant through tremendous social change and upheaval. They all played their parts at making the plant successful, but, Williams was such a dominate personality that most of my stories will involve him.

It is safe to say that Williams was strong-willed and had a dominate personality. He was definitely an extrovert, outspoken, and expressive. I had the sense that this sometimes got him in trouble with his operational bosses. In 2012, Campbell had mentioned "Jesse wanted to get away from Dave Waters at Doe Run." 5-6 years after takeover, when it was announced that Campbell would become the Lake Charles plant manager and that Hal Foss would become the Bleach plant manager, Williams was physically shaken. He told me later, "I can't work for Foss so I'll be out of here as soon as possible."

Williams and I simply did not get along with each other. Williams would tell me what I had done wrong, and what had to be done to fix it, and I would point-blank resist him if I thought he was not right. I owe Larry Matson an apology for all of the grief he had to take about something I had done that Williams did not like. To his credit, Matson did a good job of defending me, but, over the years, I could tell that managing the Williams-Paschall interface was wearing Matson down. I appreciate all the support Larry gave me.

I started off resisting Williams almost immediately. Shortly after I "sold" my house in Cleveland, Tn., to Olin, Williams came to me and said, "The relator Olin contracted to sell your house says the interior needs

paint and that you took landscaping with you that was supposed to stay at the house. You will have to pay for the paint and landscaping costs to make the house saleable."

I asked him, "Who is the realtor" and he told me. I laughed and Williams took offense and asked what I was laughing about. I told him I knew the realtor quite well, and we had both worked in the Charleston, TN, Olin tech center. I told Williams that realtor had been let go by Olin and that the word was he had got caught at a gate check with a dozen gloves in his lunchbox. I asked, "Olin is using a realtor who they fired?" Williams told me, "It is Olin's practice to rotate the realtor assignments and it was his turn." I was already miffed about the conversation and asked, "Why would he be allowed a turn?"

I then explained to Williams that we had painted all of the interior walls in the house, and that other Olin employees had helped me and would verify that fact. "I think the realtor is trying to take advantage of Olin." I was confused about the landscaping claim and asked Williams to come up with more details.

A couple of days later Williams showed me "before" and "after" pictures from the realtor that supposedly proved the landscaping claim. After looking at them I laughed so hard I thought I would faint. The more I laughed the redder and madder Williams got. When I caught my breath I pointed out that all of the "missing landscaping" were annuals. "You know, you plant them in the spring every year and tear them out after frost when they die? This guy is really trying to screw Olin and he is wasting your time." Williams must have given up on me paying to "improve my house for sale" because I heard nothing more about it.

Olin had a cost-of-living payment plan they had given me as part of the relocation package. A few months after moving down to the valley Williams came up to me and abruptly told me, "They calculated the cost-of-living incorrectly and gave you too much. They are going to have reduce the monthly amount they are paying you." I told Williams, "I just want what the system allows. Have someone go through the calculations with me and I'll agree to whatever the procedure says I am eligible to receive".

A little later, a group HR representative sat down with me to explain the "lowered" cost-of-living payment calculations. As we went through her worksheet, I pointed out several math errors. When we were done going through what the procedure provided, I had convinced her I was owed twice the amount they had originally told me when I accepted the position, and almost 4 times the amount they thought I was due with their poor math. The gal was somewhat embarrassed, apologized for the confusion, and committed to getting the payment amount increased to the amount we had agreed was correct. Next month, I was getting double for cost of living adjustments than what I thought I would get when I took the job. Williams never mentioned it to me. I knew he was mad about it and I avoided the topic with him but had fun describing what had occurred to Matson.

One final Williams-Paschall story summarizes the distrust and problems we had between us. We were discussing a Maintenance employee that had excessive absences and somehow, we got on the topic of "calling off sick and just doing what you want to do." I told Williams I had never, and would never, call in sick to take a day off and go do something. He ridiculed me, "You got to be kidding, you've never called off sick and not been sick?" He laughed at me when I continued to claim no, "It's stealing and I can't stand a thief." Williams and I had completely different paradigms about a lot of things; that is for sure.

A few months after take-over, Williams came to my office as mad as I ever saw him. He was red-faced, short of breath, and stammered to me "That SOB who works for you just goosed me in front of a bunch of other people!" A GM had literally grabbed William's buttocks in a classic "goosing." This was the kind of horseplay that use to occur at FMC but was absolutely unthinkable within Olin. (I was personally glad the GM had not goosed me because we both would have lost a job, he would have lost teeth, and I probably

would have been arrested and jailed. Williams had a lot more experience than I did and acted much better than I probably would have.) It had been out of my control but Williams was so mad I felt like he thought it could have been partially my fault. I asked Williams, "You want me to suspend him, pending investigation" and that is what happened.

In 2012, Campbell recalled the incident; "It was a significant turning point in our takeover. After initial investigation, and talking to group HR, I left the decision to Jesse about whether the guy got fired or not." The individual got a long suspension – seems like 30 days. Campbell noted, "Some of the hourly employees came up to me and asked if they could take up a collection for the man. I had to tell them that the company could not support such a collection activity."

I think Williams did the right thing by doing a suspension instead of a termination. Not because I thought the incident did not justify termination because I did. But because for years afterwards, that GM was a working reminder of "***no horseplay allowed***." If he had been terminated, the incident would have been forgotten a lot faster because of "Out of sight, out of mind." Officially, Olin and any management have to keep discipline private. In this case, it was impossible to keep the discipline private. So, with such a public display of discipline, the impacts of the action were greater on the rest of the plant, not the individual who got suspended.

Within a couple of years, the Steelworkers had enough cards signed to go to the NLRB and request a vote on whether the hourly employees desired to be union. The initial strategy by Olin was very muted, especially by what "remaining union free" consulting usually advocates. Olin felt like the employees now knew what it was like to be non-union, and the previous representation by the Steelworkers had protected nobody when it came to getting a job with Olin and protected very few with keeping a job with FMC. Thus, the famous Williams quote: "If you don't like working here, stand on the Mound and look north!" (At this time, the main FMC plant north of the mound was being demolished and hundreds of Steelworkers were out of work.) Our employees had got their jobs with Olin based on their personal performance, not by seniority or contractual rules and the Steelworkers had done nothing for them in terms of getting employment with Olin. Olin felt like the best thing going for not getting organized was the fact it was the same old Steelworkers trying to get our employees unionized. With our heads in the sand, plant management decided a low-keyed "let's remain union free" campaign would best fit the current culture at the plant. I think a just a few informational meetings were held to explain the company's position. Because of the shift configuration, Olin also wanted two different days for the voting so each employee could vote before a regularly scheduled shift.

I was not present during the voting and the incident that occurred at the beginning of the second day of voting. But, what transpired became plant lore. I am telling it from "hearsay."

After the first day of voting, employees representing the union (including Bob Beckett, an I/E technician) and Olin (Williams) signed seals that were put across the voting box. The NLRB representative took the voting box and was to return with it the next day for day two of voting. When the box returned for day two, Beckett observed that the seals had been violated and the signatures on the seals no longer matched up. Voting was completed and when the count was done, the "Yes" votes had a clear majority. The suspect voting said the Steelworkers would represent Olin employees at the Bleach plant.

Olin filed a claim with the NLRB stating that the violated seals indicated that the voting box could have been "stuffed" with yes votes. The story was that the NLRB representative had put the sealed voting box in the trunk of his car and then took the car for service locally. He did not have control of the voting box while the car was in the shop. The NLRB ruled that, since the seals had been violated, the first round of

voting would not be validated and that a second election would have to be held. Olin ran an aggressive campaign the second time, and all of the voting was done on one day. The second time, the "No" votes won by a clear majority. Williams always claimed that he honestly felt like the first vote had been "rigged".

Shortly after the hourly employees voted to remain union free, Williams spearheaded a large change in benefits for the hourly employees at the plant. Olin essentially rewarded them by providing the same benefit most non-union, Olin, plants had: paid absences for any sickness or illness. I was surprised that this benefit change occurred immediately after the union vote. It was against fair labor law to promise or provide pay raises, increased compensation value, etc, to employees before an election if they voted against the union. Obviously, no promises were made by Olin, but, I also suspect that Williams, Zapp, and Crimans let it be known before the election that remaining non-union would be beneficial for employees. I fully expected another unfair labor claim to the NLRB by the Steelworkers but it never occurred.

I have to put credit where it is due. Williams, Zappitelli, Crimans, and Bentley, managed the plant through two unique union organizational efforts. The initial straw vote at take over and refusal to recognize the Steelworkers was a stroke of genius. That by itself is probably unique in terms of union disfranchisement. Then, managing thru the first organizational effort also ended up with the plant Steelworker free. Note I did not say "Union Free" since I really did not think Olin was as concerned about being union free as much as avoiding the baggage that would come with the Steelworkers. These stories about how the plant remained union free are valid case studies.

One last story about Jesse Williams. Again, this is hearsay and I do not know if it is true, although I did see the switch under his desk. The story goes that Williams had a switch under his desk that he could use to record conversations without others knowing it about it. If true, this would have been very unethical. Unfortunately, many at the plant believed this was true and we were all careful about what we said in front of William's desk. I know for sure there was a switch because I saw it a few years later. I always wondered if this was another "mind game" being played by Williams.

Operations, Engineering, and Other departments

I would love it if someone from Operations, Engineering, and other departments would tell stories about their part of the organization. Operations was led by John Drew, an Englishman (aka the "Limey") who eventually became a plant manager for Bayer. Steve Parsons led the engineering effort required to pour millions of dollars into the facility for physical improvements. Both departments participated in and drove the changes that occurred, as important to the success of the plant as any of the other departments.

The Ones Who Have Not Retired

The vast majority of people who went to work for Olin at the bleach plant in 1985 made it to retirement. There are still a handful of people still working in the bleach business; either at the plant or still associated with the business. At a "retiree breakfast" in late December, 2013, a list was made of the people who are still not retired. By our count, there are about a dozen of the original 170+ still working "Bleach". (Send me corrections of this list is not right):

- Kenny Lewis, Maintenance
- David Hensley, Maintenance
- Steve Hartley, Maintenance
- Reed Hess, ??
- Steve Hudson, Operations

- Chuck Mallory, Operations
- Jerry Parsons, ??
- Joe Zeeger, Operations
- Richard (Bull) Durham, Operations
- Ronnie Easter, I assume still IT.
- Sandy Offenberg ??
- Mike Ligon, I assume still in Supply Chain or Purchasing

The Ones Who Have Left Us

We are all getting older. As time goes on, our "community" will be getting smaller. Many more than a handful of our co-workers have passed away. These folks greatly helped the plant, and are no longer with us to share these stories, discuss what grand and great- grandchildren are doing, and attend the informal "retiree" breakfasts and lunches. We all dearly miss our departed friends; they helped all us to get to retirement. Let us keep them and their families in our memories and prayers.

A few of us tried to reconstruct the organization chart at takeover. Our feeble memories convinced us that we probably did not get it right. Individuals we thought had died are listed in blue on the org chart. Send me a quick e-mail at Fred@MakingBleach.org with suggestions for corrections in this org chart. If you happen to be listed as dead, and are alive enough to read this article, rejoice that "the rumors of my death are greatly exaggerated." If you know that someone else has passed, let us know so we put their names in blue.

Appendix

First Quarter ■ 1985 Vol. 4 No. 1

pipeline

Specialty Chemicals Division, South Charleston, WV 25303

1984 — A Thanks for Challenges Met Well

Dear Fellow Employees,

As I write this note to you in January for the first 1985 issue of the Pipeline, we can look at 1984 with a great sense of accomplishment and pride. In many ways the achievements of the past year were a milestone that we as a group had been striving to reach for some time. In our various major responsibilities as a plant last year we achieved some solid, substantial goals that we had been aiming toward with great effort. We had carried out a difficult role while hoping that our product lines would improve.

Several years ago each of you were shown a video film that outlined problems in the South Charleston Plant as they were seen by corporate management at that particular time. I am sure that most of you will remember the dramatization of two employees discussing the shutdown of the FMC Avtex plant in West Virginia and the thought that it might happen here. Well, through those tough times and the recession FMC South Charleston is still operating. In 1984 we had the best safety year in recorded history; top flight environmental performance, also the best on record; increased reliability; and all-time production record in one department and the best in five years in another; another restricted only by the market; and teamwork supreme. We are viewed as having the best labor relations in West Virginia and stand as a national example. These various accomplishments did not come easily for anybody.

Now, however, the challenges of 1985 are upon us. We are in severe winter weather, the worst since 1919, that is threatening our production, safety, and environmental performance. We are also weathering much criticism of the chemical industry because of what occurred half way around the world in Bhopal, India. The effect is particularly fierce here in Kanawha Valley, a major chemical center of the United States. Temporarily, the problems are tarnishing the good of 1984. But the fact is that the people of this plant will overcome these difficulties. My three and a half years with you have taught me to have that faith.

Our accomplishments in the safety and environmental responsibilities have set new standards for personal and plant responsibilities in 1985. Our record production and near-record production of different products reveal the possibility of improving further so that we will meet the demands of the marketplace. Our cost awareness and productivity programs will continue to meet the challenges of our domestic and international competitors.

New pressures and higher standards of performance are upon each of us. Bhopal, India, has changed the chemical business. South Charleston, because of this and for your security, must keep getting better.

Thusly, even as I thank you for the effort and determination that made 1984 such a fine year, I must challenge you in this new year and raise our standards. I pledge with you my determined effort towards improvement and the survival of the chemical business in Kanawha Valley.

My thanks for your efforts in the past year are unreserved and sincere. It is a pleasure to operate the plant with you. You are an outstanding group of people.

"Woody" Wayland

1985 Org Chart at Olin Take Over
Estimated 77 Salaried and 104 Hourly Employees

We think individual's whose names are in blue are deceased. Rev 1-7-14

Plant Manager: Richard Campbell
Barbara Peal

Accounting Manager – Ron Thompson
Accountant – Randy Lawson
Clerks – Susan McGee
Sandy Offenberg
Norma Lowe
Patti NcComas
Norm Casto
Minerva Tinsley
Raw Materials Jeanne Stephens
IT Ron Warren
IT – was there a second IT

Safety Manager - Ray Ehnle
Secr. - Nancy Thompson
Safety Supervisors (McCray was the only safety supervisor at take-over. Others were added within a few weeks.)
Tim Martin
Eddie Miles
Stan McCray
Chuck Mallory
Nurse - **Bill Norman**

Purchasing Manager – Luis Morales
Purchasing Agents
Mike Ligon
Keith Rumbaugh
Purchasing Clerk
Joyce Crouch

Engineering Manager – Steve Parsons
Secretary **Joan Peters**
Lab Supervisor – **Bob Scalese**
Industrial Hygenist Kathy Bowyer
Bo Wessien
Lab Techs Lloyd Nelson
Huey Goodall
John Duncan
Debbie.Mosley
Environmental –Morgan French
Project Mngr – Mitch Toto
Elect Engr – Larry Harris

PAC Engr – Jim Reid

Process Engs – Tawney Hall

- Regina DeVillier
- Bill Hensley

Ernie Nolet

Dick Brendler

HR Manager – **Jesse Williams**

HR Supervisors

- Gene Zappitelli
- Thom Crimans

HR Admin

- Jeannie Horsfield
- **Vicki McNeil**

Operations Manager – Larry Matson

Operations Supt – John Drew

Front End Day Supvr – Dick Ely

Front End Shift Supvrs

Joe Lively

Pokey Allison

Steve Allison

Bob Jarvis

Back End Day Supvr – Bill Fields

Back End Shift Supvrs

Stan Taylor

Gary Goins

Freddy Bell

Jim York

Was there a relief shift supvr?

