JOSEPHTOWN/MONACA ZINC SMELTER
1930 - 2014

Potter Township
Beaver County, PA

AECOM
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Carol A. Benenson & Associates, LLC

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2020

On the front cover: *View of Oxide Department Building, Josephtown Smelter, c. 1960. Terry Frank Photograph Collection, Senator John Heinz History Center, Pittsburgh, PA.*

On the back cover*:* ***Left:*** *Casting Zinc Metal into Slabs, Josephtown Smelter, c. 1964. Gary Specht Personal Collection, Aliquippa, PA.* ***Right:*** *Packing Zinc Oxide, Josephtown Smelter, 1960s. Terry Frank Photograph Collection, Senator John Heinz History Center, Pittsburgh, PA.*

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Preface

The St. Joseph Lead Company, Zinc Smelting Division, came to Potter Township, Beaver County, Pennsylvania in 1930 at a site along the Ohio River approximately 28 miles west of Pittsburgh. Other than a brief period of time (late December 1979 to October 1980), and throughout several changes of ownership starting in 1981, the smelter—a facility for extracting or separating base metals from ores—operated continuously until 2014. The various units that comprised St. Joseph's 263-acre site transformed zinc ore (or concentrates) into zinc products and other metal byproducts that fueled diverse industries and supported national defense. In the eight-plus decades the smelter's furnaces fired around the clock, thousands of people and generations of families made their livelihood.

The smelter operated under several names and owners. Throughout its first four decades, the St. Joseph Lead Company, Zinc Smelting Division was known familiarly as "St. Joe." It continued as some form of "St. Joe"—St. Joe Minerals Corporation and St. Joe Resources Company—through two rounds of corporate reorganization and the first change of ownership in 1981. Following acquisition by Horsehead Industries in 1987, "St. Joe" became Zinc Corporation of America (ZCA) and, finally, Horsehead Corporation in 2003. The location of the smelter was originally referred to as "Josephtown"; by the 1970s the location was more commonly referred to as "Monaca".

The smelter closed in 2014, and with the removal of the facility by Horsehead Corporation in 2014-2015, the physical reminder of St. Joe and Horsehead was removed from the landscape. Horsehead Corporation sold the property in 2015 to Shell Chemical for the construction of a petrochemical complex. As part of the regulatory requirements associated with Horsehead's removal of the smelter, a historical overview and oral histories was completed. This booklet, a condensed version of that historical overview, seeks to preserve the smelter's legacy.

Documentation for this booklet came from archival records, sourced locally in western Pennsylvania, in libraries from New York to Alabama, and on the Internet. The oral history program contributed significantly to the research process. St. Joe issued several commemorative publications and annual reports that proved extremely valuable. In addition, a diverse and growing collection of St. Joe materials exists at The Thomas and Katherine Detre Library and Archives, Senator John Heinz History Center in Pittsburgh, Pennsylvania.

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1926-1930: St. Joseph Lead Company Comes to Potter Township

The St. Joseph Lead Company was founded in New York City in 1864. The company's only asset was a large tract of mining land in the lead region of southeastern Missouri. Its mining and lead smelting business grew slowly, but by the 1880s, the company netted greater profits thanks to the rail line it built. In 1890, St. Joe began construction of the nation's largest lead smelter, located along the Mississippi River, naming the smelter and resulting town, "Herculaneum." In 1926, under the leadership of Clinton H. Crane (president, 1913-1947; chairman of the board, 1947-1957), the company expanded its interests into zinc with the purchase of three zinc mines in St. Lawrence County, New York (NY). Crane could either sell the ore to an established smelter, or he could take St. Joe into the zinc smelting business and market the zinc metal and its byproducts. He seized upon the latter opportunity.

Crane hired inventor and engineer Earl C. Gaskill (see inset) along with consultants George Frederic Weaton Sr. (see inset) and William T. Isbell, to develop a process for the electrothermic smelting of zinc ore. The challenge with smelting zinc was developing the thermal energy requirements for the process, which are greater for smelting zinc than for other metals. Building on Gaskill's patented ideas for the smelting of zinc ore, manufacture of zinc oxide, and the electrothermic zinc furnace (Figure 1), the team assembled and operated a pilot facility at Herculaneum. The electrothermic furnace produced 540 tons of zinc oxide before they closed the pilot plant on May 14, 1929. Though they had not yet solved the problem of how to condense large quantities of zinc vapor into liquid metal to create slab zinc, St. Joe was ready to build a large-scale electrothermic zinc smelter to commence the commercial production of zinc oxide powder. The company came to Beaver County, Pennsylvania (PA), dubbed "Josephtown," to do just that. Not even the October 1929 stock market crash that precipitated the Great Depression would stand in its way.

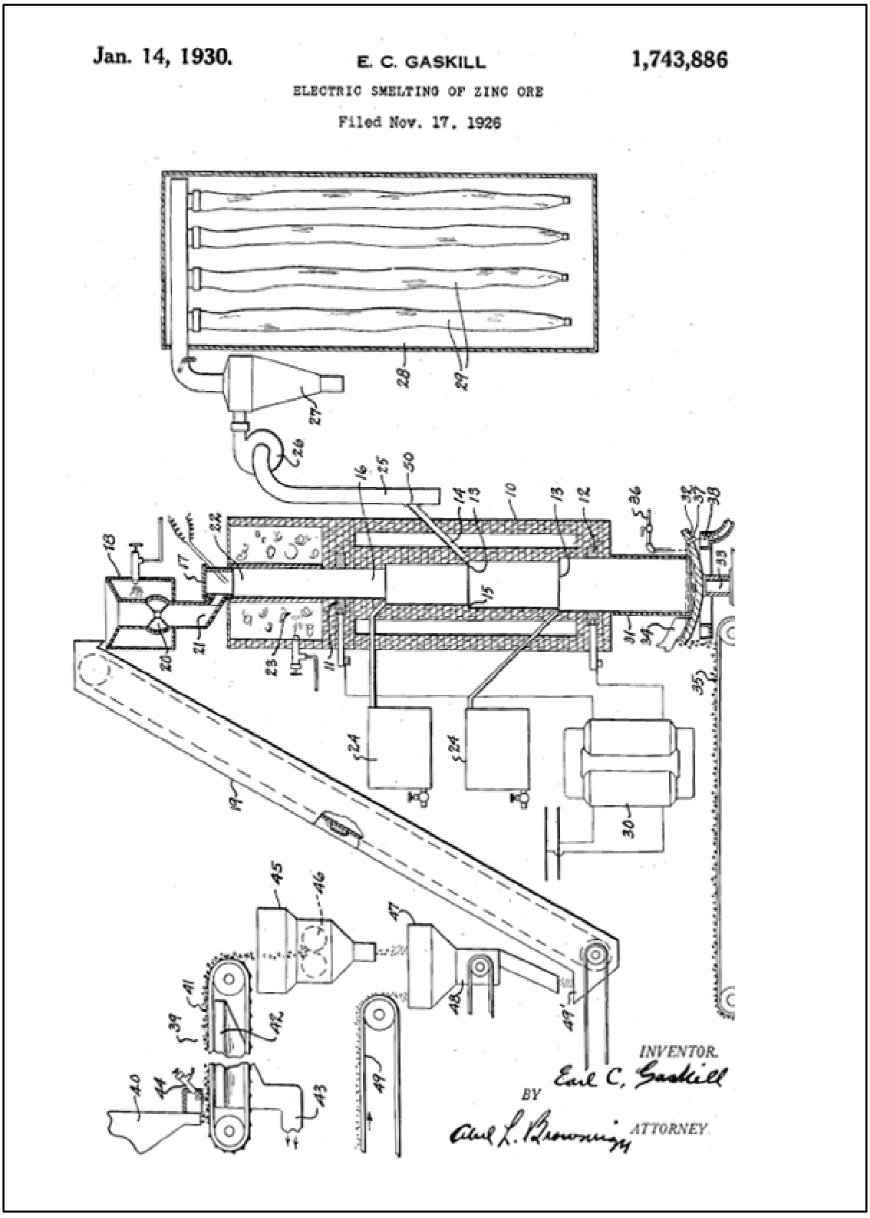

Figure 1. Gaskill's patent #1,743,886 for the electric smelting of zinc ore.

