

# Lukens Steel: A Pennsylvania Steel Company

The roar of the fire from the furnace and the smoke from the stacks told the men how long it would take to heat the iron or steel so it could be shaped into plates. The large water wheel creaking as it struggles with the heavy water of the Brandywine Creek making pass after pass. Air thick with a blue smoky haze from the charcoal furnaces and the sweat of the men was constantly around the rolling mill. The white-hot steel plates emerging from the roaring furnace onto the tables running towards the mouth of the huge iron rolls. Metal banging



(National Iron & Steel Heritage Museum)

against metal, emerging on the other side and made ready for another pass through the mill. At night the glow of a tap could light up the dark sky with a warm orange glow. These are the sights and sounds in the heart of Coatesville, Pennsylvania home to iron and steel making for over 200 years beginning in 1810. Here in rural Pennsylvania, the iron and steel workers could escape to the woods, fields, and creeks, and, although their work was often dangerous, they were paid relatively well.

The Lukens National Historic District is now a national historic site, it lies in the middle of the Great Valley half way between Philadelphia and Harrisburg and along the Brandywine Creek halfway between Wilmington, Delaware and Reading in Berks County in southeastern Pennsylvania. It Provides a glimpse into the iron and steel industry that played a central role in the growth of America as an industrial nation.

*The photo on this page has a resolution of 72 dots per inch (dpi), and therefore will print poorly. Click on the photo to download a higher resolution image.*

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The lesson is based on Lukens National Historic District, one of the thousands of properties listed in the National Register of Historic Places.

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## About This Lesson

This lesson is based on the National Register of Historic Places registration file, “Lukens National Historic District”, the book “Remarkable Past Promising Future”, the book “Coatesville” by Bruce Mowday, which was written with the assistance of Scott G. Huston and Eugene DiOrio. The lesson plan was edited by Jewel Lee, and the Teaching with Historic Places Staff. TwHP is sponsored, in part, by the Cultural Resources Training Initiative and Parks as Classrooms programs of the National Park Service. This lesson is one in a series that brings the important stories of historic places into classrooms across the country.

### Where it fits into the curriculum

Topics: This lesson could be used in American history, social studies, and geography courses in units on the growth of the American economy during the early National period.

Time period: Early National

[Relevant Curriculum Standards for Social Studies](#)

### Objectives for students

- 1) Describe how natural resources influenced the location and development of the early American iron-making industry.
- 2) Identify the steps in making iron and steel products at Lukens Steel.
- 3) Trace the effects of national events on Lukens Steel, its owners and community.
- 4) Describe how work helped determine social status within the Coatesville community.
- 5) Compare and contrast the early economic development of their own community with that of the Coatesville community.

### Materials for students

The materials listed below either can be used directly on the computer or can be printed out, photocopied, and distributed to students. The maps and images appear twice: in a smaller, low-resolution version with associated questions and alone in a larger version.

- 1) [map 1](#) & [map 2](#) showing Lukens Steel and the surrounding area;
- 2) [reading 1](#), [reading 2](#) & [reading 3](#) about iron-making and the Lukens Steel community;
- 3) [photograph 1](#), [photographs 2 & 3](#) & [photograph 4](#) of the steel-making process, the historic site today, and some Lukens Steel’s products;
- 4) [illustration 1](#) & [illustration 2](#) of the steel-making process and of the restored Lukens National Historic Site.

## Visiting The Site

The Lukens National Historic District, administered by the Graystone Society, is open daily Monday through Saturday except New Year's Day, Independence Day, Thanksgiving Day, and Christmas Day.

Coatesville is located about 40 miles west of Philadelphia on Pennsylvania Route 30.

For additional information, contact Lukens National Historic District, 50 South 1st Avenue, Coatesville, PA 19320, or visit the [Web page](#).



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## Inquiry Question



*(National Iron and Steel Heritage Museum)*

**What might these men be doing?**

Click here for [Photo Analysis Worksheet](#).

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## Historical Context

### Setting the Stage

Iron in colonial America was hard to find, basic tools had to be brought over from Europe either as personal household items or imported at a high cost. Early colonial Americans sought iron and the means to make the tools they needed to farm the land. Axes, hammers, and plows were needed in the fields while fireplace pokers, log holders, cranes and cooking pots were needed in the kitchen. Iron works were quickly established along rivers in Virginia and Massachusetts by colonial businessmen to supply the need of the growing population. Charcoal furnaces took iron ore and melted it into bar iron and casts. Forges took the bar iron and made harder flat tools. These works were located close to the necessary natural resources: iron ore, limestone, hardwood forests, and water. The Middle Atlantic colonies and Pennsylvania in particular, had an abundance of these raw materials as well as a mild climate.