Operators

Production Engrs

The gal that eventually became our environmental engr

SusanThompson & Jodi Thyan later

Shipping

Bill Cantebury ***Shipping Operators & Storeroom rotated initially***

Maintenance Supt – Fred Paschall

Secretary. **Lois Thomas**

Maint Day Supvrs

Bob Rowe – Front End

Steve Mathews – Back End

Grant Offenberg

Joe Motus – I/E 6mos…Reggie Daniels later

Maint Shift Supvr

Dean Miles

John Grandbouch

Evenings

Billy Joe Smith

Larry King

Maint Planners

JJ Dodson – lead planner
Ron Johnson
Harold Gandee

Maint Engrs

Will Fields – Back End
Howard Rice – Front End

Storeroom –

Storeroom clerks

I & E

Mike Stover	**Ed Clay**	
Ronnie Armstrong	**Jay Jacobs**	
Ronnie Bailey	Delbert Huffman	
Fred Snyder	**Joe Halstead**	
Dana Huffman	David Painter	15
Steve Midkiff	**Paul Bumgardener**	
Bob Beckett	Rodger Droddy	
Kenny Patterson		

Shipping/Storeroom

Roy Mallory	GA Parsons	D W Dalton	
Mark Foster	R. L Grimes	J W Hudson	
L L Kouns	Bob Price	Reed Hess	
Denis Starcher	C E Mallory	O A Rippetoe	15
Steve Brisco	Kim Dolin	D C Chandler	

Maintenance GMs:

Fred Hamrick	Steve Hartley	**Dave Kapp**	Mike Pauley	
Ralph Parsons	Arthur Boggs	Dave Burgess	Jerry Miller	
Bob Franklin	Doug Dent	Mike Merguc	Steve Hartley	
Dave Parsons	Gerald Wood	Grant Walker	Keith Grant	
Herman Harless	Larry Hedrick	Ken Scarberry	Kenny Lewis	
Gary Childress	Jerry Duke	Dave White	**Steve Lowery**	
Dale Akers	Tom Crouch	Ashley Bishop	Lee Givens	
Butch Marker	Oscar Hensley	Rodger Clark		
Bill Rust	Mark Sayre	Jerry Mannon		
Richard Riling	Dave Whitlock	Vernon Good		40
Paul Griffith	**Paul Stricklen**	Dave Kidd		

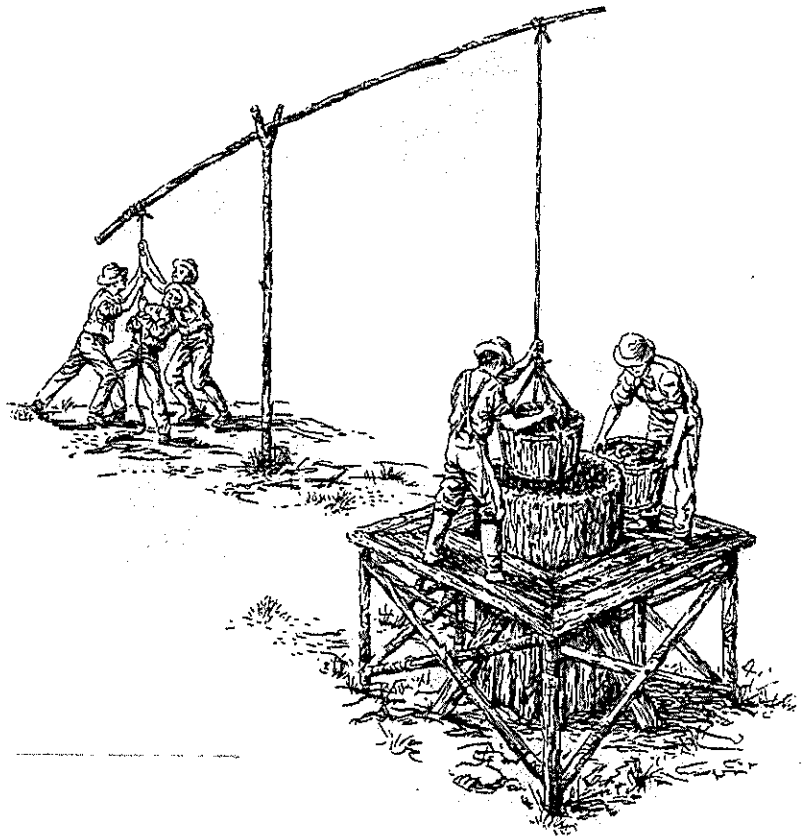
(continued next page)

Production:

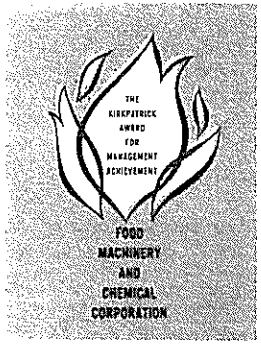
Danny Preistley	George Lawson	Hoy Young	
Fred Blackburn	Dave Dawson	**Richard Withrow**	49
J B Lewis	Gerald Priestly	**Rodger Turley**	
John Lovett	Paul Kilgore	John Harris	
Rick Duram	Dave Haynes	Tim Martin	
Joe Zegeer	Glen Sigmon	Ronnie Easter	
Wally Rose	Marge Rowley	Bob Lockheart	
Jerry Parsons	Jerry Withrow	Dave Spurlock	
Bill Hutchinson	Colon White (Blue	Sandy Carmen	
P T Turley	Ron Myers	Frank Cassel	
Diane Montaue?	**Dick Pierce**	**Pete Jones**	
Diane McErlean	Steve Hudson	Dave Howard	
Bob Searls	Larry Gore	**John Clark**	
Quenton McCallister	Bill O'Neil	Terry Sponoggle	
John Winter	**Dave Jones**	Archie Michael	
Rex Dean	Bill Dlugus	Jerrel Stephenson	
John Harrison	Jimmie Stewart		

HOURLY EMPLOYEES	SENIORITY DATE
1 Hamrick, F. G.	10/05/59
2 Parsons, J. R.	09/27/65
3 Franklin, R. C.	09/26/66
4 Parsons, D. L.	11/07/66
5 Hudson, J. W.	11/25/66
6 Jacobs, H. J.	12/05/66
7 Harless, H. R.	03/27/67-3
8 Childress, G. W.	03/27/67-4
9 Akers, R. D.	04/03/67
10 Marker, B. E.	03/19/68
11 Huffman, D. O.	09/03/68
12 Rust, W. L.	09/16/68
13 Jones, J. P.	10/07/68
14 Grimes, R. L.	02/24/69
15 Riling, R. N.	03/31/69-2
16 Griffith, P. L.	03/31/69-4
17 Boggs, A. C.	05/26/69
18 Dent, D. M.	04/06/70
19 Mallory, R. R.	04/20/70-2
20 Cassle, F. K.	04/20/70-3
21 Wood, G. M.	08/06/70
22 Hedrick, L. W.	08/10/70-2
23 Duke, J. L.	08/10/70-3
24 Price, R. B.	09/28/70
25 Foster, M.	02/12/71
26 Crouch, T. W.	03/22/71
27 Searls, R. L.	03/29/71
28 Blackburn, F. L.	05/06/71
29 Priestley, D. J.	07/07/71
30 Hensley, O. D. Jr.	08/23/71
31 Sayre, M. L.	09/21/71
32 Stover, M. D.	09/28/71
33 Whitlock, D. L.	10/05/71
34 Turley, R. D.	10/19/71
35 Stricklen, P. F.	02/07/72
36 White, C. R.	02/21/72-1
37 Kouns, L. L.	02/21/72-2
38 Bumgardner, P. G.	04/03/72-1
39 Starcher, D. F.	04/03/72-3
40 Michael, A. R.	04/25/72
41 Droddy, R. D.	05/11/72
42 Snyder, F. F.	05/22/72
43 Stephenson, L. J.	06/19/72
44 Kapp, D. E.	07/17/72
45 Harris, J. E.	08/21/72
46 Young, H. O.	09/05/72
47 Burgess, J. D.	12/06/72
48 Merguc, M. A.	01/26/73
49 Hess, K. R.	02/08/73
50 Beckett, R. D.	02/14/73
51 Armstrong, R. R.	02/21/73
52 Walker, U. G.	03/12/73
53 Scarberry, K. W.	04/02/73
54 White, D. L.	07/10/73
55 Painter, D. B.	07/13/73
56 Duty, E. J.	07/20/73-1
57 Sponaugle, T. L.	07/20/73-2
58 Spurlock, D. P.	08/23/73
59 Lewis, K. B.	08/29/73-2
60 Bishop, A. D.	08/29/73-3
61 Kilgore, P. M.	09/17/73
62 Clark, J. R.	09/20/73
63 Mannon, J. L.	10/04/73-3
64 Good, V. D.	10/04/73-5
65 Patterson, W. K.	10/17/73
66 Kidd, D. H.	10/31/73
67 Halstead, J. C.	02/01/74
68 Dolin, K. L.	02/06/74
69 DLugos W. P.	02/14/74-2
70 Pauley, M. L.	02/14/74-5
71 Withrow, R. L. II	03/01/74-4
72 Miller, J. W.	03/01/74-7
73 Briscoe, S. F.	03/29/74-3
74 Hartley, S. M.	03/29/74-4
75 Chandler, D. C.	05/07/74
76 Zegeer, J. M.	06/21/74
77 Grant, K. P.	07/18/74
78 Meickles, L. W.	07/23/74
79 Stewart, J. W.	08/13/74-1
80 Hensley, D. L.	08/13/74-3
81 Haynes, D. R.	08/13/74-5
82 Lowery, S. L.	08/22/74
83 Huffman, D. R.	09/10/74-2
84 Howard, D. A.	09/10/74-3
85 Clay, A. E.	09/10/74-4
86 Dalton, D. W.	09/10/74-6
87 Midkiff, S. C.	09/10/74-7
88 Bailey, R. L.	09/10/74-9
89 Parsons, G. A.	09/30/74
90 Withrow, J. L.	10/28/74
91 Priestley, G. E.	12/02/74-7
92 O'Neill, W. C.	12/02/74-9
93 Kessell, M. R.	12/02/74-12
94 Dean, R. E.	04/21/75-1
95 Given, G. L.	04/21/75-5
96 Miller, J. H. Jr.	04/21/75-7
97 Jones, D.	04/21/75-10
98 Lockhart, R. G.	05/19/75
99 Lovett, J. E.	02/16/76-3
100 Lewis, J. B.	02/16/76-5
101 Sigmon, G. E.	03/15/76-4
102 Durham, R. D.	03/15/76-5
103 Rowley, M. J.	04/26/76-1
104 Rose, W. S.	04/26/76-2
105 Mallory, C. E.	05/17/76
106 Parsons, J. B.	07/19/76-10
107 Clark, J. K.	07/19/76-12
108 Hutchison, W. E.	09/27/76-7
109 Winter, J. F.	09/27/76-9
110 Easter, R. E.	09/27/76-10
111 Rippetoe, O. A.	09/27/76-12
112 Hudson, S. W.	09/27/76-13
113 Fralin, W. C.	12/13/76
114 Lawson, G. G.	07/13/84
115 Carman, S. F.	09/10/84
116 Turley, P. T.	10/29/84
117 Pierce, R. D.	01/14/85-2
118 Gore, L. D.	01/14/85-3
119 Bolland, C. H.	01/14/85-4
120 Montague, D. K.	01/14/85-5

The Salt Industry in the Kanawha Valley



To portray and help preserve a community's economic and industrial development, this booklet is published by the Chlor-Alkali Division of Food Machinery and Chemical Corporation in South Charleston, West Virginia.



December 1, 1959 the Chemical Divisions of Food Machinery and Chemical Corporation were presented the first Kirkpatrick Award for Management Achievement, inaugurated by the business publication "Chemical Week." In part the award stated: "In recognition of the conspicuous success achieved by its management in formulating and executing policies conducive to the welfare of its owners, its employees and the nation"

CHLOR-ALKALI DIVISION OF

FOOD MACHINERY AND CHEMICAL CORPORATION

South Charleston, West Virginia

JARRETT PRINTING COMPANY, CHARLESTON, W. VA.

The Why of This Booklet

THE extent to which a community's history is influenced by its industrial development is uniquely borne out in West Virginia's Great Kanawha Valley. On the banks of a beautiful river, the manufacture of salt was the very first economic enterprise. Today, 160 years after the first pound of salt was made, great industries have created one of the world's most important chemical centers, using practically the same basic resources as the salt makers. It may rightfully be said that there is scarcely a home in America which does not bear evidence in some manner of what has grown out of ingenious man's accomplishments in the Magic Valley of West Virginia.

We believe that communities and industries are joint owners of an area's history. Each, therefore, should take pride in this heritage, find occasion to make it known, and, most of all make every effort to preserve it.

In transforming resources into marketable products an industry creates payrolls, finds need for a vast quantity of supplies, becomes responsible for its share of taxes, participates in community affairs. We think it evident that communities expand as their economies expand, that they experience stagnation when economic development ceases or is retarded. Thus, development of local resources becomes a very real part of a community's well being and prosperity.

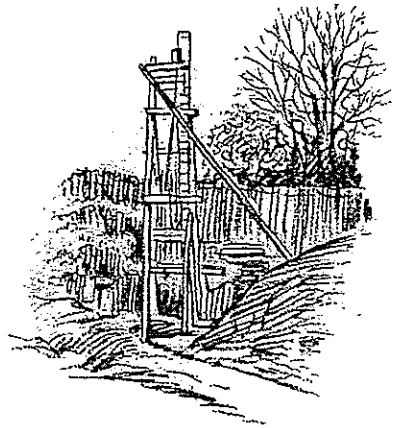
We, in Food Machinery and Chemical Corporation, with two important plants in the Valley, present this brief history of salt in behalf of our employees, in appreciation of what the people and resources of the area mean to us. It is our hope that this booklet will give people in the Great Kanawha Valley wider knowledge of this particular phase of their history.