Earl C. Gaskill (1895-1930)

Engineer and inventor Earl C. Gaskill played an essential role in the decision of the St. Joseph Lead Company of Missouri to open a zinc smelting division in western Pennsylvania. Gaskill had worked as a “physicist” at the New Jersey Zinc Company in Palmerton, Carbon County, Pennsylvania, filing three patents (awarded in 1925) for improving the manufacture of zinc oxide. On October 28, 1926, St. Joe hired him to develop a process for the electrothermic smelting of zinc ores for the production of zinc oxide. These experiments, which took place between 1926 and 1929, resulted in five patents for the technology that launched the Josephtown zinc smelter. Gaskill served as division manager during most of the smelter construction, but died just one month after the patent for the electrothermic zinc furnace was awarded and a few months short of seeing it operate at Josephtown.

George Frederic Weaton Sr. (1886-1959)

George F. Weaton Sr., an engineer whom St. Joe employees affectionately referred to as “The Old Man,” managed St. Joe’s Zinc Smelting Division from 1931 to 1954 (Figure 2). Weaton began his career with General Electric Company and was working as steam engineer in charge of Thomas Alva Edison’s New Jersey power plants before starting his long career with the St. Joseph Lead Company in 1921.

Figure 2. George Weaton Sr.

As a power engineer in Missouri, Weaton consulted on Gaskill’s experiments in developing the electrothermic furnace for zinc smelting. With Gaskill’s untimely death, Weaton oversaw completion of the initial smelter unit at Josephtown and became division manager. Weaton, along with Herand K. Najarian, later developed the patented condenser that made it possible to transform zinc vapor into molten zinc metal. As plant manager, Weaton contributed significantly to the positive culture that engendered employee loyalty, professional growth, and retention. He later played a pivotal role in construction of St. Joe’s new power plant along the Ohio riverfront, a facility named in his honor.

Crane considered Rochester, NY, and Cleveland, Ohio, as sites for the smelter, but chose the Pittsburgh area, with the purchase of 263 acres of farmland in Potter Township, near Monaca, PA, on May 5, 1930**.** The location (Figure 3) along the Ohio River, 28 miles below Pittsburgh, four miles from Beaver, PA, and 12 miles from the Ohio state line, provided access to rail and water transportation, fuel for production, a power supply, and a skilled labor force in the region. It also offered proximity to ready markets for the smelter's immediate and anticipated products—sulfuric acid (a byproduct), zinc oxide, and slab zinc—in the nearby steel, paint, and rubber industries of Pittsburgh, Cleveland, and Akron. Land acquisition brought several farmhouses into St. Joe's possession, one of which the company remodeled into a modern clubhouse with sufficient living quarters to house six unmarried management and clerical staff.

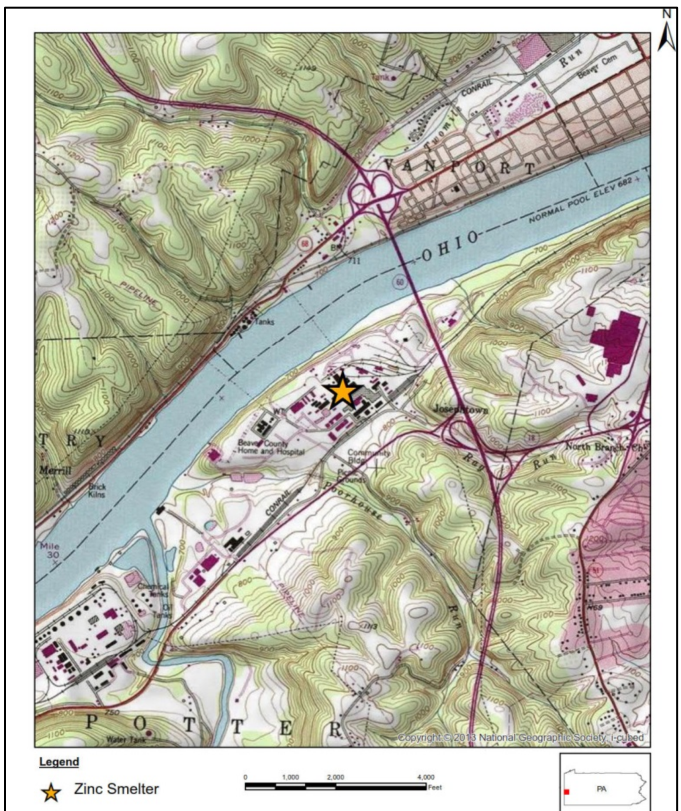

Figure 3. Site Location Map

Smelter construction began with a crew of 75 men in mid-May 1930. Negotiations for electric power and railroad service via a spur track off the Pittsburgh & Lake Erie Railroad were completed by the time of groundbreaking. The initial construction consisted of the administration building (used for offices, laboratories, and research facilities), sinter plant, furnace plant, roaster plant, acid plant, oxide department, shops, and railway facilities (Figures 4 - 10).

Josephtown

"Josephtown" became the name for the railroad station and a short-lived, fourth-class post office established at the plant with Miss Ethel M. Anderson, a telephone operator at the St. Joe smelter, serving as postmistress. A bus route was established from Monaca and surrounding suburbs to Josephtown. A large employee parking lot was created on the plant grounds for the many employees who arrived by automobile. The St. Joseph Lead Company referred to its zinc smelter location as "Josephtown" until the mid-1970s, when it was more commonly referred to as being at "Monaca."

Figure 4. Yard track work and 300-foot stack under construction, July 15, 1930.

Figure 5. Furnace plant construction, September 2, 1930.

Figure 6. Acid plant (left) and roaster plant (right) under construction, September 18, 1930.

Figure 7. Office building nearing completion, October 15, 1930.

Figure 8. Oxide department, October 15, 1930.

Figure 9. Construction of the sinter, coke and residue building, November 15, 1930.

Figure 10. Main office building (left) and oxide department (right), October 29, 1930.

1930-1940: The Early Years

With completion of the acid plant in December 1930, the Josephtown zinc smelter generated its first commercial product, sulfuric acid. On January 12, 1931, the furnaces began to produce zinc oxide, a product in high demand in the paint and rubber industries. For 1931, the first full year of operation, the plant, with a workforce of 150, produced 10,402 tons of 100 percent sulfuric acid, 5,638 tons of zinc oxide, and 75 tons of zinc metal as a by-product of the oxide process (Figure 11). Given the poor state of market conditions during the Depression, the plant faired relatively well as its zinc oxide products, including the initial superfine "St. Joe 20" (then called "Black Label 20"), were superior to its competitors.

Figure 11. Aerial view of Josephtown Smelter, 1930s.

New technologies and products helped propel the zinc smelting division forward. Robert S. Havenhill, a rubber chemist recruited from B.F. Goodrich, helped develop slow-curing, fine particle zinc oxide products for the rubber trade. Further experimentation yielded larger particle oxides useful for white sidewall tires, heat resistant tires, and high-quality white paints, as well as "Jozite," an iron-bearing zinc oxide, an alternative for certain zinc oxide uses, and suitable for paint primer, brake bands, and other products.