William Penn lured colonists to Pennsylvania by stressing not only religious toleration, but also the fact that his colony was rich in natural resources, including good quality iron ore and extensive forests. Immigrants from Europe poured into the colony. Large numbers settled in Philadelphia and its surrounding region. These settlers needed everyday objects such as tools, nails, horseshoes, and cooking utensils. Many small iron-making furnaces were built in southeastern Pennsylvania to take advantage of that market. By the time of the American Revolution, there were approximately 65 ironworks concentrated in southeastern Pennsylvania. After the revolution, the repeal of British rule and taxes along with the creation of the United States of America allowed the emerging domestic iron industry to rapidly expand.

Isaac Pennock took notice and started the Federal Slitting mill in 1793 along the Buck Run creek in Southeast Pennsylvania. This mill made nails, wagon wheel rims and barrel hoops. This venture was so successful that in 1810 he purchased a saw mill along the Brandywine River and converted it into the Brandywine Iron Works and Nail factory. This mill was located along the first National Turnpike where it crossed the Brandywine River half way between Philadelphia and Lancaster. This mill was successful in supplying the needs of the frontier settlers on their way west and Isaac was busy running both mills. In 1820, Dr. Lukens converted the nail factory to make large charcoal iron plates for the steam boilers used as engines for boats and trains. Isaac and Dr. Lukens both died suddenly leaving Isaac's daughter Rebecca determined to run the mill and make boiler plates for the locomotives for the railroads. She became the first female industrialist and ran the mill successfully until she eventually turned management of the business to her sons-in-law, Abram Gibbons and Charles Huston. The mill continued in the family driving the transportation revolution as trains and ships needed to travel farther and carry heavier loads and generally got larger.

During the Civil War the company doubled in size and made iron for the Union gunboats a deviation from their Quaker beliefs of non-violence. The industrial revolution in the late 1880-1890's saw the demand for Lukens Steel grow enough to expand into Steel making and adding more rolling mills. Large steel companies were formed under Carnegie and Schwab absorbing many smaller companies in the early 1900's. World War One showed how armor plate could be used in large battleships and tanks so Lukens installed the world's largest plate mill in 1918. The economic depression caused many companies to close, but the effort to build dams for electrification needed many large steel parts for the turbines. World War Two had the Lukens Steel Company supplying the materials needed to fight a large global conflict. The 1950's and 1960's with exploration for resources from the Arctic to Space again saw Lukens Steel. The global economy suffered a major setback and the creation of the Rust belt with many mills closing was a tough time on many steel making communities. Lukens was sold to Bethlehem in 1998 and is now operating under ArcelorMittal a large multinational firm. The Lukens National Historic District is managed by the Graystone Society.



## Locating the Site

### Map 1: Pennsylvania and surrounding region.

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the Map](#)

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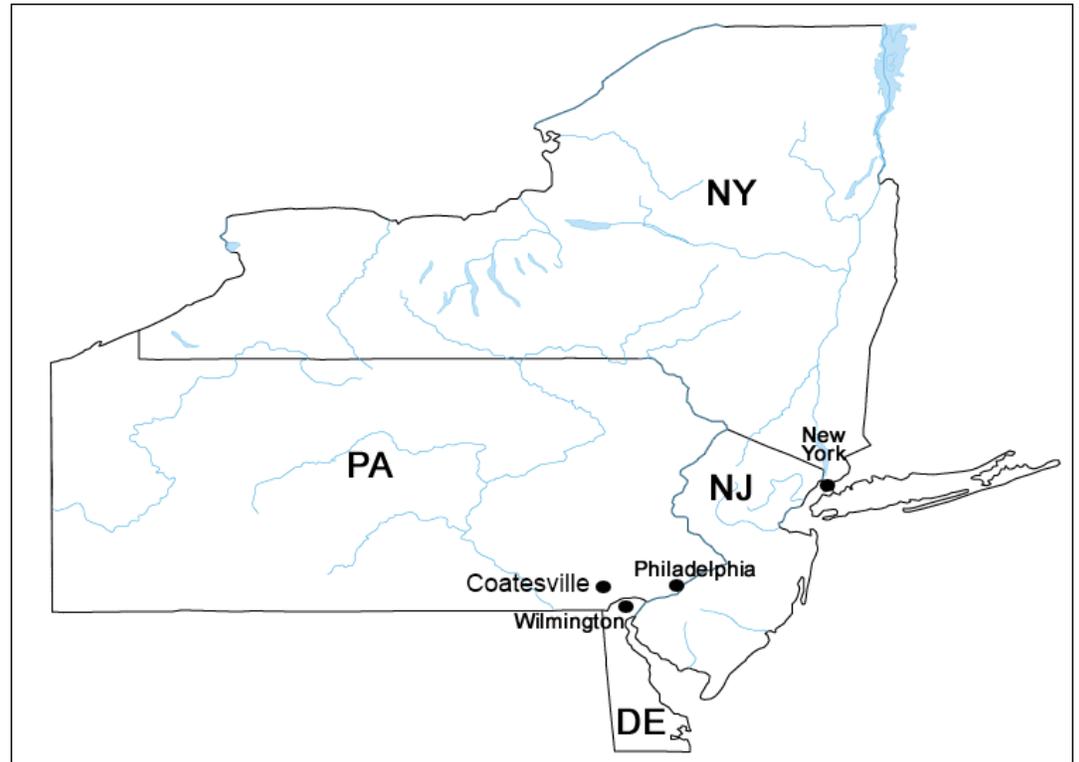
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*(National Park Service)*