Carl F. Prutton

DR. CARL F. PRUTTON,
Executive Vice President
Chemical Divisions
Food Machinery and
Chemical Corporation
New York City, N. Y.

June 1960

Acknowledgments



THIS description of the Kanawha Valley's first industry was made possible through the assistance of numerous people, among whom are: Dr. Roy Bird Cook, (author of the "Annals of Fort Lee," "Washington's Western Lands," "The Boyhood of Stonewall Jackson," etc.,) C. C. Dickinson, Nicholas Winowich, Olive B. Crummett, Lee M. Kenna, and the research staff of Kanawha County Public Library which provided materials from every possible source. The illustrations are the work of Paul K. Jordan of Charleston; editor, Charles A. Williamson. The bibliography includes:

Ellis T. Crawford, the West Virginia Review—Vol. 11 1933-34; Vol 13, 1935-36; History of the Great Kanawha Valley, Illustrated — Vol. I; Salt — The Fifth Element — Eskew; History and Biography — History of Charleston and Kanawha County — Laidley; New World Chemistry —Jaffe; The Kanawha Spectator—deGruyter; An Industry Reports to a Community; West Virginia Geological Survey —Bulletin 7; Rock Salt Deposits in West Virginia; West Virginia Geological Survey, 1937; West Virginia Geological Survey No. 1—Salt Mines and Mining; Salt Industry in the Kanawha Valley—Anderson (Microfilm); Salt Industry in the Kanawha Valley—Mosby (Microfilm); The Charleston Gazette, Magazine Section, September 16, 1956, page 19m; The Charleston Daily Mail, Sunday, November 14, 1937, page 2; West Virginia Business Index, September, 1959; West Virginia Department of Labor; Interview with Mrs. Kemper D. Ruffner; History of the Presbytery of Kanawha; Pioneers and Their Homes on the Upper Kanawha—Ruth Woods Dayton; Salt Report on the B & O Area, the Baltimore and Ohio Railroad.

Neil Elphick

NEIL ELPHICK, Resident Manager
Chlor-Alkali Division
Food Machinery & Chemical Corporation
South Charleston, West Virginia

June 1960

Old brine well

A Brief Summary

THE Leonard Morris family came to the Kanawha Valley in 1771 from the Shenandoah, and settled about 20 miles east of the Elk River. The Morris settlement and Clendenin's Fort Lee, erected in 1788 where the Elk river meets the Kanawha, offered protection from Indians for settlers in this area and in scattered settlements farther west. There were six small dwellings at Fort Lee, named in honor of Light Horse Harry Lee, father of Robert E. Lee, when Joseph Ruffner arrived in 1794 to settle and to make salt on the 502 acres of land he had purchased.

Ruffner bought 1,000 additional acres, which included Fort Lee, from the Clendenins. This land came to be part of the city of Charleston. In its earliest days, Charleston was a slower growing community than was a settlement a few miles to the east, known at various times as Ruffner's Salt Works, Saltborough, Terra Salis, Kanawha Salines, and finally Malden. As Kanawha Salines, because of its salt production, it became one of the most important industrial communities in western Virginia.

As the salt industry developed, it brought into being many other businesses, tin and copper smiths, wagon and barrel makers (at one time 130,000 barrels were used annually), blacksmiths and foundries. Each salt furnace required from 8 to 10 tons of cast iron construction, and ½ ton of bar iron; 1,500-2,000 pounds of wrought iron were required each year to repair a furnace and damaged equipment. As late as 1875, when the salt industry was far beyond its peak, of the 301,000 tons of coal produced in the valley, 101,000 tons were used by the salt industry for its furnaces.

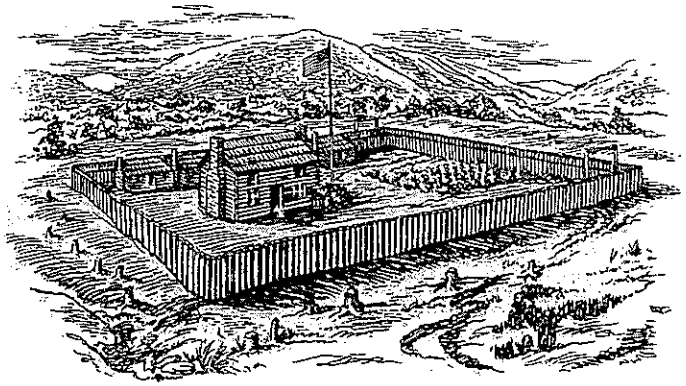
Boat making also became an important activity. The first boats were made near Kelly's creek by the Morris family for the George Rogers Clark expedition against the western forts of the French in Illinois. Since the road from the east ended in the vicinity of the Kanawha Valley, travel further westward for many years depended upon boats.

When coal replaced salt as the chief industry in the valley, Charleston supplanted Kanawha Salines as the chief commercial center. In 1810, Charleston had but twelve homes; at the end of the Civil War, there were two thousand. Because of natural resources such as brine, coal, and gas, and excellent transportation to eastern and midwestern markets, the Kanawha Valley in the years since, has become one of the world's greatest chemical areas.

*"There is another class of explorers whose exploits are rarely heralded by the waving of flags, to whom few monuments are erected, and whose names find small place in the world's history. They are the explorers in science. They change no maps, but they change our way of living."**

This happened in the Kanawha Valley.

*H. W. Haggard, 1929



Fort Lee (Site of Charleston, W. Va).

The First References

IN 1671, Sir William Berkeley, governor of the colony of Virginia, sent out from Williamsburg Captain Thomas Batts, Robert Fallam, Thomas Wood, a servant and an Indian guide to explore the land that lay to the westward beyond the Shenandoah Valley. On September 16 they reached the falls of a river, located in a narrow valley surrounded by rugged hills. The Delaware Indians called it "The White Stone River." (A century after Batts' visit the Virginia General Assembly officially named it the "Kanawha.")

At these falls, Captain Batts took possession of lands, drained by the river, for King Charles II of England, Ireland and Virginia. An Indian from another tribe, whose village was located further towards the west, told the explorers of a place where salt could be obtained in abundance.

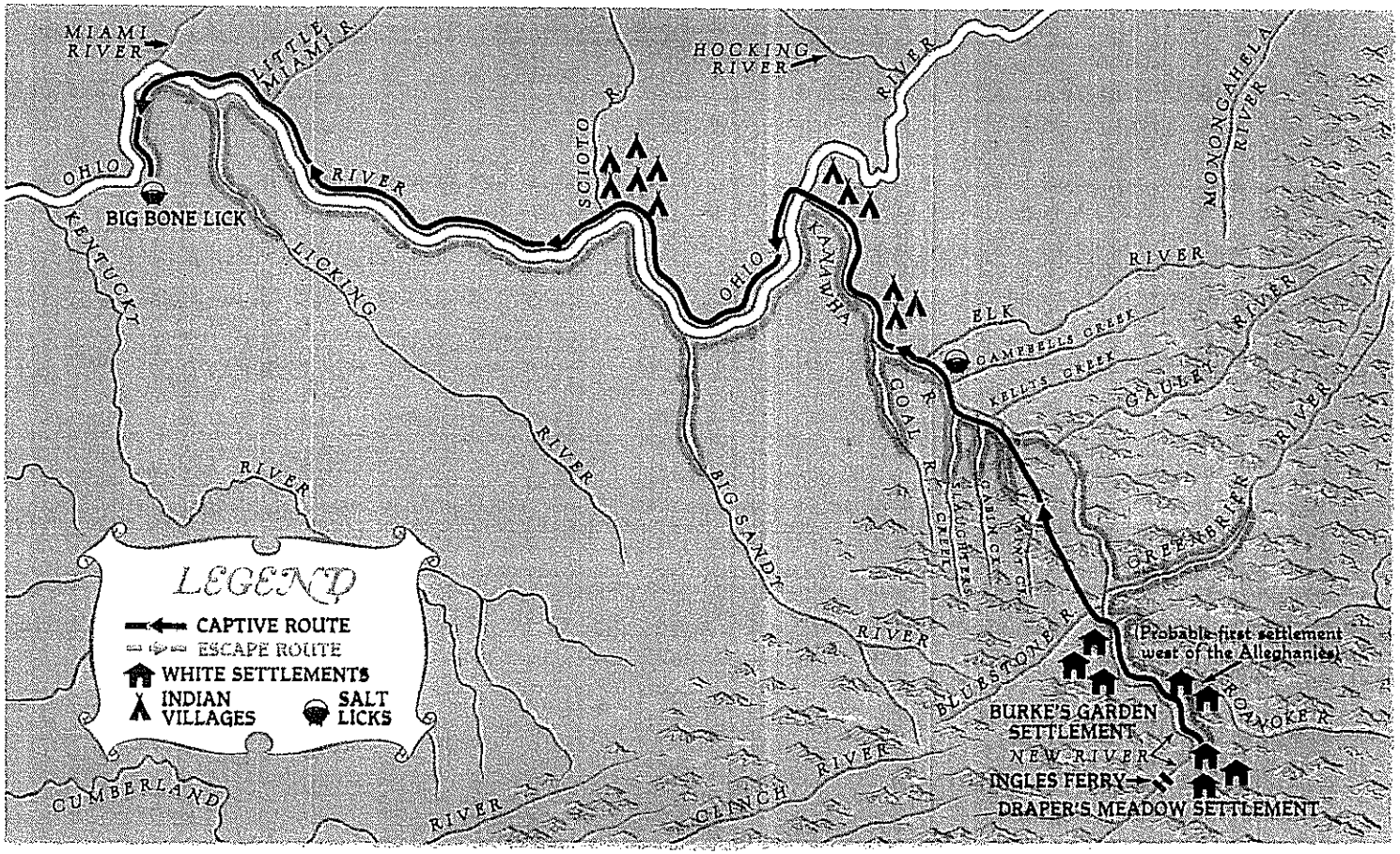
By the next year, 1672, another young explorer, Gabriel Arthur, after escaping from Indian captivity, wrote that he and his companion had stopped at some salt springs about a day's journey from where the Kanawha flows into the Ohio.

In 1750, the first wedding west of the Alleghenies took place between 18 year old Mary Draper and William Ingles in Virginia's westernmost settlement, Draper's Meadows (not far from present day Blacksburg, Virginia). Mary Draper Ingles was a fine product of her time. Besides being a good cook, seamstress and nurse, she could shoot, run, and ride horseback as well as most boys her age. Five years after her marriage on Sunday, July 8, 1755, a band of raiding Shawnee Indians, captured her, along with her two sons, two and four years of age, and her sister-in-law, Betty. The Indians killed Betty's infant daughter.

The Shawnees traveled down New River with their captives. Three days out, a baby daughter was born to Mary Ingles. After leaving the Bluestone River, the party traveled across Flat Top mountain and down Paint Creek, where they crossed the Kanawha. At the site of the present town of Malden, the Indians and their captives camped near a salt spring, or buffalo lick. The Indians rested and hunted. The captives were put to work boiling brine from the salt spring.

After curing meat from the game killed near the lick, the party traveled to the Scioto on the Ohio. Here the captives were traded to new owners. Mary Ingles was separated from her two sons, but she was allowed to take her young daughter with her. Because of her ability to cook, nurse and sew she was well treated. Several weeks later, the tribe moved to a salt lick located about 40 miles below where Cincinnati is today. Mary Ingles decided her chances for

Mrs. Mary Ingles captured by Indians



Captive and escape routes of Mary Ingles

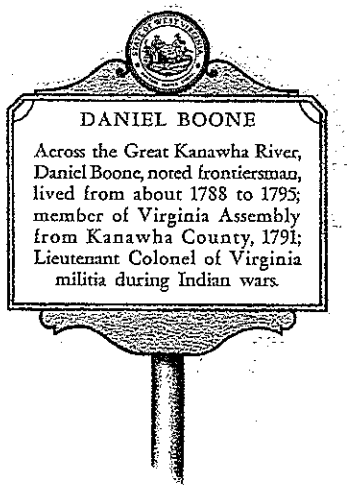
an escape were now better than at any other time. Leaving her child behind, she and an old Dutch woman, captured in Pennsylvania, escaped and, after many hardships, made their way back to the Virginia settlement. (Later, the older Ingles boy was recovered from the Indians. The younger one had died shortly after he had been separated from his mother. No trace was ever found of the infant daughter who had to be left behind at the Kentucky salt lick.)

Mary Ingles' account of her experiences contained the first reference to salt making in the Kanawha Valley.

By 1770, settlers were coming to the Kanawha from the east, by way of the James and Greenbrier rivers; from the west by way of the Ohio. Following the Battle of Point Pleasant in 1774, and the defeat of the great Indian warrior, Chief Cornstalk, by General Andrew Lewis, many Virginians settled in the area.

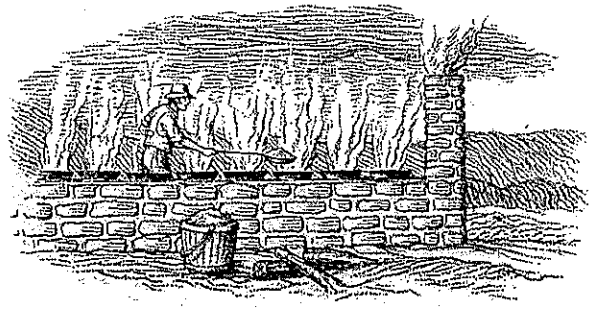
Daniel Boone at one time had a cabin across the Kanawha opposite the great buffalo lick. After Kanawha County was formed he served as one of the county's first delegates to the General Assembly in Richmond. One of the earliest land locations, a tract of 502 acres, was staked out in 1785, by John Dickinson, a farmer of the Shenandoah Valley. It included the mouth of Campbell's creek, the bottom above it and the salt spring. In 1794 he sold this tract to Joseph Ruffner, also from the Shenandoah.

Three years later the first commercial salt was to be made at the salt spring on this tract.



Marker on U. S. 60 near Charleston

The First Commercial Salt



FRAGMENTS of earthenware pottery, found near Big Buffalo salt lick, indicate that Indians used such containers to make salt. They also filled hollowed-out wooden logs with brine, into which they dropped hot stones which evaporated the water. Mary Ingles used some of her own iron cooking pots which the Indians had brought along, following their raid in Draper's Meadows.

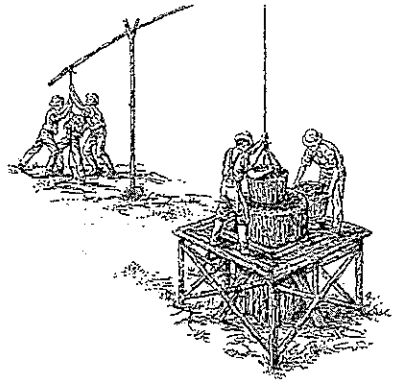
In 1797, Elisha Brooks opened the first commercial salt operation in the Kanawha Valley. He had leased from Joseph Ruffner the land adjoining the salt spring for the right to manufacture salt. Brooks used 24 iron kettles, set in a double row, 12 kettles each, "with a flue beneath, a chimney at one end and a fire bed at the other."