The "Weaton-Najarian" condenser, designed and patented by George Frederic Weaton Sr. and Herand K. Najarian (see inset), at last fulfilled the initial vision for the plant to produce not only zinc oxide and sulfuric acid, but also slab zinc, which would soon dominate sales (Figure 12).

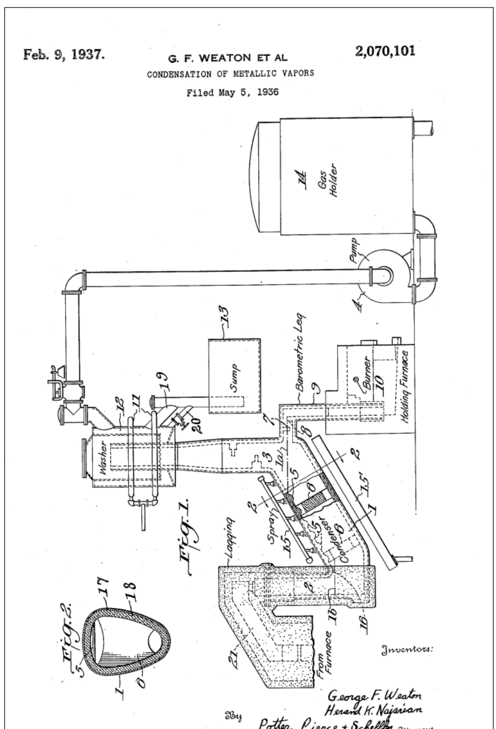

Figure 12. Condensation of metallic vapors, the "Weaton-Najarian condenser", patent #2,070,101.

The first experimental condenser ran on the #2 furnace in October 1935; improved production models went into operation in 1936. A vacuum condenser, it drew zinc vapor and furnace gases through molten zinc heated nearly to the boiling point to produce slab zinc. Weaton and Najarian (see inset, Figure 13) solved two key problems:

(1) developing lining materials for the condenser that could withstand molten zinc at extreme temperatures; and (2) devising systems to handle the carbon monoxide gas involved in the process. The company credited their innovation "without a doubt, the most important single factor in the growth of our smelter."

Herand K. Najarian (1889-1978)

Figure 13. Herand K. Najarian

Metallurgical engineer and designer Herand K. Najarian joined St. Joseph Lead Company in 1931 and worked as a company employee until retiring in 1967. Najarian had immigrated to the United States from Marhsh, Turkey (later identified as Armenia), in 1910 to study mining engineering at Yale University. After graduating in 1913, he acquired experience working in extractive industries—copper in Nevada and Utah and cobalt in Missouri—and designed a smelter for the Missouri Cobalt Company. By 1930, Najarian had relocated to St. Lawrence County, New York; there he likely crossed paths with St. Joe, which had acquired zinc mines a few years prior. At Josephtown, Najarian headed the mechanical maintenance, construction, electrical, and yard groups, and later served as general plant superintendent. In addition to the patented "Weaton-Najarian" condenser, which put St. Joe in the business of producing zinc metals, Najarian received 15 individual patents and one with St. Joe's Carleton C. Long.

Market demand for St. Joe products boomed after 1936 to a point where sales exceeded production and production demand exceeded ore supplies. The U. S. Government, which was building up zinc stockpiles for defense purposes as early as 1939, contributed to this surge. St. Joe purchased zinc ore from additional domestic and international sources, including Quebec, Canada and Argentina. As British-blockaded areas cut off access to a large percentage of the world's zinc smelting capacity, pressure increased for facilities like Josephtown to increase production.

The company executed substantial expansion plans at Josephtown, completed through 1941. A leach plant was constructed to treat fumes from sinter machines and to recover lead, mercury, zinc, and cadmium—putting Josephtown in the cadmium business. Facilities expansion during this period also included: two new hearth roasters, waste-heat boilers, two additional sinter machines, furnace plant and shop building additions, employee cafeteria, laboratory, garage, and thaw house. A St. Joe-devised system for palletizing zinc metal into unit loads and installation of the "Cam-O-Tactor" for removing furnace residue further improved operations.

The Zinc Smelter: Products, Process, and People

St. Joe's zinc smelter grew and changed over time, reflecting new and improved, or abandoned technologies and products. The process started with the majority of zinc concentrate arriving in gondola cars via the railroad spur built to Josephtown. It arrived in powdered form, with zinc content varying from 50 to 60 percent, sulfur about 32 percent, and other impurities including iron, cadmium, and lead. Cranes unloaded zinc concentrate from the gondola cars into stockpiles in the yard or under cover in the concentrate storage building, which could hold 10,000 tons of concentrate. Frozen concentrates were defrosted in a thaw building.

A four-step electrothermic process transformed the concentrate into the plant's primary products: three grades of zinc metal (High Grade, Intermediate, and Prime Western), each having its own circuit (furnace), and multiple grades of lead-free zinc oxide, tailored in purity to meet customers' needs. French process zinc oxide, made from Special High Grade zinc metal, had certain commercial and industrial applications that distinguished its product from American process zinc oxide, made directly from zinc concentrate. Valuable commercial by-products also included sulfuric acid and cadmium metal. The main processes for creating these products took place in the roaster plant, acid plant, sinter plant, leach plant, furnace plant, and bag house.

<u>*Roaster Plant*</u>

The roaster burned powdered zinc concentrate into a crude zinc oxide called calcine, an intermediate product from which final zinc products would be made. The roaster also removed impurities such as iron, cadmium, and lead from the ore. St. Joe began operations with hearth roasters and subsequently added flash and fluid roasters, for a total of nine roasters (Figure 14). From the roaster, calcine moved via conveyor to the sinter plant or storage tanks. The roasting process also produced a clean sulfuric dioxide acid gas for further treatment in the acid plant. Dust, created from red-hot ore scraped across the hearths, carried over with the gases and was removed in the Cottrell electrical precipitator. The Cottrell consisted of a system of wires and plates; the former negatively charged the dust particles and then positively charged plates removed the dust from the gas stream.

Figure 14. Drying hearth in the hearth roaster.

Acid Plant

The acid plant converted sulfur dioxide gas, created in the roaster, into commercial grade sulfuric acid. Hot gas went through a system of cooling, scrubbing, and drying to remove dust and water. In the converter heat exchange system, sulfur dioxide turned into sulfur trioxide, precursor to sulfuric acid. Heat generated from the exothermic reaction in turn provided the heat needed to treat the gases. The sulfuric trioxide passed into towers where it was absorbed by 98 percent sulfuric acid, which then was cut to various commercial grade strengths (Figure 15). Sulfuric acid was loaded into barges for transport on the Ohio River, or shipped in tank trucks and tank railroad cars.

Figure 15. Acid tanks.

Sinter Plant

The sinter plant performed five mechanical processes: sizing coke for use in the sinter mix and furnaces; separating residue; making a high zinc bearing material called "blue powder" into pellets to return to the furnaces; grinding calcine to produce "Jozite," an iron-bearing zinc oxide; and most importantly, converting calcine—high concentrate zinc made in the roaster plant—into a material to charge the electrothermic furnaces. Calcine conversion happened on two different systems, Prime Western and High Grade. For Prime Western, calcine was mixed with silica, sand, coke, and residue from Prime Western furnaces, the Dracco dust collector system, and other materials. Sintering machines burned out the coke and fused the remaining material into a strong porous mass, which was then crushed and sized for the furnace (Figure 16). For the purer, High Grade system, silica sand, dust, and other impurities were removed.