## Map 2: Southeastern Pennsylvania in the mid-19th Century.

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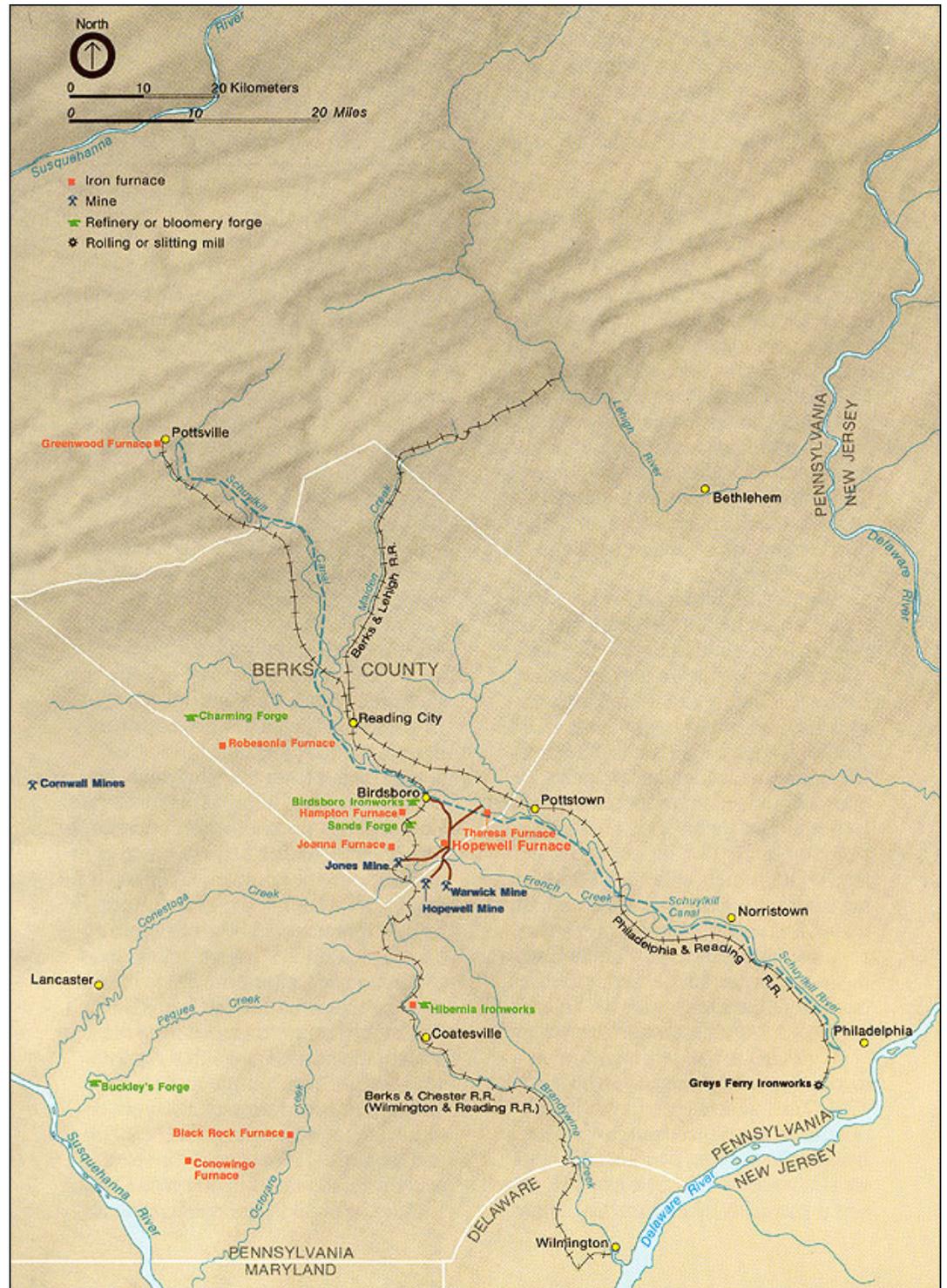
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*(National Park Service)*