To secure his brine, Brooks sank several gums into the mire and quicksand of the salt lick—a gum is a hollowed-out log, 8 to 10 feet in length. The brine was dipped out with a swape, or sweep (a long pole on a pivot, with a bucket at one end), as it oozed into the gum from the sands below. In this manner he made about 150 pounds of salt a day, selling it at the furnace for 8 to 10 cents a pound. Brooks did no settling or purifying, so the salt contained the impurities found in the original brine.

When the brine came from the spring or wells, it was clear and sparkling, but after it had been heated, even slightly, it became red, and when nearly saturated and hot it was as red as blood. On cooling, it became clear again. The red color was caused by iron impurities, which also gave the salt a red tint. Kanawha salt soon acquired a reputation for its strong, pungent taste and for its superior qualities for curing butter and meat. Many thought that the red coloring had something to do with giving it superiority over salt from other areas. In time, the "red salt from Kanawha" became known as the best salt produced in this country. It was the only salt free from calcium sulfate. Brooks got a bushel of salt, 50 pounds to the bushel, from each 500 gallons of brine.

Workman tending kettles

The Ruffner Salt Works



JOSEPH Ruffner, on his death-bed, urged his sons to begin making salt on the land which he was bequeathing them. Salt-making had been his original reason for coming to the valley. He had been side-tracked into farming, however, when he bought Fort Lee from Clendenin, and leased the salt marsh to Elisha Brooks. Three years after their father's death his sons began their search for the source of brine. They wanted both a larger and stronger brine supply, and to devise a more efficient way of producing larger quantities of salt.

To get to the bottom of the same mire and quicksand where Brooks had sunk his gums, the Ruffner brothers set up a gum made from a straight, well-formed, hollowed-out sycamore tree, four feet in diameter, sawed off square at both ends. This gum was set upright in the spot where it was to be sunk, large end down, and held by braces on four sides. A platform, on which two men could stand, was fixed at the top. A "swape" (a sweep) similar to the one used by Brooks, although larger, was fashioned and a bucket, made from half a whiskey barrel, was attached by rope to its end. One man worked inside the gum with a pick, shovel, and crowbar. When he had filled the bucket, the two men on the platform on top of the gum pulled it up. It was emptied and then returned, with the help of three or four men who worked the swape from close by, where the fulcrum was set in a forked post. This was the well-digging crew. After many days and many delays, at a depth of 13 feet, they broke through a six-inch layer of shale (sand, gravel, and iron) which allowed the brine to flow quite freely. However, this brine proved to be less saline than that obtained nearer the surface.

Discouraged, they attempted digging a well farther from the river. This well proved even more discouraging when the same layer of shale was found.

The crew returned to work on the original well, and reached bed-rock at a distance of 16-17 feet below the surface. It was necessary to make the bottom of the gum fit snugly so that fresh water would not seep in between the gum and the rock. This was accomplished by trimming the bottom face of the gum to fit the rock as well as possible and using wedges of wood to complete a seal. Soon a small amount of stronger brine oozed up through the rock.

The next problem was to get to the source of this stronger brine, and get it in larger quantities. They drilled a hole as far as they could by means of a hammer and a hand drill. It then became necessary to drill a larger and deeper hole through the rock, which had become covered with a seepage of brine. The only way open to them was the use of larger

Sinking the first well

and longer drills. So a long iron drill with a two and a half inch chisel-bit of steel was attached to a spring pole by means of rope. The spring pole was bounced up and down by the weight of three men. In this manner the well boring continued slowly until November 1, 1807, when a fissure was reached, yielding an increased flow of stronger brine.

By the middle of January, 1808, at forty feet below the surface, such a heavy flow of strong brine appeared that drilling was halted. The main problem at this stage was to prevent the strong brine from being diluted by the seepage of fresh or less salty water from above this lower level of strong brine. A long metal tube would have been the perfect answer, but no such thing was available in the frontier country. The ingenuity of the Ruffner brothers was again called upon.

Since it would take too long to bore a wooden tube forty feet long to go into the two and a half inch hole, two long strips of wood were shaped into halves of a tube. These halves were fitted together and wrapped with tarred twine. The tube was then carefully lowered down the hole. The innovation worked to perfection. The brine from the fissure in the deep bed-rock flowed up freely through the tube into the bottom of the gum.

Eighteen months after the work on this well had begun, brine could be raised from the gum with a "swape" and a bucket. This was the first salt well, rock-bored, tubed, and rigged west of the Alleghenies, perhaps the first in all the United States.

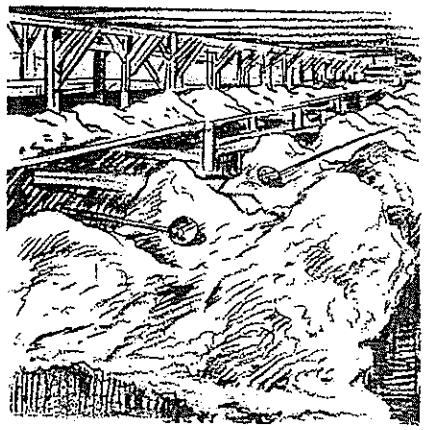
While in the process of drilling, the Ruffner brothers had begun work on a furnace. This furnace was like that of Brooks, but with more and bigger kettles. On February 8, 1808, the Ruffner brothers produced their first salt. A bushel of salt could be made from 200 gallons of the brine from this well, instead of 500 gallons as at Elisha Brooks' furnace. The price was lowered to four cents per pound.

A younger Ruffner brother, Tobias, was the first to suspect that there was a great saline reservoir underneath the deep rock stratum that underlies the valley. He believed that if he went deeper than did his brothers, the brine would be stronger. His belief and his search to find the underground salt lake was called "Ruffner's Folly."

Undaunted, Tobias hammered out a new kind of auger, and leased the site of one of his brother's abandoned wells. His bits were sharp, made of wrought iron and lowered on shafting as the boring went deeper. Instead of using manpower and the spring pole, he used a horse mill. This was a more powerful and more complicated arrangement, using a lever, crank, shaft, and a blinded horse and/or mule which pulled in a circle around the shaft.

At a depth of 410 feet the auger encountered an artesian well from which spouted a stream of clear, sparkling brine. A bushel of salt could be made from 45 gallons of this brine. Soon everyone who owned land near the river started digging for brine. Furnaces were started on both sides of the Kanawha river for seven miles. (see map, back cover, for location of furnaces.)

The Age of Invention



THE pioneers of the salt industry were resourceful men. The inventiveness of the Ruffner brothers led the way for other improvements in well-drilling and pumping. The "swape," operated by men, soon gave way to the horse-mill for pumping brine out of wells. About 1827, the steam engine was first utilized for drilling, pumping and for other tasks about the wells.

The wooden tubing of the Ruffner brothers gave way to tin tubing made by a tinsmith from Charleston, who previously had made only tin cups and coffee pots. Tin corroded badly, so copper was used when it became available. Copper was followed by iron and steel.

The first screw joints appeared with the copper tubes. Dates were not recorded for these changes, since early inventors were too busily occupied to keep exact records.

The Seed-Bag

To "bag," or make water-tight the joint around the bottom end of the tube and the hole above, the early well-drillers used a seed-bag. The seed-bag served its purpose effectively. It was made of buckskin or calfskin, sewed to make a cylinder, 12 to 15 inches long and approximately the diameter of the well bore. This bag was slipped over the end of the tube, and fastened to prevent it from slipping. Then six to eight inches of flaxseed, alone or mixed with powdered gum, was poured into the bag, and the lower end sealed by tieing. The top end of the bag between the flaxseed and end of tubing was then sealed like the lower end, and the tube was ready to be lowered into the well. The seed-bag, swelling from the water which the seeds absorbed, made the joint water-tight. The steel and rubber casing shoe-packers, used today in oil and gas wells, evolved from this early seed-bag.

Slips

"Uncle Billy" Morris, a practical and ingenious well-driller, invented a piece of equipment which enabled the salt drillers to go deeper than ever before. This equipment, called "slips" in the Kanawha salt region, came to be known as "jars" in oil and gas well drilling.

The "slips" consisted of a long, double link of metal, with jaws that fitted closely crosswise, but which allowed the links to slide loosely vertically. They were made of the best steel available, about 30 inches in length, and fitted pin and box connections. For use, the "slips" were placed between the heavy iron sinker, just above the bit.

Salt on drainage board

and the socket which attached to the drilling line. The "slips" gave the heavy sinker and bit a sharp, rapid cutting fall. It also allowed the loosening of auger poles or other tools stuck in the well by a jarring action. (This sticking of tools was one of the nuisances that plagued the well-driller.) The invention of the "slips" or "jars" was a great step forward in well-drilling, and this equipment has been used along with the heavy sinker wherever drilling has been carried on.

Billy Morris never patented his invention, and never received any money for it. About the only recognition he received for originating the "slips" has been the naming of a city street for him in Charleston.

The science of well-digging progressed so far in the Kanawha Valley that when Drake drilled for oil in Titusville, Pennsylvania, he employed well-diggers from Kanawha to do his drilling. The valley sent forth skilled well-drillers to all parts of the country, wherever there was boring to be done– for water for irrigation on western plains, artesian wells for city or factory use, for salt wells in other areas, for oil and gas well drilling, and for other geological and mineralogical explorations.

The Multiple Effect Evaporator

While the wells were being dug deeper and larger in diameter, the tubing made better, the pumps and rigging made simpler, and better and more efficient fuels were being utilized, another tremendous improvement was made in the evaporation of the brines.

At this time the major salt producing areas in the country were Kanawha County, Virginia (the state of West Virginia had not been formed), Saltville, in Southwestern Virginia, and Onandaga, in the vicinity of present day Syracuse, New York.

The various salt makers in the Kanawha Valley were producing over a million bushels of salt a year when George H. Patrick from Onandaga, New York, was invited to come to Kanawha to introduce a new kind of steam furnace. His idea had been rejected at the salt works at Onandaga. Andrew Donnally and Isaac Noyes were the first salt makers in Kanawha to adopt Patrick's new method of evaporating salt. After some improvements, the Patrick furnace was adopted by all the salt makers. When salt brines were found in Pomeroy, Ohio, this was the only type furnace used there.

Patrick's Patented Steam Furnace, as it was called when improved and completely developed, consisted of large cast iron pans over which were built wooden steam chests made watertight to the pans. Two, three or four sections of these were arranged longitudinally to form one continuous furnace. Each section might be 24 to 30 feet in length and 8 to 10 feet in width. (See illustration p. 34)

The wooden steam chests were held to the pans by bolting them to flanges on the sides by wooden clamps and keys, and by iron bolts and rods, all made water-tight by calking. After the steam chests, came a series of wooden vats, usually made of four to five inch thick poplar planks,

and fitted in a frame of oak by silla and clamps. These were tightened by driving wooden keys, and also made water-tight by calking.

There were two sets of vats or cisterns. After the brines were boiled in the furnace proper, they went to the first vats, or settling cisterns, where they saturated and settled to remove impurities from the brine. The second series of cisterns were the graining cisterns, or grainers, where the salt was crystalized. Once every 24 hours, the deposited salt was lifted out by long handled shovels onto a slat board, which was suspended above the grainer. After the salt had dried properly, it was moved in wheelbarrows to a salt house, where it was packed in barrels for shipment.

The grainers were 15 to 18 inches in depth, while the settling cisterns usually were deeper. Through all the cisterns ran three rows of copper pipes, usually about five inches in diameter. The steam generated by the boiling of the brines in the furnace proper (the first long, shallow cast iron pans) was carried from the steam chest by wooden pipes, and thence to the copper pipes in the settling systems and the grainers. This steam maintained the temperature of the brine, causing a more rapid evaporation.

The temperature of the brine determined the kind of salt crystallized. The higher the temperature, the finer the grain of salt. Ultimately, production was increased many times over that of the kettle furnace with resulting improvement in quality.

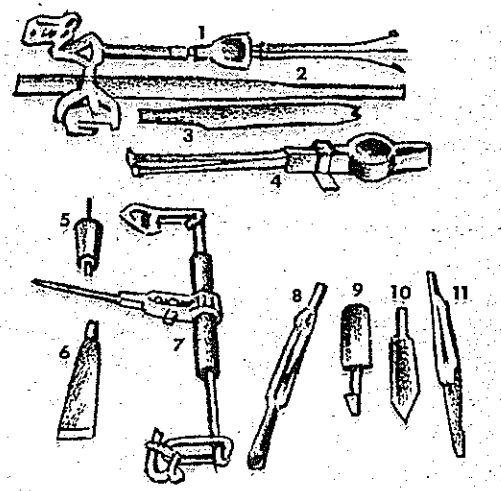
Thus the days of the kettle were numbered. The kettle furnaces had been extremely expensive to operate because of the large amount of labor needed, the high cost of maintenance and the inefficient use of fuel. The multiple effect system, introduced by Patrick, required less labor and less fuel, and produced better, purer, finer salt in larger quantities.

Snow Hill, a small village between Malden and Charleston, had a multiple-effect furnace owned by the great-grandson of Mary Ingles. This furnace, the largest in all the valley, was located not far from where Mary Ingles had been taught to make salt by her Indian captors. In one year alone, this furnace produced 140,000 bushels of salt. It had 20,000 square feet of evaporating surface in the grainers, and over 1,300 square feet of surface in the furnace proper. It burned 1,200 bushels of coal a day.

Gone was the "old red salt of Kanawha" for in the settling pans of the new furnaces the iron impurities were eliminated. The salt from Kanawha was now pure white. Kanawha salt was exhibited and won prizes in the first World's Fair held in London in 1851 and in the Paris Universal Exposition in 1868.

With the passing of the Brooks Furnace located about one mile below Campbell's Creek around 1890, there remained in operation only the Dickinson Salt Works immediately above Malden. This closed down in December of 1945 after more than 120 years of operation by four

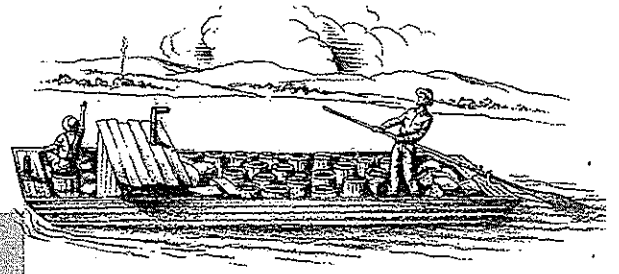
generations of this one family. Even though air lifts had been substituted for the walking-beam-sucker-rod brine pumps, closed steel pans for cast iron pans with wood steam chests, stoker for hand firing, mechanical rakes and belts for hand lifting and wheelbarrows, it was to no avail. The cost of coal had more than doubled and the insufficient supply of brine in that area did not justify investment in the more efficient multiple vacuum pans.