Figure 16. Sintering machine, 1930s.

Leach Plant

The leach plant processed and purified by-product materials: dust and fumes from the sinter plant, and weak acid bearing lead, zinc, and cadmium from the acid plant. These materials, fed to a continuous settler, were mixed with acid solution, then treated with various processes. Insolubility and filtration obtained lead; electrochemical replacement and distillation obtained cadmium; and evaporation and crystallization obtained zinc. Very pure cadmium metal (99.5 percent) was cast into balls, slabs or "pencils". Residue in lead contained small quantities of gold, silver, and indium; this product, called "lead cake," was also sold.

Furnace Plant

While the number and sizes of furnaces changed over time, as did their designation for High Grade, Intermediate Grade, and Prime Western circuits for making different end products, the underlying operation relied upon the electrothermic process. Preheated coke, the principal electrical conductor, and zinc-bearing materials (sinter and metallic secondaries) were fed continuously into the furnaces. The different sinters (High Grade and Prime Western) helped control the making of products with distinct qualities in the furnace plant, as did the quality of coke and secondary materials fed into the furnace. Graphic electrodes introduced the electrical energy that developed the heat energy needed for smelting to take place. The power level varied, depending upon the product being made.

Figure 17. Casting zinc metal into slabs, c. 1964.

There were furnaces for making zinc metal and furnaces for making zinc oxide. For zinc metal, zinc-rich furnace vapors bubbled through a water spray-cooled condenser developed at Josephtown. Workers ladled condensed metal into slabs, each weighing approximately 45 pounds (Figure 17). In the oxide furnaces, gases containing zinc mixed with air, producing zinc oxide and carbon dioxide. A system of large fans and tuyeres blew air into the furnace, creating suction that moved suspended zinc oxide from the oxide furnace to the bag house (Figure 18). American process zinc oxide, produced directly from zinc ore, was used for paints, abrasives, rubber goods, and other products.

Figure 18. Blowing air into the oxide furnace with tuyeres, 1930s.

In 1959, St. Joe erected a zinc refinery with a dedicated circuit to produce 99.99+% Special High Grade zinc metal for galvanizing and the manufacturing of zinc die castings. Molten metal in ladles moved in an overhead system from the furnace plant to the refinery. More impurities like lead and cadmium were removed and the purer zinc passed through oxide columns to make French Process zinc oxide for use in food products, medicines, cosmetics, and photocopy paper.

Bag House (Zinc Oxide Department)

In the bag house, zinc oxide was collected, screened, and packaged. Zinc oxide suspension from the furnace plant was blown through a cyclone to remove large particles of oxide, mixed with cold air to reduce its temperature, and then passed through 45-foot-high cloth filter bags to remove the oxide particles (Figure 19). These particles next went through a blending, screening, and packing operation, where packers loaded and sealed the product in 50-pound bags of “St. Joe Lead-Free Zinc Oxide.”

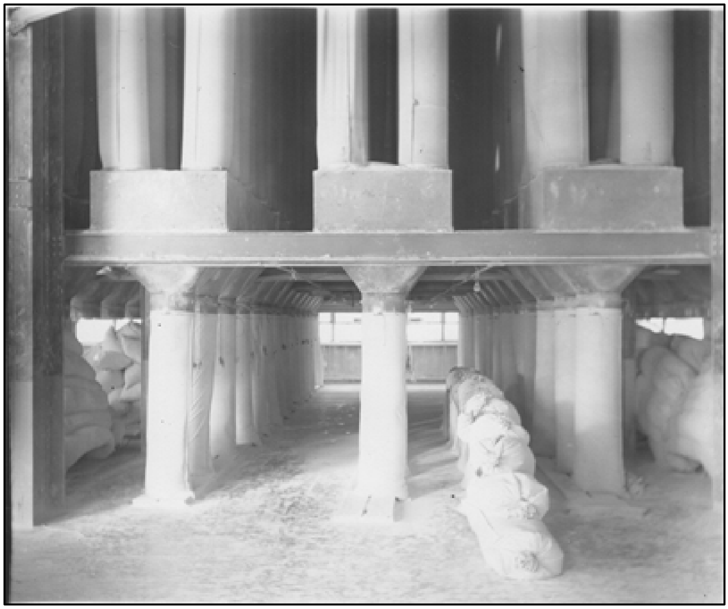

Figure 19. The oxide department bag house, 1930s.

<u>*Secondary Materials Plant*</u>

The secondary materials plant, which opened in 1954, made a feed product from smelter byproducts, such as blue powder (zinc that escaped the furnace condensers), and zinc waste in the form of skimmings and drosses (somewhat oxidized forms of zinc) (Figure 20). Secondary materials were a cheaper source of raw material and cheaper to process than zinc ore. Blue powder was processed, pressed into briquettes, dried, and reintroduced into the smelter. St. Joe purchased skimmings and additional zinc waste from galvanizers and die casters—the same customers who bought the zinc. The materials went through a size classification system. Very fine material ("fines"), more oxidic in nature, was sent to the sinter plant. Larger material, like parts from cars, carburetors, and grills, were more metallic in nature and could be fed directly into the furnace.

Figure 20. Secondary materials plant, 1955.

Smelter operation relied on the efforts of laborers, engineers, scientists, lab technicians, bricklayers, electricians, pipefitters, machinists, millwrights, tinsmiths, blacksmiths, surveyors, and safety, security, administrative, railroad, paint shop, and other personnel. The yard, essentially a labor group, was the point of entry for most workers, many of whom followed in the footsteps of family members. Assignments could vary from day to day: digging up rocks known as "St. Joe potatoes," shoveling briquettes on the sinter incline, railroad cleanup, cleaning out the furnace basement, among other tasks. A department needing to fill a position pulled a laborer from the yard, or converted someone's temporary assignment into a permanent one. St. Joe's reputation as a good place to work attracted a constant influx of hands to run the smelter's round-the-clock, 365-day-a-year operation (employment peaked at 1,700 in 1978). Workers rotated weekly across three, eight-hour shifts: daylight, 6am-2pm; evening, 2-10pm; and night, 10pm-6am.

The furnace plant required the most hands to operate (35-40 per shift) and offered the greatest variety of jobs and opportunities for advancement from utility gang, responsible for cleanup, to supervisory positions**.** Temperature extremes created brutal conditions in the furnace plant: full protective clothing and gear exacerbated summer heat, while in the winter, workers huddled near the furnaces to avoid freezing in the unheated mill (Figure 21).

Figure 21. Residue from the furnace tables worked with hand-bars before the "Cam-O-Tactor," 1930s.

1941-1945: The War Years

War has brought a great many improvements industrially in a good many processes. We ourselves have learned things during the war, which we believe will lead to making the jobs in the plant more interesting and further improve working conditions . . .

George F. Weaton, Plant Manager, *The St. Joe Catalyst*, February 1945

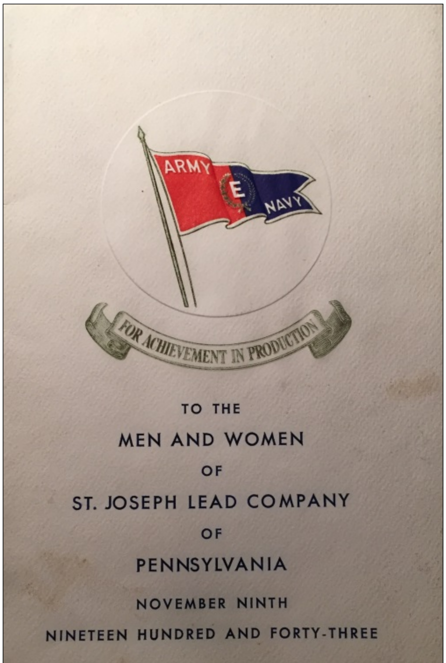

Figure 22. Army-Navy "E" Award, 1943

On January 7, 1941, exactly 11 months before the Japanese attack on Pearl Harbor would plunge the United States into World War II, President Franklin D. Roosevelt signed Executive Order 8629, establishing the Office of Production Management (OPM) to mobilize the nation's industrial resources needed for defense. On June 10, 1941, OPM placed zinc under 100 percent Priority Control, launching Josephtown into a full-scale war production program that would change the composition of the plant's work product and workforce.