EARLY DRILLING EQUIPMENT

1. A fishing tool
2-3. Sections of hickory poles used as drilling cables, forerunners of the modern sucker rod
4. A clamp similar to that on the modern temper screw
5. A reamer
6. A drill or bit
7. A device used to "feed" a drill, described as the forerunner of the modern temper screw
8-11. Hand-forged jars or slips
9. A reamer used for enlarging
10. A wood bit used to bore logs lengthwise to make pipe

(From Vol. 8 West Virginia Geological Survey)



Kanawha Salt Goes to Market

BECAUSE sodium chloride is a heavy, bulky product — a bushel of salt weighs 50 pounds — transporting it from plant to market has been an influential factor in its production.

The Shawnee raiding party, which took Mary Ingles from her frontier home to their Scioto River capital, carried their salt in grass baskets.

When Elisha Brooks sold salt from his furnace to his neighbors for ten cents a pound, they took it home in tin buckets, kerchiefs, pillowcases, or whatever else was available.

By Horse and Wagon

As more salt was produced by improved methods and by more economical fuels, the price of salt could be lowered enough to compete with eastern-produced or imported salt. In 1797 Kelly's Creek was the terminal point in road transportation to the west. Here the first permanent settlement in the valley was made. Kelly's Creek is now known as the town of Cedar Grove. The road to Kelly's Creek was so bad in 1814 and the difficulty in getting the salt out of the valley was so great that the price of local salt fell to a new low.

However, there were several attempts over the years to get better roads in and out of the valley, since it was one of the gateways to the west. From 1818 to 1823, a highway was laid out on the trails made by buffalo. Mountain wagons took salt over this road to eastern and southeastern cities.

The James River—Kanawha River Turnpike

The James River—Kanawha River Turnpike was the most important road between the Virginia seaboard and the west. (Route 60, or the Midland Trail, generally follows the same route today.) In the early 1800's, the only practical way of transporting salt overland was by putting it in bags and taking it out by pack horse.

One of the descendants of an old Greenbrier County family who married a descendant of the early salt-making Ruffners, relates that it was the custom in her grandfather's day, when all the harvesting had been completed and before the winter set in, for many of the men of that area to make an annual visit to Charleston or Kanawha Salines to buy their year's supply of salt. This trip amounted to a great holiday for the men. Here they indulged in some social drinking, card games, discussions of politics and other topics of interest in that day. There were hotels and taverns in the salt-making communities to accommodate them. A sign proclaiming "Entertainment for man and beast" dangled in front of Daniel Ruffner's tavern. These men traveled in horse-drawn wagons or on horse back, and the

Flatboat loaded with barrels of salt

task of taking their year's supply of salt back home with them was an arduous one.

By River

The settlers, west of the valley, were dependent upon Kanawha salt for their nutritional needs, the needs of their livestock, and for curing meat and butter. Travel to the west was by river and the first boats were called "Juroques." These were dugout poplar trees, canoe-like, sixty to eighty feet in length. In 1808 salt was packed in tubs, boxes, and hogsheads, and floated down the river on rafts of logs.

Next came the flat-boats, the first of which were called "bitter heads." These flat-boats floated down the Kanawha, guided by pole and bar, and on down the Ohio to supply the settlers in Ohio, Indiana, Illinois, and Kentucky. The flat-boats increased in size from those fifty feet in length and ten feet in width to ones that were more than 160 feet long and 25 feet wide. They were navigated downstream only.

The flat-boats were guided by hand and at great risk. Sometimes a boat with all of its cargo would sink, although the Kanawha boatmen were known to be among the best in the country. The crews of the boats varied. If it were a single boat, there would be an oarsman at each end of the boat, plus a cook. If the boat were a larger size, there might be as many as eight oarsmen, and a pilot. These flat-boats carried up to 2,200 barrels of salt. Barrels were made in two sizes to take Kanawha salt to market: one held 280 pounds of salt, the other 350 pounds. The pork-packing trade used the larger barrel and the retail trade the smaller size. When the boatmen reached their destination they would sell the load of salt, sell the flat-boat and make their way back home as best they could.

The First Steamboat Visit—The Steamboat Era

In 1816 the valley witnessed the visit of its first steamboat, the "Eliza." By 1824 there were daily and weekly steamboat packets. Now the salt could be shipped as far west as the Mississippi and Missouri rivers.

Dr. John P. Hale, the great-grandson of Mary Ingles, built a fleet of steamboats to move salt to the packing houses of Cincinnati, and to carry passengers. Towboats and barges were used to take salt to more distant markets. A towboat could carry 8,000 to 15,000 barrels on one trip, transporting them to Louisville, Nashville, Evansville, Memphis, St. Louis and other river cities.

No matter what kind of boat was used to ship the salt, shipments depended on the stage of the Kanawha river. A rise in the headwaters meant a fleet of boats going down river to western markets.

Sluices, Dams, and Locks

In 1825 a system of sluices and wing dams was begun to secure not less than three feet of water all year around. (Improvements made by the U. S. Engineers to make slack water navigable did not begin until 1873.) The tenth and final system of locks and dams was not completed until 1898, long after the peak of the salt industry in the valley.

Soon after the steamboats came into use, there were races between them and the flat-boats. One race was between a steamboat and a six-rower flat-boat. It was reported that $5,000 to $8,000 may have changed hands in betting. The flat-boat sank when upset by waves from the steamer.

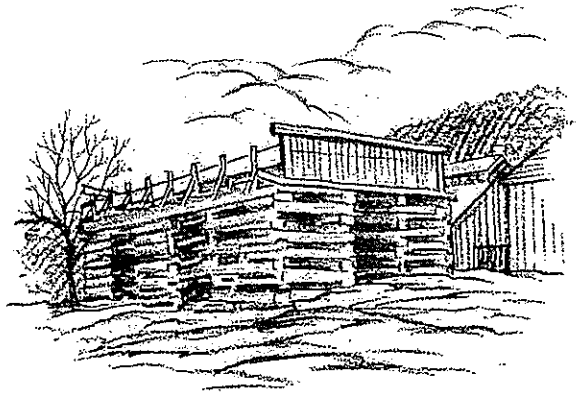
The steamboat era reached its peak in the mid-1800's but barges continued to be used to take the valley's products to western markets.

The Chesapeake and Ohio Railroad came to the Kanawha Valley in 1872 and from then on, salt was shipped by rail.

Barrel-Loading

Some salt-producing areas shipped their salt in bags, but barrels, made of white oak staves and hickory loops, were generally used in the valley because barrels were cheaper than bags. Barrels were easier to handle, more convenient to store, and would stand rougher treatment. They also were superior to bags in withstanding exposure to weather.

In the 1880's a young negro boy named Booker T. Washington went to work for one of the largest salt producers, General Lewis Ruffner, a relative of the Ruffner brothers who originally had done so much of the pioneer work in the salt industry. Washington's work was strenuous—rolling out loaded salt barrels and placing them on a chute for loading onto the decks of the steamboats. The work was kept from being even more back-breaking by the unique loading chute. It was so arranged that it could be filled almost to the top, but a curved bottom held a certain number of barrels in the chute. When another barrel was added, the bottom barrel rolled out onto the steamboat deck, making room for another barrel at the top. Besides making it easier to load the boat, this chute also saved many barrels from being broken in loading.



A brine reservoir

Fuels Used in Making Salt

MAN'S first source of salt was probably the sea. Almost all of the ocean's three percent solid matter is salt. In warmer climates, man got his salt by solar evaporation. Early American colonists along the coast obtained their salt in such a way. In some countries where the winters were long and cold, sea water was run into shallow troughs. As the top layers of water froze, the ice was removed until the salty sea water below was concentrated. This concentrated brine was heated to evaporate the remaining water. This method, or that of solar evaporation of sea water, was too expensive to make it worthwhile commercially. Solar evaporation of brines was never used in the Kanawha Valley, though it was used in some salt producing areas which did not have as warm a climate as Kanawha.

Wood

Wood was the first fuel used in the valley. Not only was the wood used for fuel, but it was also used in drilling rigs, for pipes to take the brine from wells to furnaces, for storage tanks, for barrels in which to ship the salt, and for flatboats in which the salt was transported to market.

The salt acted as a preservative, and the wood, used in the pipes and the steam chests of the Patrick multiple effect system, lasted for a long time. (Some of the wooden pipes which carried the brine were two miles in length.)

Coal

There were 15 to 20 wells and 52 furnaces boiling brine when, in 1817, it was found that coal made a more efficient fuel than wood. David Ruffner was the first to utilize coal for fuel in the making of salt. It took many months for the salt makers to learn how to use coal. It would burn slowly at the top but then go out. However, they learned to make and use a grate and provide for a draft.

Henry Ruffner, who later became president of the college at Lexington, Virginia, now known as Washington and Lee, experimented with coal fires. He found that a small jet of steam, turned under the grate bars, formed small gravel-like cinders which were more easily handled. Most of the large salt works owned and operated their own coal mines.

Gas

Quite often the salt brines were found to be associated with natural gas and oil. Gas was a hazard until man learned to use it. The first gas in the valley was struck by James Wilson in 1815. Gas was not put to use, however, until 1841 when a William Tompkins, while boring a salt well, struck a large flow of gas. He used this gas for fuel to boil the brine. Two years later, Dickinson and Shrewsbury, boring a few hundred yards below Tompkins, struck gas at about 1,000 feet. This was the great gas reservoir of

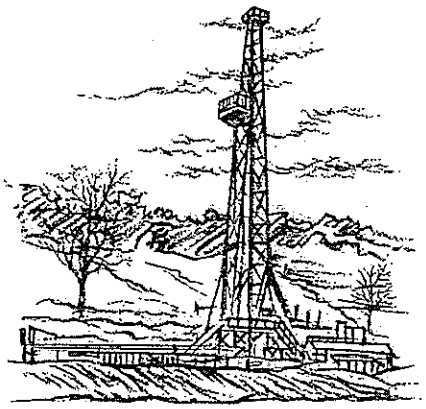
Indians used hot rocks to evaporate brine

the region. A column of salt and gas roared 150 feet into the air and could be heard for several miles. Often, while the well was blowing, stage drivers stopped in order to allow their passengers to view the phenomenon.

When one of the stages stopped to view the blowing well, one of the passengers, a professor from Harvard, went as near to the well as he could and lighted a match to determine if the gas erupting from the well would burn. Instantly the whole area was on fire. The professor jumped into the river to extinguish his burning clothes. He was later fished out and sent to Charleston for medical attention. Colonel Dickinson sent his manager, Colonel Woodyard, to get a warrant to have the professor arrested and punished for wilfully and wantonly destroying property, unless, however, the lawyer found proof that the professor was such a fool as to know no better than to light a match to see if the gas would burn. When Woodyard arrived at the bedside of the burned professor, he quoted Colonel Dickinson verbatim. The professor answered that he must, indeed, have been such a fool.

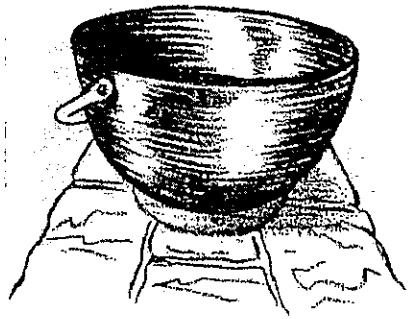
The brine and gas from this well were partially collected and conveyed through wooden pipes to the furnaces. For many years the natural flow lifted the salt water 1,000 feet from the bottom of the well and forced it a mile or more through pipes to the furnaces and raised it into a reservoir. The accompanying gas boiled the water in the furnaces and lighted the area around at night.

Others tried boring for gas to use as fuel and met with success. Land on which one well was drilled originally belonged to George Washington. Later this land was sold to Dickinson and Shrewsbury by Lawrence Washington, who had received it as an inheritance from his Uncle George.



A modern drilling rig

Production, Costs and Prices



AT ONE time, early in the kettle furnace era, it was estimated that it cost 29¢ to produce 100 pounds of salt, with no value being placed on the brine or on the coal used in the furnaces.

Production Exceeds Demand

In 1817, when there were 52 furnaces along the Kanawha river with fifteen to twenty wells producing brine, and 700,000 bushels of salt to be exported, the price dropped from $5 a bushel, or 10¢ a pound, to $2 a bushel, or 4¢ a pound. Production was beginning to run ahead of demand.

The largest kettle furnace in operation was that of Joseph Friend and Son at the mouth of Campbell's Creek. It made 100,000 bushels of salt a year; however the average furnace produced 25,000 or 50,000 bushels yearly.

The largest multiple effect evaporating system was one at Snow Hill, owned by Dr. Hale. It could produce 420,000 bushels of salt a year, using 1,200 bushels of coal a day in the furnace and 300 more in the engine house.

Production Costs

In 1876, when the production of salt probably was not too much greater than it was in 1817, and the peak of the salt industry in the valley had passed, it was estimated that it cost 16 to 22 cents per 100 pounds to produce salt, the range depending upon the concentration of the brine. The strongest brine yielded 50 pounds of salt for every 65 gallons of brine, while the weakest yielded 50 pounds of salt from 100 gallons of brine.

Coal cost $1.20 per ton, delivered at the furnace. Laborers at the furnace received from $1.00 to $1.25 per day. The cost of barrels and of packing for shipment brought the price up to 26 to 32 cents per 100 pounds.

There was some slave labor used in the early furnaces and also in the mines to dig coal for fuel. The earliest paid workers in the salt works received 75¢ a day, or about $20 a month. However, at one time the furnace workers seldom received any money, but were paid in scrip which could be redeemed for merchandise at the salt company store.

Drilling Costs

The cost of boring a well to a depth of 100 feet varied from $1,200 to $1,500, after the engine and forms were in place. It took from sixty to ninety days to drill a well.

Furnace Costs

There was a large sum invested in the valley to produce salt. A Patrick furnace cost from $40,000 to $100,000 to construct, depending upon its size.

An old kettle used in making salt

Other Factors Bearing on Price of Salt

The stage of the Kanawha river often determined the selling price of the salt. When the river was high enough, a steady stream of salt boats went to market. When it was not possible to ship salt, prices at the furnace dropped.

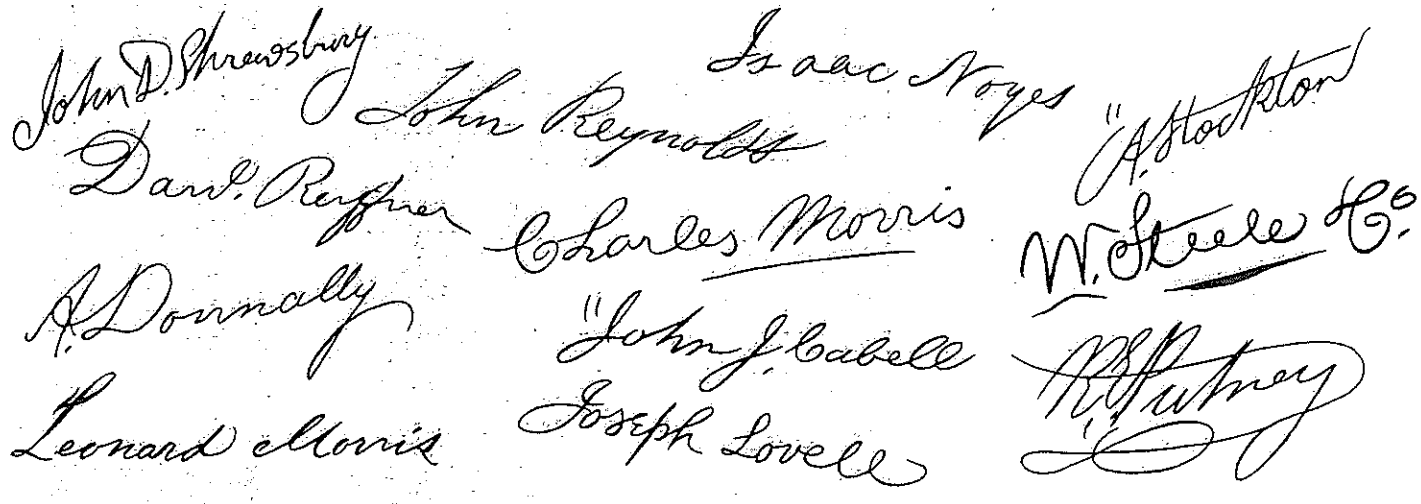
Prices were also affected by the tremendous jump in production which leaped from 146,000 bushels in 1810 to 600,000 bushels in 1816.

The Formation of the Kanawha Salt Company

To protect themselves from a surplus market and to counteract the fluctuations in prices due to transportation difficulties, the salt producers in the Kanawha valley formed a cooperative organization to control prices and production, and to handle sales.

The organization may have been the first industrial trust in America. At the organizational meeting, held November 10, 1817, all of the producers joined the organization, called the Kanawha Salt Company. Members were called subscribers.

The membership agreed to limit production in 1818 to one half of what the 1817 production would be; to pool all



Signatures from "Trust" Agreement signed in 1818

salt produced; to establish prices for the salt sold; and to create a joint sales agency. All salt was to be turned over to the company and sold at a price fixed by the company. After expenses had been deducted, each subscriber would receive monthly dividends in accordance with the amount of salt each was permitted to produce. Salt carried over from the 1817 production was not to be sold for less than the company price.

Each subscriber signed a bond for $50,000 to be forfeited if he violated any of the agreements, the forfeit to be divided among the other members in proportion to their holdings in the company. The salt company undertook to buy all the salt-producing land not owned by the subscribers. It was then believed that the brine was restricted to a small area near the mouth of Campbell's Creek.

Kanawha Salt Company Apportionments

It was decided that the amount of salt produced in 1818 should not exceed 450,000 bushels. The proportions allowed some of the subscribers are shown on page 22.

Production was partly controlled by having the salt works shut down on Sundays, thus initiating the first six-day work week in the plants. Some of the furnaces were "dead-rented," that is, their owners were paid for shutting down their furnaces and producing no salt. The "dead-rental" to some of the subscribers was as high $1,500 per furnace per year.

Decline of the Salt Trust

This trust organization lasted 16 years. It ended in court litigation which was carried on for several years between the company and the heirs of some of its former subscribers. However, the trust was revived nine times in sixty years. Intermittently, it succumbed to poor management, the operation of inefficient plants, "dead-renting," and competition from salt works in other areas of greater brine concentration, or areas closer to the markets.

In 1882 the salt organization then in effect, operating in an effort to keep the dying industry alive, was persuaded by a group of "slick New York financiers" to "dead rent" to them the entire group of salt works. All but one of the salt works in the valley belonged to the cooperative organization at that time. The organization received rent for six months in advance. When they received no more, the salt makers realized that they had been swindled. By then, the furnaces were in bad shape, the cost of repairing them was prohibitive, and markets had been captured by the salt-makers in other areas. The plants never reopened. The Dickinson Salt Works of Malden, which had not joined the last trust, alone remained operating in the valley after the 1890's.

The Peak of the Industry

In the early days, the production capacity grew faster than the demand for salt. However, as the west developed, demand for salt grew. With the development of Patrick's multiple effect evaporating plant, Kanawha could have

supplied nearly all of the salt needed by the settlers along the Mississippi river and its tributaries, had it not been thought that alum salt, imported from the West Indies, was necessary for putting up provisions commercially and for long distance shipping. There was no real basis for this belief—the Kanawha salt with its smaller crystals would have been excellent as a preservative.

The peak years for the salt industry in the Kanawha Valley were 1842-55, the year 1846 showed the greatest production — 3,224,786 bushels. When salt brines were discovered in 1849 near Pomeroy, Ohio, with a greater concentration than those in the Kanawha Valley, competition soon became very keen. In 1868 Pomeroy was producing 3,607,968 bushels of salt, while production in Kanawha was down to 1,528,282 bushels.

Effect of the Civil War

During the Civil War, production of salt declined in the Kanawha Valley because of lack of fuel. Little coal could be mined, since explosives, needed for mining were necessary in the war. During the brief time in which the Confederacy held the area, there was an attempt to repair the furnaces and produce badly needed salt for the southern armies. Because the North could not afford to keep the large number of troops on hand necessary to guard the plants, the Union armies destroyed many of the salt furnaces to prevent the South from trying to use them for salt making. One of the reasons given for the loss of the war by the South was the lack of salt. Many of the plants did not reopen after the war because of the extensive damage done by the troops and by the years of lying idle.

Typical 1818 "Trust" Allotments

Daniel Ruffner—9,000 bushels

Tobias Ruffner—20,000 bushels

David Ruffner—40,000 bushels

William Steele of Kentucky—20,000 bushels

Stephen Ratcliff—10,000 bushels

Aaron Stockton—20,000 bushels

John Reynolds—12,000 bushels

John, Samuel, John D. Shrewsbury—32,000 bushels

Leonard and Charles Morris—3,000 bushels

William Steele and Company—53,000 bushels

Charles Brown—16,000 bushels

Andrew Donnally—40,000 bushels

Isaac and Bradford Noyes—30,000 bushels

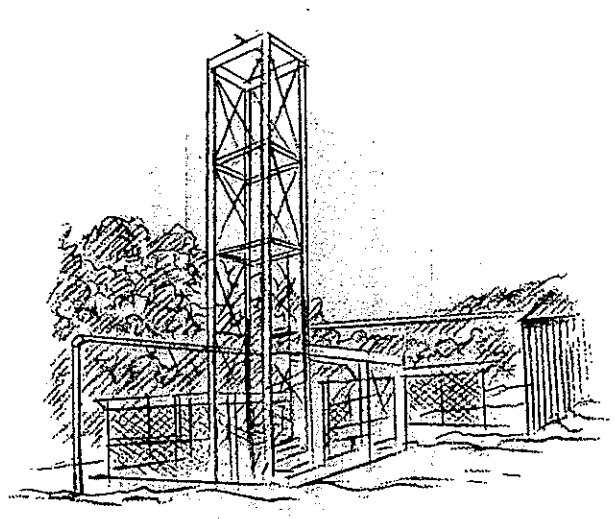
John J. Cabell—20,000 bushels

In his book "Salt, the Fifth Element," Garnett L. Eskew, a native of the Kanawha Valley, described the North-South struggle for the salt area in this manner:

" 'Hold the Kanawha salt works in Western Virginia', President Jefferson Davis orders Lee in 1861. So a Grey army under General Wise moves west from Richmond, across the Alleghenies, down the Kanawha Valley. Spang in the middle of the valley, it meets a strong Federal force moving up from Ohio, on both sides of the Kanawha River, the commander, General Jake Fox, riding upstream and directing the attack from the pilot house of the steamboat. The shots ring out; the field guns bark; the Grey forces fall back. (Among the companies under Wise was the Kanawha Riflemen, commanded by a V.M.I. graduate named George S. Patton, later killed in the Battle of Winchester. His grandson, George S. Patton III, became famous in World War II.) The salt works pass to Northern hands. Off goes a long wagon train carrying salt to Northern encampments, after which Cox's men systematically destroy the furnaces, knock down the pumps, fill the wells.

"But the South tries again. The following year comes General Loring's Confederate brigade and drives out Cox's men. Once more the South holds the Kanawha salt fields and more than a quarter million bushels, made at the repaired furnaces, move out to salt-hungry secessionists. The end was not yet. Loring's men in turn were driven out late in 1862 by an invading army under General Lightburn, and for the last time Kanawha changed hands."

The demand for salt further declined in the Kanawha region after 1870, when Chicago replaced Cincinnati as the meat packing center of the country. Because of transportation costs, Michigan salt was cheaper in Chicago than Kanawha salt.

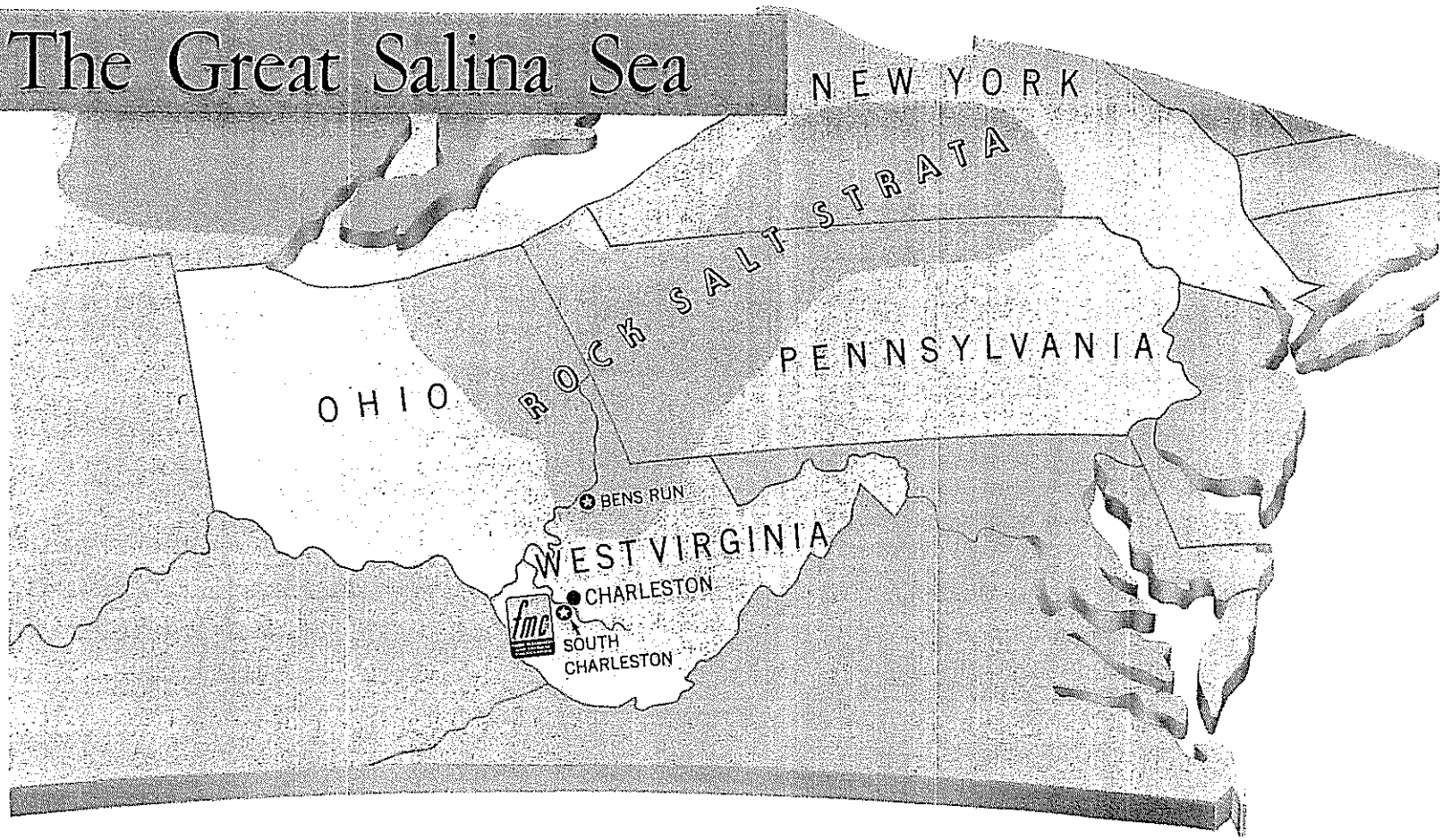


A modern brine well

Production of Salt in the Kanawha Valley

1797—150 pounds per day, or 3 bushels per day, 1 furnace
1808—25 bushels per day
1810—400 bushels per day or 146,000 bushels per year, est.
1814—600,000 bushels per year
1815—600,000-700,000 bushels, 52 furnaces (David Ruffner)
1816—600,000 bushels
1817—700,000 bushels, 52 furnaces, 15-20 wells
1818—450,000 bushels (decided on by Kanawha Salt Company)
1827—787,000 bushels, 61 wells
1828—863,542 bushels, 65 furnaces
1829—989,758 bushels
1930—906,132 bushels
1831—956,814 bushels
1832—1,029,207 bushels
1833—1,288,873 bushels
1834—1,702,956 bushels
1835—1,960,583 bushels, 40 furnaces
1836—1,762,410 bushels
1837—1,880,415 bushels
1838—1,811,076 bushels
1839—1,593,217 bushels
1840—1,419,205 bushels
1841—1,443,645 bushels
1842—1,919,389 bushels
1843—2,197,887 bushels
1844—1,874,919 bushels
1845—2,578,499 bushels
1846—3,224,786 bushels,—the peak production
1847—2,690,087 bushels
1848—2,876,010 bushels
1849—2,951,492 bushels
1850—3,142,100 bushels
1851—2,862,676 bushels
1852—2,741,570 bushels
1853—2,729,910 bushels
1854—2,233,863 bushels
1855—1,493,548 bushels
1856—1,264,049 bushels
1857—1,266,749 bushels
1858-1863—no records for these years
1864—1,300,991 bushels
1865—861,973 bushels
1866—1,275,017 bushels
1867—1,321,066 bushels
1868—1,528,282 bushels
1869—1,822,430 bushels
1870—1,721,963 bushels
1871-1874—no records for these years