OPM required St. Joe to suspend the making of Prime Western zinc metal in favor of High Grade zinc metal—better suited for armaments manufacturing. Ammunition for everything from small arms and machine gun cartridges to airplane cannon and anti-tank guns required brass, of which zinc is a key component. Zinc die castings went into the production of hand grenades and aviation equipment, as well as parts for tanks, trucks, tractors, and motor cars. Zinc sheets rolled from slab zinc metal were used for massive boiler construction and hull plates for Navy ships. Zinc metal, utilized in galvanizing, provided a protective coating against rust or corrosion from salt water or air. Zinc alloys went into propellers and zinc oxide went into heavy-duty rubber tires, tank treads, and paints for camouflage. Josephtown-made sulfuric acid was used to manufacture rayon, explosives, storage batteries, and other products.

With employees serving in the Armed Forces, the Josephtown smelter increased its daily zinc production with fewer hands. Long hours on the job helped the plant sustain higher production levels. St. Joe turned to Canada, South America, and other domestic mining operations to supplement zinc concentrates from the New York mines. In 1943, St. Joe received the Army-Navy "E" Award for achievement in production (Figures 22-23). Three additional stars acknowledged the plant's ongoing contribution to the war effort.

Figure 23. Army-Navy "E" Day Committee. Robert F. Mitchell, Roy W. Miller, Mildred B. Link, G.F. Weaton, Paul Marthens, Louis E. Taylor.

Like industries throughout the wartime nation, Josephtown added more women to its payroll. While the majority worked in salary/payroll, they also worked alongside men in the bag house, roaster plant, furnace plant, mechanical and electrical departments, and store room; women were absent from the sinter and leach plants, acid plant, and yard. Local schoolboys, too young to serve in the Armed Forces, also pitched in, working in the bag house and elsewhere during weekends and other free time.

Organized in October 1942, the Women's Auxiliary consisted of the wives of plant workers. Many stepped up to fill positions in the plant. The Women's Auxiliary sold war bonds in the cafeteria and gatehouse, sought blood bank donors, sponsored first aid classes, sent Christmas packages to employees, and shared expertise on home canning and planting Victory Gardens. The company also sent copies of *The St. Joe Catalyst*, the company newsletter, to its employees serving overseas.

Letter to Mr. Weaton:

I think it is wonderful that you and the men at the plant have achieved so much during the war and I sincerely hope that all of us fellows who have been away are back in there helping to make the plant greater than it is at present. Receiving The St. Joe Catalyst is just like a hometown newspaper as it keeps a fellow up with what is going on back there at home.

Jimmie Duff
Paris, France
July 12, 1945

1946-1969: Mid-20th-Century Expansion

At the end of World War II, Veterans returned to their jobs at the zinc smelter and the St. Joseph Lead Company embarked on the Josephtown Expansion Program to increase production and improve working conditions. Reinvestment in the plant's infrastructure included: a zinc oxide storage building, larger condensers, a new circuit and flash roasters for direct production of Prime Western zinc metal, furnace plant expansion to house four new furnaces, acid plant expansion, a new Dracco conveyor system, three new Cottrells to handle fumes in the sinter plant, a new office building, and more laboratory space (Figure 24-25). Expansion also meant staffing up—beyond returning servicemen—and training new hires, roughly 250 in 1946 alone.

Figure 24. Acid plant expansion, c. 1948.

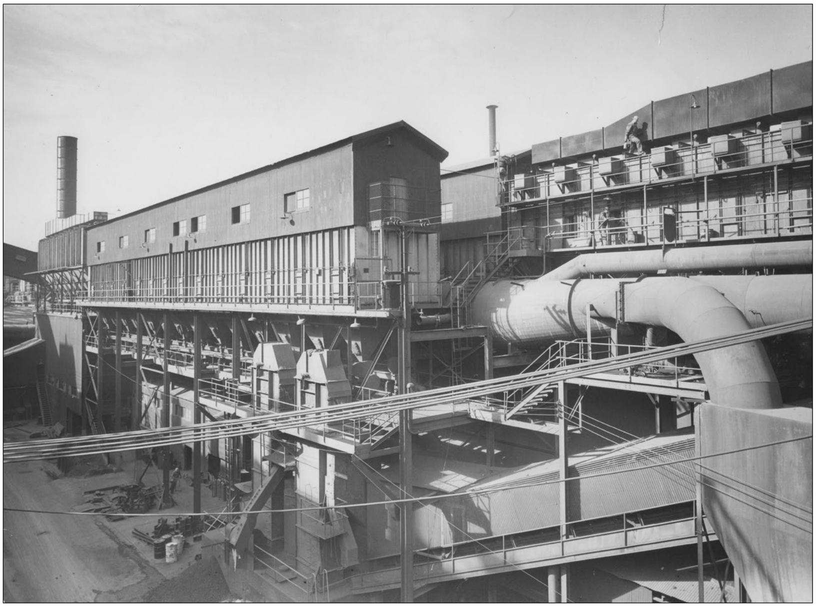

Figure 25. Dracco conveyor system. The system removed dust and impurities from the sinter plant.

Only five years after Allied victory in World War II, the U. S. Government was rebuilding the nation's military strength for the Cold War. St. Joe embarked on a 10-year program (1950-1960) to support national defense interests. A new electric furnace, expected to increase output by 10 percent, was built to maximize the full capacity of roasting, sintering, and acid facilities. Other construction projects in the early 1950s included: a compressor and turbine building (to utilize waste heat from roasters), a zinc packing plant for the zinc oxide department, a water reservoir, an Emergency Response Building, a scale house, ore shed, a second bag house, and, likely most appreciated by the employees, an auditorium (Figure 26). Located next to the administration building, the auditorium or "gym" provided additional facilities for plant meetings and became a hub for employee social and recreational activities.

Figure 26. Auditorium, 1952.

With the outbreak of the Korean War, the U. S. Government established ceiling prices for lead and zinc, while prices increased abroad. This action created an artificial domestic shortage of zinc, a large increase in imported metals, and unsold inventory at Josephtown that resulted in curtailed production. St. Joseph Lead, along with other companies, sought relief from Congress and the Eisenhower Administration in the form of import quotas, domestic subsidies, additional purchases for government stockpiling, and tariff adjustments. Eisenhower opted for stockpiling lead and zinc ores and metals to have an adequate supply for an emergency and to stimulate and subsidize the lead-zinc industry (Figure 27). The direct impact of that decision is unclear, but by May 1954, the plant was seeing improved prices and increased demand for zinc production.

Figure 27. Storage of zinc slabs. St. Joe stockpiled zinc for government emergencies.