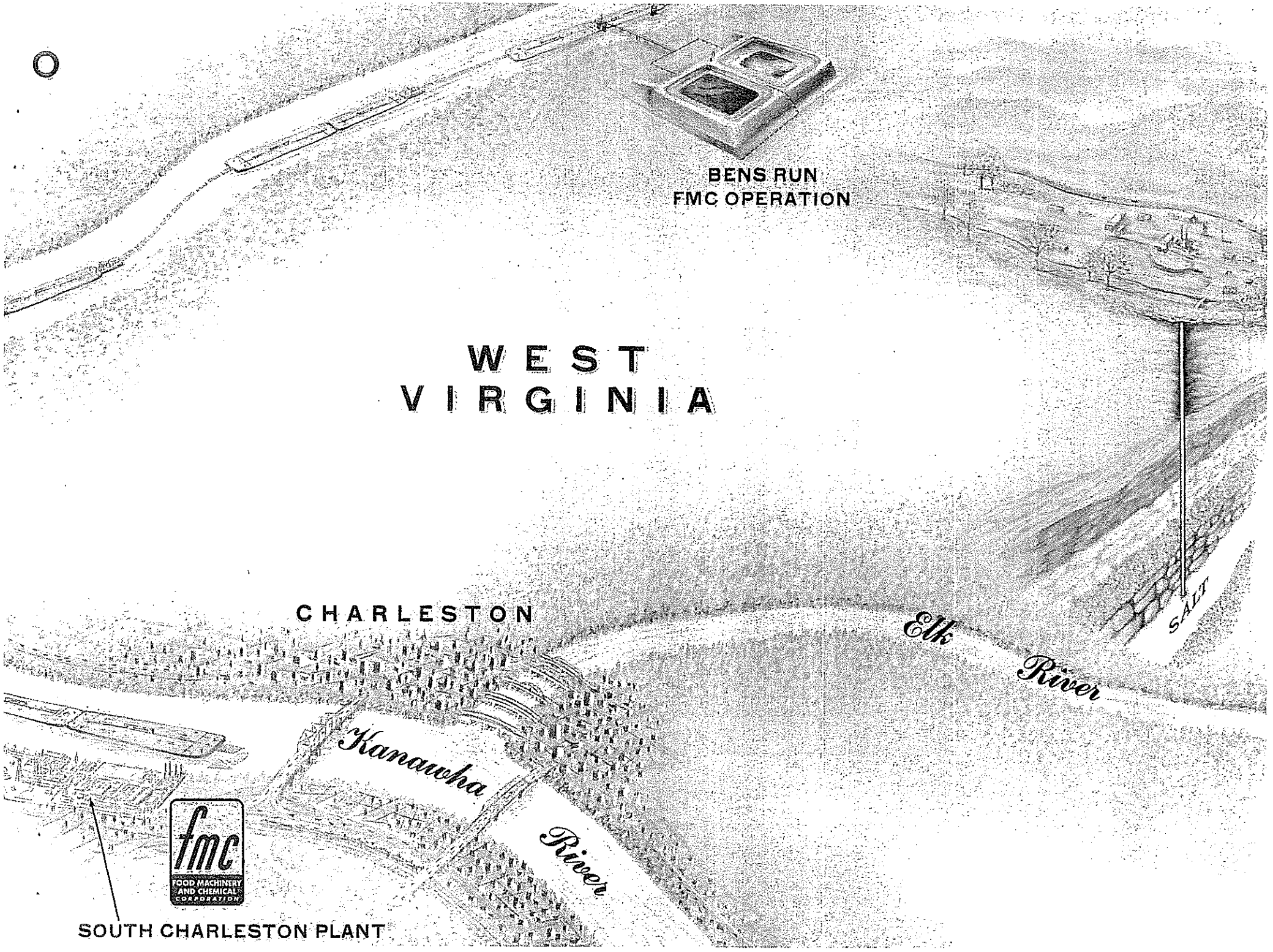
The Great Salina Sea



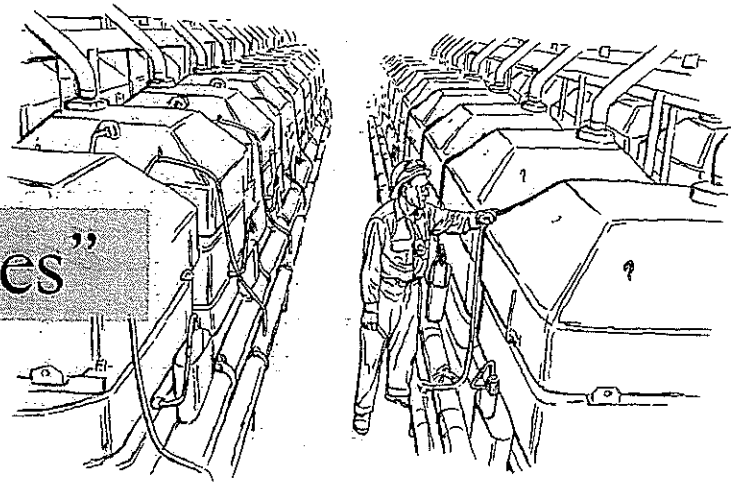
The Salina Sea is a term used to designate the site or sites of deposition of salt of the upper Silurian age, 350,000,000 years ago. This particular sea may have been a single, shallow basin or a series of connected basins, which, during some period of time, maintained a connection with the ocean proper. The depth of the salt beds underlying the areas shown is from 5,000 to 10,000 feet. Geologists estimate that the total thickness of the rock salt averages more than 100 feet. At Bens Run, FMC utilizes this deep salt bed for the production of brine.

Today's "Flatboats" Transport Brine

THE FMC installation in South Charleston today supplements the natural brine of the Kanawha Valley with brine of its own making at a place 177.3 river-miles distant at Bens Run, West Virginia. Here, deep wells were drilled into that part of the great rock salt bed, which geologists call the Salina Sea. Water, under heavy pressure, is pumped deep into the earth, it saturates the rock salt, and as brine, it flows back to the large storage reservoirs on the south bank of the Ohio river. Here it is transferred to the largest barges on the inland waterways (which with the towboat exceed two football fields in length.) FMC made the first shipment of brine to its South Charleston plant in August 1958, and since that time a shuttle service has been continued. In this manner, slightly more than two centuries after Mary Ingles helped her Indian captors make salt on the Kanawha river, a modern industry, with modern methods and all the skill which science and engineering can bring to bear, continues the useful manufacture of a natural resource, creating employment and new economic wealth, thereby contributing constantly to a rising standard of everyday living.


BENS RUN
FMC OPERATION
WEST
VIRGINIA
CHARLESTON
Elk
River
SALT
Kanawha
River
fmc
FOOD MACHINERY
AND CHEMICAL
CORPORATION
SOUTH CHARLESTON PLANT

20th Century "Salt Furnaces"



DURING the decline of the salt industry, Dr. John P. Hale, a great-grandson of Mary Ingles, a salt maker, boat builder, physician, and operator of a fleet of steamboats, predicted that sometime in the future, industry would again use the brines which lay underground in the sloping sedimentary beds of the Pennsylvania Age. Industry would flourish, he said, but the product made from the brine would not be salt as such.

This prediction began to come true in the days before America entered the first World War. The second chemical company to come to the Kanawha Valley was the Warner-Klipstein Company (1915). Its site in South Charleston was chosen because of the unlimited supply of high quality coal, brine, natural gas, oil if needed, ample labor and excellent transportation to eastern and midwestern markets, particularly Cincinnati, home of the great soap manufacturers. World War I had cut off imported supplies of chlorine and alkalis which previously had come from Germany. The alkali industry in America was still in its infancy.

Warner-Klipstein expanded to meet the increasing demand that resulted from these circumstances, and the valley's brine was used to make chlorine and caustic soda. Wells had been drilled nearby and were pumped by electric motor-powered deep well turbines, a far cry, indeed, from the hand operated "swape" used by Elisha Brooks when he dipped his brine from a sycamore gum.

The Nelson Cell

To make chlorine and caustic by electrolysis of the brine, the company used the Nelson cell which had been patented by the manager of Warner-Klipstein's plant in Carteret, N. J. It was this cell which made possible the production of critically needed chemicals in those days. Following the war, the demand continued to grow.

The Vorce Cell

The Westvaco Chlorine Products Corporation came into being following the passing of Dr. Warner and Mr. Klipstein. In the 1920's two large cell rooms were constructed and equipped with the Vorce cell, a greatly improved unit which was capable of producing 75 pounds of chlorine per cell per day. In the electrolysis of the brine in the Vorce cell, chlorine gas passed off through an outlet in the dome of the cell. Hydrogen gas passed out through another opening in the chamber outside the steel cathode. The heavier caustic soda solution, which collected at the bottom of the cell, was drawn off to be evaporated and dried.

Rows of Hooker cells

By the end of the 1920's, this plant had become the largest chlorine producing plant in the world. As many as 17 wells were supplying brine. The first wells were drilled to 1800 feet and brine was removed by air pressure. Shortly afterwards air lifts were replaced by pumps. The brine-head in these wells started at a depth of 400 feet and gradually dropped to the 700 foot level, which was considered the best pumping level at that time. At the present, wells are drilled to a depth of 1300 feet and are pumped from the 900 foot level.

It is worth mentioning here that all original wells were within the plant limits. The first six wells, and a later one, were soon abandoned, however, because the drill holes were too small for installation of deep-well pumps. Since they were also too closely spaced, some were pumping dry and some could be pumped only a short time. The life of a good well being practically unlimited, some of the wells drilled in the 1920's are still producing.

In the early 1920's the manufacture of rayon began to create a large demand for carbon disulfide, a product also used in the manufacture of carbon tetrachloride. Westvaco added these to its product list along with trichloroethylene, caustic potash, bromine and ethylene dibromide. It was during this period of expansion that the then Carbide and Carbon Chemicals Corporation took up a site adjoining the Westvaco plant to be near a source of chlorine to use in making glycol antifreeze for a product they had developed and named "Prestone."

During World War II the Westvaco plant supplied many important products such as chemicals used in incendiaries, smoke screens for beach assaults, a catalyst for synthetic rubber production and the new insecticide DDT, to name a few.

In 1948 Westvaco merged with the growing and versatile Food Machinery Corporation, leading to the adoption of the new corporate name, Food Machinery and Chemical Corporation. The South Charleston plant was operated by FMC's Westvaco Chlor-Alkali Division. The name of this division was shortened in 1960 to Chlor-Alkali Division.

Great Changes

The 1950's saw the plant almost completely modernized. Among extensive changes was the installation of 450 new Hooker cells for decomposition of brine, each of which has a capacity of one ton of chlorine per day. New brine facilities were also installed. The brine progresses from large reservoirs, where continuous treating and settling is now carried on, to the cells. Several hundred thousand gallons of brine flow through the operation every 24 hours. Automatic controls guide it unerringly all along its journey. The brine ultimately enters the Hooker cells where an electric current breaks it down into three products—chlorine gas, hydrogen gas and caustic soda. Weak brine from the cells flows to large salt evaporators where under high vacuum it is concentrated into salt crystals for recycle to the process. As Dr. Hale had predicted many decades before, brine would be used by industry but the end product would not be salt.

New Sources

In its earliest years the South Charleston plant, as pointed out previously, had the advantage of practically sitting on its brine supply which existed in the Kanawha Valley's underlying permeable sandstone formations. This brine provided not only salt but bromine and magnesium chloride as by-products, which were comparatively easy to extract during the process of making solid salt from brine.

Beginning in the 1930's and continuing to this day, there has been a tremendous growth in the demand for chlorine. Other manufacturers have built new chlorine plants in the north central United States and on the Gulf Coast so as to take maximum advantage of the beds or domes of solid salt which exist fairly close to the surface in those areas. Since the production of high-performance gasoline required very large quantities of bromine for the modification of gasoline, other companies constructed plants for more efficient and less costly extraction of bromine from sea water.

Thus there came a period in the history of South Charleston's plant when it operated at a severe economic disadvantage in comparison to the newer, competitive plants. It was these unfavorable conditions so vitally connected with its supply of salt which forced FMC to find a more economical source of brine for chlorine production. FMC was by this time augmenting its own high-cost local brine supply by purchasing solid salt from fairly distant places, thereby incurring high transportation charges. The use of these sources was uneconomical, but it was the only way in which the plant could continue operations. To expand its use of the local, weak brines would have been still more costly.

Since its extensive modernization program had to be predicated on dependable raw materials, FMC looked for and found a practically inexhaustible new source of the great quantities of brine which would be required.

Bens Run

Alongside a creek called Bens Run, which flows down from the hills in Tyler County to the Ohio River, the Company tapped the southern-most edge of the great bed of rock salt which underlies the area shown in the illustration on page 25.

In the summer of 1957 drilling began at Bens Run and continued thousands of feet into the earth. The bed of rock salt was found, as anticipated. Later a second well was drilled. Conventional rotary drilling methods were used as were special air drilling techniques, to bore through the great thickness of over-lying rock strata. The completion of the two wells made possible the use of a new method of recovering salt from a rock salt bed. This patented method* uses hydraulic fracturing to establish a connection between two wells in a rock salt bed. The method is related to the modern oil field technique of hydraulic fracturing (used to increase production from single wells), but was developed specifically for improved recovery of rock salt.

In this process water is forced down one hole under high pressure, fracturing the salt bed. By continuous pumping,

*U. S. Patent No. 2,847,202 and others Pending.

the water is forced into the fracture, which keeps extending horizontally until it connects with the second hole. The brine which results from the water's dissolving action on the rock salt bed flows through the second hole to the surface.

The brine obtained in this ingenious manner from Bens Run, which is 177 miles by water from South Charleston, is lower in impurities and higher in saline content—25% saline content as against 8.3% for the brine available locally in the Kanawha Valley. The Bens Run brine is transported to the South Charleston plant on large river barges. The high proportion of salinity in the new brine source and the low-cost hydraulic fracturing method used in its recovery, make it possible for FMC to overcome the handicap of barging the brine to South Charleston and still realize important advantages over using the less concentrated local brines.

Other Facilities

During the program of expansion undertaken by FMC, a new carbon disulfide plant was constructed. It is the largest and most efficiently operated such plant in the world, and is so unique that FMC engineers are building carbon disulfide plants based on this South Charleston process in such faraway places as Italy, Germany and Argentina. Sulfur and natural gas are the basic raw materials used, the sulfur coming from Louisiana by barge. Natural gas is reacted with the sulfur under high temperatures in a continuous operation which is controlled from a central point. In place of the old, hand-operated retort method, carbon disulfide is now produced in a continuous-flow system of furnaces, reactors, condensors, scrubbing towers and a sulfur reclaiming unit.