Expansion and improvement projects in the mid-1950s continued with additional furnaces and new buildings for personnel, a change house, heavy maintenance, lubricant storage, motor storage, and wastewater treatment. An extension to the furnace plant to house No. 15 furnace was underway in 1957, with plans for furnaces 16 and 17 in the future. A secondary materials plant for producing briquettes went into production in 1954. At a new river dock, a whirly gantry crane unloaded zinc concentrates shipped in barges from the mines, and barges laden with zinc metals were shipped to customers, largely in Pittsburgh. St. Joe added a Direct Reader Spectometry Laboratory for the analysis of zinc metal, oxides, and calcines, and constructed a fluid-bed roaster for more economical and effective production of high-grade zinc metal products and oxide.

The most monumental construction project of the decade was the George F. Weaton Station, built between 1956 and 1958, on land acquired from the Beaver County

Home and Hospital. The coal-fired power plant, equipped with two coal-fired, 50,000kw turbo generators with a combined capacity of 120 megawatts, provided a low-cost, reliable energy source to increase the smelter's slab zinc production instead of relying on the Duquesne Power Company (Figures 28). The power station's location adjacent to the Ohio River made it easy to transport coal to the plant by barge. The river also provided cooling water to condense the steam needed to drive the turbine-generators. A 4,000-foot-long double circuit transmission line transported power at 14,400 volts from the station to the smelter electrical system.

Figure 28. George F. Weaton Station, St. Joe's power plant, 1957.

Supervising and running the power plant took a staff of 62 people; the initial crew was selected among personnel at the zinc smelting facility and trained to keep the power plant running around the clock (Figure 29). In time, the Weaton Station produced even more power than the zinc smelting plant needed; St. Joe sold surplus power to Duquesne Light Company and other utilities.

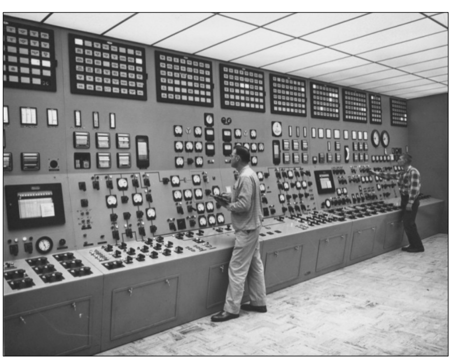

Figure 29. Power plant controls.

Just as the defense industry influenced the operation of Josephtown in the 1940s and '50s, the automotive and appliance industries increasingly created opportunities for zinc production in the 1960s. Demand for these consumer goods meant growth in the die casting industry—the second largest use for zinc—for which St. Joe constructed an additional circuit (a refining column) that produced 99.99+ Special High Grade zinc metal. The production of continuous zinc-coated steel sheets remained a growing market, while St. Joe's researchers developed zinc anodes for corrosion protection in sea-going tankers and new plating techniques for decorative zinc die casting for cars and appliances. By 1963, the Josephtown plant employed 1,164, compared to 958 in 1955. The company's offices and research department, also known as the Technical Center, relocated into the reconditioned portion of the Beaver County Home and Hospital building in 1964 (Figure 30). These were very productive years: in 1966 the plant produced 216,910 tons of slab zinc equivalent compared to 146,732 in 1960.

Figure 30. Main offices and laboratory space (former Beaver County Home and Hospital, which was acquired and partially renovated for use in 1964).

Increased competition from imports and decreased industrial activity in the U.S., including the automotive industry, adversely affected production at Josephtown in 1967. As it had in the past, the company responded by tailoring or developing new products to meet customer demand. It identified growth opportunities in sulfuric acid, for which a new unit was built to increase production capacity by 15 percent, and introduced a photo-conductive grade zinc oxide for the photocopying industry. The late '60s also witnessed a new pilot galvanizing facility that enabled the technical group to investigate hot dip galvanizing to make protective coatings for steel products; mechanized casting and stacking devices designed by St. Joe engineers; construction of a new metallurgical control center with comprehensive analytical laboratories; and a new No. 1 storeroom, instrument repair shop, and electrical construction shop.

1970-1986: Decline and Modernization

Figure 31. Environmental ductwork between furnace and sinter plants.

In 1970, the smelter's parent company, St. Joseph Lead Company, changed its name to St. Joe Minerals Corporation, reflecting its broadened interests in natural resources, including coal, gas, oil, and gold. Diversification proved to be fortuitous during a decade in which a number of economic forces undermined the profitability and ultimately led to a shutdown of the Josephtown plant. St. Joe rode the ups and downs of the automobile industry, which relied heavily on zinc for die casting and galvanizing. The oil crisis shifted automotive design toward smaller, lighter cars that required less fuel to run and less zinc to make. More stringent environmental standards affected plant operations and profitability too. The company made major improvements to the acid plant to reduce sulfur dioxide emissions and added a new dust collector unit to improve plant hygiene (Figure 31).

By 1973, St. Joe Minerals Corporation had identified growth opportunities in two areas: zinc oxide, the uses for which were diversifying, and slab zinc for the galvanizing and brass industries. This meant phasing out production of Special High Grade zinc alloys to concentrate resources on these areas. St. Joe became the nation's second largest producer of zinc oxide and, according to the company's 1976 *President's Annual Report to Stockholders*, "the only one in the country to use an electrothermic process which directly produces Prime Western grade used by galvanizers."

Various factors made it more costly for St. Joe to operate the plant and maintain its furnaces and other equipment, some of which was nearly 50 years old. In 1974, St. Joe hourly workers voted to join Union Local No. 8183, United Steel Workers of America. The union brought about higher wages and certain benefits that added to operating costs. Decreases in non-residential construction, which relied on zinc for galvanizing and brass, stricter environmental standards, and competition from alternative materials like plastics and aluminum took their toll on the smelter.

While some zinc smelting plants in the United States and Canada approached these industry-wide economic challenges by converting their plants to electrolytic rather than electrothermic processes, St. Joe opted not to make that considerable capital investment and, instead, closed down its smelter that employed 1,500 people in December 1979. The company retained enough maintenance and supervisory personnel to keep the power plant running to sell electricity, and the Research Department, which served a corporate function, continued albeit somewhat cut back. But most jobs were lost, as was the beloved cafeteria.

The shutdown was short-lived. In the summer of 1980, customer demand for zinc oxide and sulfuric acid—at a time of rising zinc prices—gave St. Joe incentive to reopen. Ingenuity gave the company, renamed St. Joe Resources Company, a path to do so. Bob Sunderman, plant manager at the time of the shutdown, was the architect behind the transformation that extended the plant's life into the 21st century. The plan called for high-grade zinc extracted from St. Joe's Pierrepont mine in upstate New York, enhanced secondary material recycling to reduce feed costs, and streamlined operations and equipment—fewer furnaces and only the most profitable metal products. Modernization and streamlining breathed new life into the plant, which Charles O. Bounds, assistant director of research, noted came back on line as "the only nonelectrolytic zinc smelter operating in the United States and Canada and the only primary zinc-producing plant in the United States operating at capacity."

In 1981, Fluor Corporation purchased St. Joe Resources Company's diverse zinc, lead, and coal interests. At Monaca (the plant no longer referred to as Josephtown), they soon added Larvik furnaces that could process metallic secondary materials too large to be processed in the electrothermic furnaces. The Larvik furnaces did not rely on the coke and sinter used in the other furnaces, making it a more environmentally clean process. The Larvik units were used primarily for zinc dust and zinc oxide production.

1987-2014: The Final Years

A few years into Fluor's ownership of the zinc smelter, the engineering and metals businesses experienced a downturn. Flour sold off St. Joe in parts, in 1987, the zinc interest going to Horsehead Industries Inc. Horsehead owned New Jersey Zinc Company, which it combined with the St. Joe zinc smelter to create Zinc Corporation of America (ZCA). The Monaca plant continued to use the electrothermic process for producing zinc metal and zinc oxide. However, with declining reserves of domestic ore, the company shifted its feed to larger quantities of recycled zinc sources. Much of this recycled zinc came from Horsehead's Palmerton plant, which operated three Waelz kilns that recovered zinc and other metals from metallurgical waste and other recycled materials. A new furnace and a single larger sinter machine, added in 1991, were necessary adaptations for the new focus on manufacturing zinc metal and zinc oxide with recyclable zinc materials. The expansion was envisioned to increase production by 50,000 tons per year.

ZCA took additional measures to address environmental concerns and regulations at the zinc smelter. The kind of coal used to fuel the Weaton power plant was switched to a low-sulfur variety. Other modifications enabled the substitution of natural gas for coal. In 1990, the addition of a tail gas plant to the acid plant further reduced emissions. As the U.S. Environmental Protection Agency (USEPA) passed laws limiting the amount of lead that could be in a product, toys, for example, the market for the plant's Prime Western zinc decreased. This trend contributed to the many factors that would lead to the final shutdown.

In 2002, ZCA discontinued the primary roasting of feed at the Monaca zinc smelter, relying only on secondary sources of zinc. This shift ended the production of sulfuric acid, the first commercial product the plant had generated in 1930. Horsehead Industries, the parent company of ZCA, filed for bankruptcy in 2003 and Sun Capital, under the Horsehead Corporation name, acquired its assets. By that time, the plant and its operations were old and newer, more efficient plants were being built in the South.

In 2011, Horsehead Corporation announced that it would build a new, environmentally sustainable plant that could produce 150,000 tons of zinc a year in Mooresboro, North Carolina. By March 2012, Horsehead reached an agreement with Shell Chemical for an option to purchase the Monaca site to build a petrochemical complex, an option that was extended and eventually would be exercised in November

2014. The Monaca smelter closed at the end of April 2014—affecting the jobs of 510 employees—and Horsehead Corporation commenced the removal of the facility, a historical leader in the zinc industry.

> *It was, as my father said in 1949, it's a great place to work. You could get a future there. . . . it was steady work. It was good work. It was hard work, it was a great place to work and I hated to see it go away. My dad, I remember him sitting in his chair saying, 'I thought it would never happen.' But it did.*
>
> Chuck Andrews, former St. Joe/Horsehead employee, 2016

A Tradition of Innovation

Innovative research and researchers like Earl C. Gaskill, George Frederic Weaton Sr., and Herand K. Najarian, gave St. Joseph Lead Company the technology it needed to create and expand the zinc smelting operation in Western Pennsylvania. In 1937, Weaton, the plant manager, demonstrated an ongoing commitment to research by establishing a formal research department, with one group for plant and process research and the other for customer and product research. The main objectives of plant and process research were: to troubleshoot technical problems arising in regular operations; to improve equipment design and operating methods; to develop new equipment, methods, and operations; and to raise the efficiency and lower the cost of existing operations. Customer and product research focused on developing new zinc alloys to meet consumer needs, analyzing materials and products for quality control, and providing product support for customers.

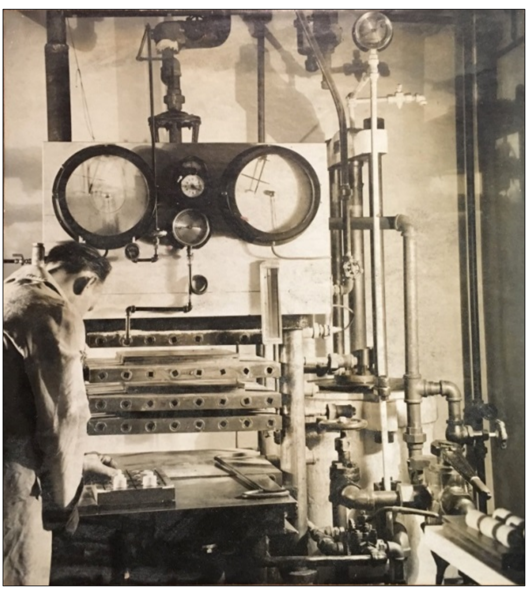

Figure 32. Samples testing in the laboratory, 1930s.

The department more than doubled in size during the smelter's post-World War II expansion. Seven interrelated laboratories—rubber, paint, electronic, ceramic, spectrographic, microscopic, and analytical—performed more than 140,000 analyses in 1955 (Figures 32-33). Via a pneumatic tube from the casting section to the lab, spectrographic analysis of an alloy sample could be run within ten minutes, ensuring the product was being made to specifications. During the mid-1960s, innovations included methods for producing zinc billets for extrusion in a wide variety of alloys and a new product—photosensitive zinc oxide, a boon for the photocopy machine industry.

Early research and development focused on smelter enhancements and products for the zinc plant. By the late 1960s, changes affecting the zinc and lead markets led St. Joe to engage research teams in support of its diverse corporate interests: lead, zinc, coal,

Figure 33. Chemist operating the research spectrophotometer to measure zinc oxide color, 1960.

and gold. The Research Department, which grew to about 100, reported to the St. Joseph Lead Company's New York headquarters although it remained at the smelter site. In 1975, a research team developed the lead strip process with a lead calcium tin alloy for maintenance free batteries. Other researchers worked with zinc oxide for the cosmetics industry and zinc alloys for galvanizing applications. Efforts to improve or replace operations spanned from feasibility studies to bench scale testing, to building pilot plants. One such pilot plant in 1983 was the flame reactor, designed to use lower cost, waste type of metal materials or feeds and process them directly without going through the sinter or furnace plants. The product development group ended in 1987—50 years after Weaton had established the Research Department—when Fluor Corporation sold off St. Joe Resources Company in parts and there was no further need for a centralized research and development operation. Process research continued at the plant under ZCA until about 1995.

Industrial Relations

> *Industrial harmony and mutual respect must be earned, they cannot be bought or induced through propaganda any more than an individual can buy respect or a good reputation.*
>
> Andrew Fletcher, St. Joseph Lead Company President (1947-1960) and chairman of the board (1960-1967)

When the St. Joseph Lead Company first came to Potter Township to establish its Zinc Smelting Division, it invested in employee wellbeing and satisfaction. Facilities, amenities, perks, and open communication between management and labor set the tone for good industrial relations and defined the culture of the plant. Barometers of successful management-labor relations were long years of service celebrated in 10, 20, 30, and 40-year increments and the absence of unions in the plant for more than four decades.

In 1930, while the plant was still under construction, Division Manager George F. Weaton initiated the Corn Roast, the first annual company picnic for employees and their families on the company's picnic grounds. These picnics, which became the highlight of every employee's social calendar, featured softball games between operating and maintenance departments (white collar vs. overall) and family-friendly contests including the children's peanut scramble, the women's rolling pin throw, the men's 16-lb. shot put, foot races, cracker eating, hog calling, and a tug of war (Figure 34). The company's annual picnic became an even more event-filled day as the workforce expanded. Approximately 1,350 people attended the tenth annual picnic in 1940. The venue eventually switched to Idora Park in Youngstown, Ohio, where, 3,900 employees enjoyed the fun in 1964.

Figure 34. Tug of war at the 1934 Corn Roast.

St. Joe provided employees a pension fund, life insurance policies, and an on-site credit union that required less stringent standards than banks and loan organizations for employees to borrow money. An incentive plan paid bonuses for meeting targets for the recovery of metals from concentrates. Through a gasoline and oil cooperative, employees could tank up their vehicles at St. Joe's gas pump at prices below the going rate at gas stations.