Part of the plant's output of carbon disulfide is used in the manufacture of rayon, but the greater part is combined at the plant with another basic product to make carbon tetrachloride. With its own chlorine and disulfide as the basic materials, FMC manufactures carbon tetrachloride in one of the two largest plants of their kind in the world. Carbon tetrachloride, a product which greatly interested E. C. Klipstein during the early days of his career, is shipped to manufacturers who make refrigerators, aerosol sprays, fumigants, solvents and fire extinguisher fluids. The South Charleston plant was one of the first in United States to make carbon tetrachloride.

An ammonia synthesis plant was also completed during the rebuilding program in the 1950's. Hydrogen from the Hooker cells is combined with nitrogen taken from the air, and with the aid of a catalyst, ammonia results.

The South Charleston plant as it enters the 1960's is a uniquely integrated, diversified and versatile operation. Its location at a distance from its chief source of salt at Bens Run presents little economic burden, for this handicap has been minimized by making ingenious and maximum use of the plant's resources and equipment.

The plant operations on the thirty-three acres on which FMC is located in the great chemical complex in South Charleston can be regarded as direct descendants of the

Kanawha Valley's salt furnaces. Instead of one product, FMC produces from salt: carbon disulfide, carbon tetrachloride, grain and soil fumigants, fluids for fire extinguishers, chloral, gaseous and liquid chlorine, dichlorocyanuric acid, ammonia, liquid caustic soda and potash, low salt caustic soda, fused and flaked caustic products, bromine, ethylene dibromide, hydrogen bromide. By rail, by truck, by barge these products are shipped in ton-loads to other manufacturers to be converted into thousands of end products, used every day in homes across the country.

Surely the old salt makers would be both surprised and pleased if they could see the contrast between this plant and their own operation, where they had to wait for rains and melting snows to raise the river level sufficiently to float their single product, packed in barrels, to market. These pioneers would see what man's skill and ingenuity have made of a natural resource.

Other Chemical Divisions

In addition to the Chlor-Alkali Division, FMC Chemical Divisions include the Becco Chemical, Chemicals & Plastics, Mineral Products and Niagara Chemical Divisions. The products of these Divisions are used in almost every home in the country but like most chemical products, they reach the consumer indirectly.

The major uses of Becco Chemical Division's hydrogen peroxide are in bleaching textiles and pulp and paper. Other Becco active-oxygen chemicals are used in disinfectants, detergents and cleaners, development of dyestuffs and preparation of foods.

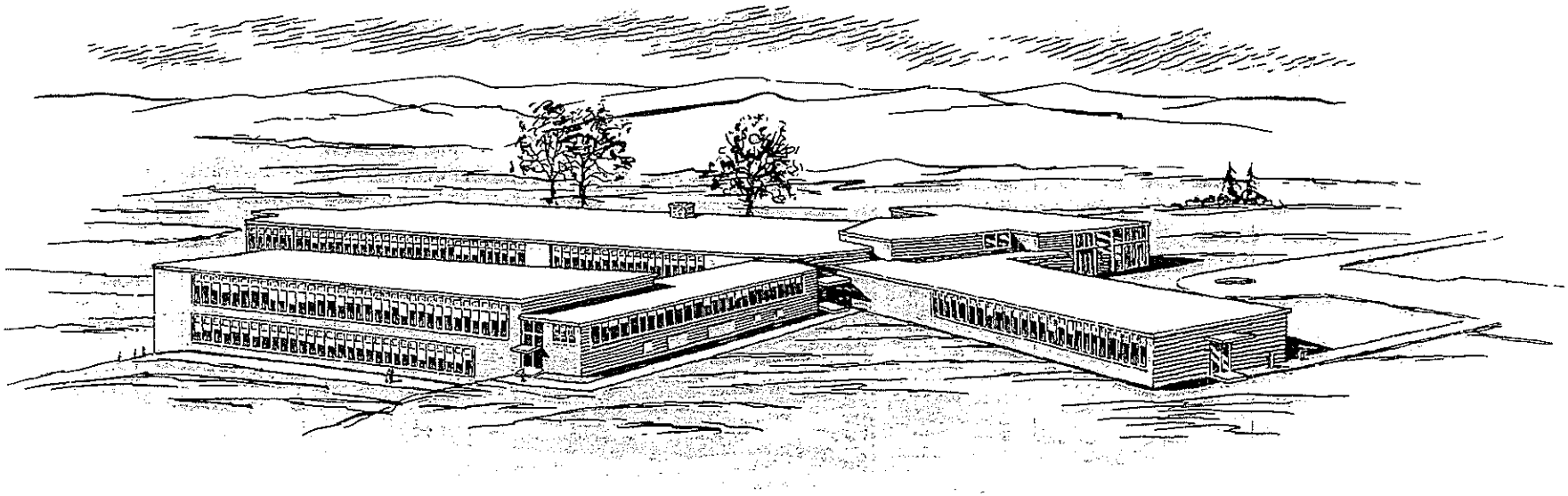
The plasticizers made by Chemicals & Plastics Division go into many types of flexible plastic products used in the home, including shower curtains, rainwear, garden hose, and plastic swimming pools, while the Division's Dapon® and Oxiron* resins are used to make long wearing furniture and wall panel surfaces, in missile and electronic parts, in adhesives, and in boat and aircraft construction.

Three groups of compounds comprise the major products of the Mineral Products Division: barium chemicals, phosphates and magnesias. These chemicals are essential ingredients of lubricating oil additives, detergents, cola-type beverages, baking compounds, cement flooring, and industrial firebrick.

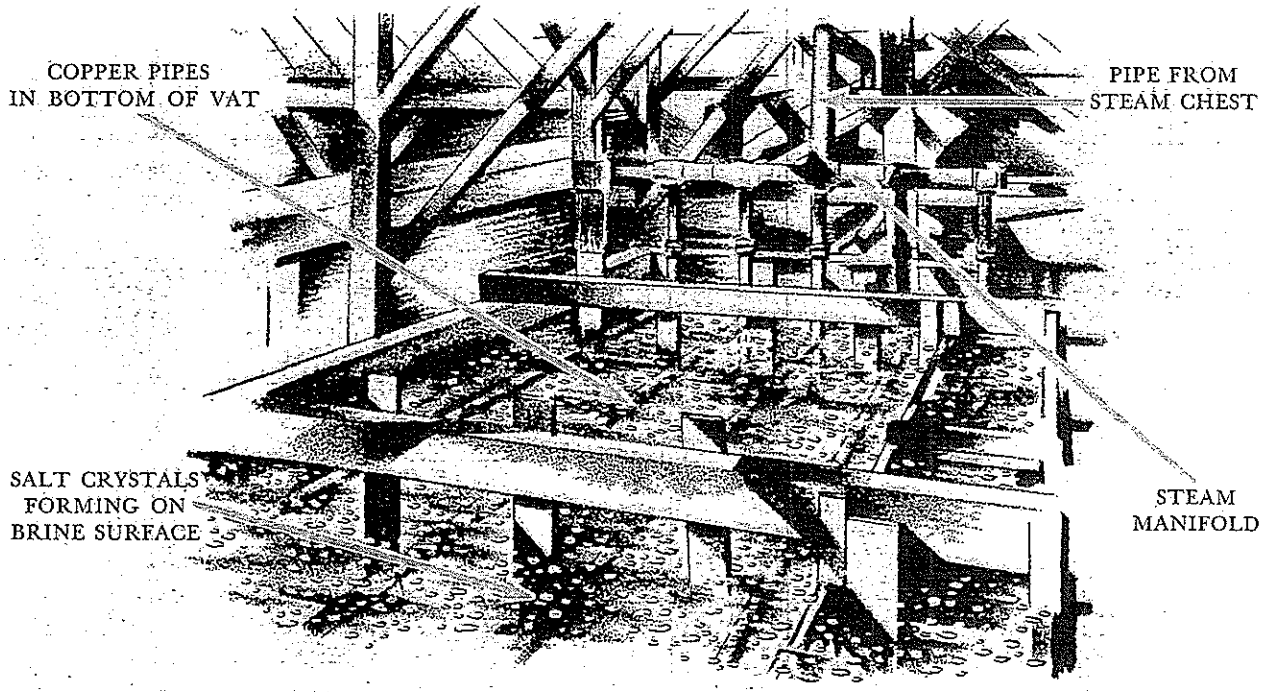
The Niagara Chemical Division makes agricultural insecticides and fungicides designed to kill virtually any pest destructive to farm crops. It also produces Fairfield® chemicals for formulators of pesticides.

For their Chemical Research and Development Center, Food Machinery and Chemical Corporation chose a 37-acre site near Princeton, New Jersey. The major work of the original building was completed in the summer of 1956. The building is air-conditioned throughout and equipped with library and auxiliary facilities. The central portion of the building contains a lobby, conference rooms, and library, with offices in a smaller wing to the north. The south wing houses an array of laboratories on two levels.

*Trademark.



In 1960, FMC completed an expansion to the laboratory, in the form of a new wing, which adds more than 50 per cent to the laboratory floor space. The total number of chemists, chemical engineers, technicians, and supporting personnel now numbers about two hundred, and is expected to reach two hundred and fifty when the Center is fully staffed. Á unique feature of the Center's new wing is its specially designed pilot scale areas for extended studies in textiles, pulp and paper, detergents, metals and other fields of intereset to FMC. In organization, the Center is divided into three sections: a central group, an organic chemical group and an inorganic chemical group. The central group performs work of a general analytical nature, related to all five chemical divisions. It also carries out statistical and engineering studies. Work of the organic group includes research in polymer applications, functional fluids, special organic compounds, and safety of pesticides. The inorganic section includes full scale testing facilities for chemicals used in textiles, pulp and paper, metallurgy, detergent and other industrial applications.



"Grainer" vat of the Patrick Evaporator first introduced in Kanawha Valley in 1835

Kenawha Salt-Works

LETTER TO THE EDITOR OF THE WEEKLY REGISTER

Sir—By your useful Register I observe that you are a great friend and patron of *domestic manufactures;* and by your diligent attention to this important subject you have added considerably to the public stock of correct information, and no doubt promoted a laudable emulation to perfect and establish them. To aid in this good work, and add something to your collection of facts, I take the liberty to forward you a brief account of the discovery, situation and extent of the *Kenawha Salt-Works.*

At the first settlement of this place there was a great *Buffalo Lick* (as it was then called) discovered, where some weak salt-water oozed out of the bank of the river. After some time, the inhabitants sunk (hollow) gums into the sand and gravel at that place, into which the water collected; but it was so weak, that though sufficient quantities might be collected, not more than three or four bushels of salt were made in a day. After the property came into the possession of my brother Joseph Ruffner and myself (by devise) we were desirous to see the effect of sinking large Sycamore gums as low down as we could force them. We found great difficulty in this, on account of the water coming in so rapidly. When we got down about eighteen feet below the surface of the river, we discovered that our gums lodged on a solid, smooth freestone rock— and the water was but little improved as we descended. We then bored a hole in the rock, of about 2½ inches diameter— the size that is now generally used for the purpose. After we had penetrated the rock eighteen or twenty feet we struck upon a vein of water much salter than any that had ever been obtained in this place. Our neighbors followed our example, and generally succeeded in obtaining good salt water, to the distance of two and a half miles below, and four miles above us, on the river. They all have to sink the gums about eighteen feet, where they come to the rock, into which they bore a hole from one to *two hundred* feet deep. The rock is never perforated through, the water weeps into the hole at soft and porous places; but no cavities are ever found in it. The cost of boring is from three to four dollars per foot; and each well produces, on an average, a sufficient quantity of water to make 300 bushels of salt per day. The first water that is struck in the auger hole is generally fresh, or salt water of an inferior quality, which is excluded by means of copper or tin tubes put down into the auger hole, and so secured that none of the water which comes in above the lower end of the tube can discharge itself into the gum, which has a bottom put into it immediately upon the rock, and is secured in such a manner that no water can get into it except that which comes up the tube from below. The water thus gathered in the gum will rise about as high as the surface of the river at low water mark; and it requires from 70 to 100 gallons of it to make a bushel of salt.

There are now established and in operation here, fifty-two furnaces (and many are erecting) containing from 40 to 60 kettles of 36 gallons each—all which make from 2,500 to 3,000 bushels of salt *per day.* The quantity may be increased as the demand shall justify.

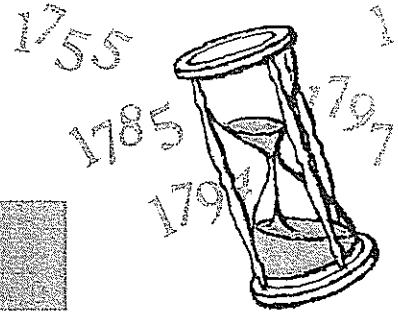
Fire wood, in the course of time, must become scarce or difficult to get—but stone coal may be used instead of it, and of this our stock is inexhaustable.

These works are situated six miles above Charleston, Kanawha Court House; 66 miles from the mouth of the river, (Kanawha,) and 26 below the great falls. The river is navigable, with a gentle current, at all seasons of the year, for boats drawing two feet water, and at most seasons for boats of any size. Your obedient humble servant.

DAVID RUFFNER.

Kenawha Salt-Works,
November 8, 1815

Chronological Events



1755 Salt making by Indians reported by Mary Ingles

1785 Land, with salt springs included, purchased by John Dickinson at Fort Lee

1788 Charleston settled

1789 Kanawha County established

1790 Daniel Boone makes home on Kanawha river opposite "Salt Licks"

1794 Present city of Charleston incorporated as Charles Town

1794 Joseph Ruffner purchased holdings of John Dickinson

1797 Elisha Brooks established first salt furnace. Made 150 pounds of salt per day, sold it for 8 to 10 cents per pound

1799 Daniel Boone leaves Kanawha Valley for the West

1800 Population of Charleston estimated at 100

1806 Ruffner brothers, David and Joseph, bored first salt well

1808 Ruffner brothers placed their first salt furnace in operation. Produced 25 bushels per day and sold salt for 4 cents per pound.

1815 First natural gas well struck by James Wilson

1815 52 salt furnaces and 15-20 salt wells in operation

1816 Visit of steamboat "Eliza," first such vessel on the Kanawha River

1817 Use of coal as fuel in making salt

1817 First Kanawha salt company formed—Steele, Donnally and Steele

1817 First trust in U. S. formed—the "Kanawha Salt Company"

1820 First Charleston newspaper, *Spectator,* established

1827 Introduction of first steam engine to pump salt from mines

1831 Billy Morris invented a mining tool called "Slips"

1835 George Patrick introduced the steam furnace to salt making

1846 Peak salt production—3,224,786 bushels

1872 Opening of Chesapeake and Ohio Railroad

1915 Warner-Klipstein chooses South Charleston as site for chemical plant based on salt brine and other resources

1948 Food Machinery and Chemical Corporation merges with the Westvaco Chlorine Company, successor to Warner-Klipstein

1958 FMC develops more economic source of salt for Charleston, based upon a new method of recovery.