Management engaged employees in efforts to promote and celebrate safety at the workplace, which included safety training (Figure 35). The zinc plant held its first Annual Safety Banquet in 1933, a rally of sorts, attended by employees, management, and their wives. The "Suggestion System" gave employees an opportunity to contribute their ideas toward plant improvement and safety, and to receive monetary awards for ideas the Suggestion Committee deemed valuable. The Plant Foremen's Association, organized in 1935, held monthly meetings to discuss safety as well as plant problems and programs, and around 1943, Weaton instituted department safety meetings and required safety reports. A scoreboard at the gate house tracked hours/days worked without a lost time injury for the various departments, while signage at the entrance read, "Through this portal pass the safest workers in the zinc industry, work safely and pass through again."

Figure 35. Safety training.

The plant opened with a first aid room for treating minor occupational injuries. In 1950, the company erected an Emergency Response Building and hired a registered nurse (Figure 36). St. Joe required new employees to pass a complete physical examination and all employees received periodic examinations. The company also provided flu shots and blood lead monitoring before any regulatory agencies required it. The roaster plant had the highest lead levels at the smelter. If someone developed elevated levels, the company reassigned him to another position and if that job had a lower pay rate, the higher rate was guaranteed.

Figure 36. St. Joe's first registered nurse, 1950.

St. Joe offered a number of training and tuition assistance programs that developed skills that were good for the company and good for the employee's career with the company. The Apprentice Training School entailed a four-year course of classroom and shop training to prepare high quality craftsman for the various aspects of smelter work, including auto mechanic, pipefitter, electrician, and machinist. St. Joe's summer Technical Training Program trained and recruited engineers; during the summer of 1960, 26 students representing 12 universities worked in 10 departments throughout the plant. A Management Training Program educated supervisors and hourly employees in basic management principles and emphasized industrial relations and leadership. A Tuitions Aid Program started in 1956 paid up to 80 percent of fees toward courses for employees who wanted to further their job-related education. Yet another technical training program in collaboration with Penn State University awarded associate degrees in drafting and design technology or materials technology-metallurgy.

The cafeteria, truly the heart of the smelter, opened in 1940. Weaton believed you would get a good day's work from a man who had a good warm meal. Known simply as "the Cafe" (silent "e"), it provided hot meals at subsidized rates, with meal tickets deducted from pay. Twenty-four employees served more than 1,000 meals a day, 24 hours a day, seven days a week, feeding workers on all three shifts. Women did the cooking, which included baking pastries (Figure 37). Men worked as meat cutters, trimming cuts of beef and pork that came from a nearby 470-acre company-owned farm (Figure 38). In the mid-1970s, cafeteria hours were cut back. When the plant reopened after the 1979 shut down, the cafeteria did not, a casualty of the streamlined smelter operations.

Figure 37. Cafeteria crew, 1949.

The auditorium building, constructed in 1951, served a practical purpose of providing additional space for plant meetings. More often, and typically Monday through Saturday, 6-11pm, the main floor functioned as a gymnasium with its beautiful wooden basketball court. The basement housed a number of recreational facilities including four bowling alleys, two tenpins, two duckpins, pool, ping pong, and shuffleboard (Figure 39**)**. The amenities were free for the use of employees and their families and guests. Bowlers paid local teenagers a small fee per game for working as pin boys. Annual Christmas parties, movies, banquets, awards dinners, and dances took place in the auditorium. St. Joe was known for its children's Christmas parties and the extravagant, age-appropriate gifts purchased months ahead of the event (Figure 40).

Figure 38. St. Joe farm.

Figure 39. Downstairs activities in the auditorium building during the 10 Year Club Dance, 1954.

Figure 40. The auditorium decorated for the annual Christmas party, 1950s.

The company's extensive athletic programs warranted a fulltime athletic director, who supervised the gymnasium and many athletic leagues: intra-departmental teams, couples leagues, women's teams, and groups that competed against other mills around Beaver County. Offerings included bowling, volleyball, softball (Figure 41), golf, trapshooting, and pistol shooting in the basement of the former Beaver County Home. The 1958 volleyball team competed in the National Championships and did so bringing honor, if not victory, to St. Joe.

Several initiatives promoting labor-management relations came about in the 1950s. In 1953, the Employees' Advisory Committee became "the first venture by management in general employee representation." In 1956, John Wehn, who succeeded Weaton as plant manager, formalized company policies that addressed fringe benefits like vacation time, holiday pay, and medical coverage. Wehn expanded the Employees' Advisory Committee to give hourly employees a voice. The cooperative efforts led to changes in wage structures, job posting and bidding procedures, grievance procedures, death and funeral leave allowance, and improvements to the pension plan and hospitalization. In 1959, St. Joe established an Industrial Relations Department, headed by Clifford A. Conklin, to coordinate the more complex labor-management administration.

Figure 41. St. Joe Lead softball team, second place finish in Beaver County Manufacturers' League, 1940.

The benefits program, good working conditions and labor-management relations, training opportunities, fair wages, and ample safety provisions satisfied most of the needs that typically turned an industrial workforce to organized labor. However, various circumstances led the St. Joe workforce to vote in the union in 1974. Union contracts brought higher wages, a shorter workweek, more paid holidays, more safety equipment, and closer medical monitoring, but things would not be the same. Activities, programs, and facilities that had built decades of esprit de corps, a sense of family, and company loyalty—things like the cafeteria, gymnasium, safety banquets, and Christmas parties—disappeared between the 1974 vote to unionize and the 1979 shutdown of the smelter. When the streamlined plant reopened in 1980, a lot of the returning workers "were disappointed, and they would say they wish we could go back to the good old days. Well, the good old days were gone, gone forever," remarked Sam Mullin, former personnel director. That's not to say that all the camaraderie went too. Chuck Andrews, who worked at the smelter until it closed, reflected, "They were your friends, . . . if you had a problem they would come together and they would help you." When the final 2014 shutdown loomed, the plant's union leaders staged job fairs to help fellow members prepare for the transition and seek new employment.

Community Relations

The St. Joseph Lead Company not only practiced good employee relations, but also good community relations. The company welcomed area residents onto the site for recreational purposes and St. Joe employees ventured out to support civic activities and causes, executives often serving on school boards and in other local organizations. There was a time when St. Joe also reached out to the community over the airwaves, presenting "radio programs of general interest to the people of Beaver County."

One of the most direct symbols of the company's community involvement was construction of the Potter Township Elementary School in 1939. The company built the two-room, orange brick schoolhouse on Poorhouse Run Road (now Pleasant Drive) and donated the school and land to Potter Township School District. St. Joe also donated five acres of land to the fire department to build their firehouse. Six acres of property, which St. Joe had converted into picnic grounds with tables, playground equipment, and other facilities, were made available to church, civic, and other organized community groups. Friends of St. Joe families used the auditorium facilities as accompanied guests, joining in basketball, bowling, and other activities.

Volunteerism was part of the company ethos: Boy Scout programs, bloodmobiles, United Way, and river cleanup activity. The company contributed Christmas trees that they decorated and auctioned off right after Thanksgiving, proceeds going to support an agency. According to Mullin, ". . . any charitable group, or any, let me say, community movement that was done, St. Joe would take some part in it."

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The St. Joseph Lead Company's Josephtown/Monaca Zinc Smelter played an important role in the industrial history of Beaver County, Pennsylvania. Other than a brief period of time and throughout several changes of ownership, the smelter - a facility for extracting or separating base metals from ores - operated continuously from 1930 to 2014. In the eight-plus decades that the smelter operated, thousands of employees and generations of families made their livelihood. This booklet seeks to preserve the smelter's legacy.

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