Lukens Steel located in Coatesville, Pennsylvania operated as part of a wider network of furnaces (turning iron ore into iron and producing cast iron products), forges (refining cast iron into wrought iron products), mines, and markets in southeastern Pennsylvania and beyond. This map shows some of the transportation networks (railroads and rivers) and ironworks connected either as suppliers or by relation to the owners in the 1830's.

## Questions for Maps 1 and 2

1. Locate Coatesville, Philadelphia, Lancaster (Harrisburg), Pittsburg, Reading and Wilmington, DE on Maps 1 and 2.
2. The map key on Map 2 identifies other categories of iron-related sites. How many can you locate that are within 20 miles of Coatesville? Why were there so many furnaces and forges in this region?
3. Early 19th-century iron-making required easily mined iron ore, a dependable water supply to provide the blast for the furnace, extensive hardwood forests for charcoal, and limestone to remove the impurities from the ore. Which of these are easily identified on Map 2?
4. Success in iron making required markets where products could be sold and transportation to get them there. Using Map 2, identify cities that might have served as markets. Use the map key to calculate how far these cities were from Coatesville. What means of transportation to carry iron products to these markets can you identify on Map 2?

*The maps in this section have a resolution of 72 dots per inch (dpi), and therefore will print poorly. You can obtain a larger version of Map 1 and Map 2 by clicking on the map and downloading a higher resolution image from our website.*



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## Determining the Facts

### Reading 1: The Work at Lukens Steel

During National periods of America's history, the tools we needed to build with were the end products of a fairly simple process developed in the ancient world. Soon stronger, more durable iron was needed to supply the demand for larger machines such as steam locomotives and steam ships for the expanding United States of America. The raw materials needed--iron ore, limestone, and hardwood forests for charcoal--were all available in the Coatesville area in Pennsylvania. Miners dug the ore and limestone from open-pit mines which was carried by Teamsters to the local charcoal furnaces. The blast furnace (a tall, stone structure shaped like a flattened pyramid) made bar or "pig" iron and sold them to local forges for processing and refinement into products. Teamsters with their wagons usually dropped off the raw materials needed for the furnaces and transported the bar iron to the forges.

In order to produce the iron and steel plate, a large number of people were required to receive the raw materials and process it into the final product. Materials for steel making at Lukens were supplied by the furnaces and forges in the area-pig iron blooms and scrap. In early years, bar iron was transported to the plant by wagons and later by trucks and trains. Once the iron blooms and scrap came into the plant, it was sorted by material handlers by type and quality before being placed in the furnaces. The professional melter who managed the open hearth and later electric furnaces were responsible for the placement of materials for melting into the furnaces, the control of heating, the tapping of furnaces when the heats were ready. When the furnace was tapped, crane operators would place and remove the ladles of molten steel. The steel was then poured into ingot molds for cooling and formation, this was called teeming the ingots.

Following melting the ingot moved on to rolling--the heart of the operation. Technicians controlled the breakdown of ingots and slabs into rolling into plates. In addition to the basic rolling, operators oversaw finishing processes: people who sheared or cut plates, people who flattened or leveled plates and people who took off the sharp edges by grinding plates bringing the plates to the exact customer requirements. In addition, production staff completed shipping. Shipping staff supervised the placement of plates on trucks and railroad cars for transportation to the customer.

In addition to actual steel production, the business required many different positions: sales personnel--many with engineering expertise to meet customer exact needs; production control managers to keep track of progress of orders; general office management; accountant; Treasurer. The owners were responsible for the entire operation.

## Questions for Reading 1

1. How did raw material arrive at the plant?
2. Construct a flowchart showing the process of turning iron ore into finished products. Identify the workers responsible for each stage of the process. Why do you suppose there were so many different jobs?
3. Why do you think the furnace operated 24 hours a day whenever possible?

*Reading 1 was adapted from Remarkable Past Promising Future (The Graystone Society, 2010).*



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## Determining the Facts

### Reading 2: Owner and Ironmaster: Rebecca

#### History 1700s - 1850

George Washington was serving his fifth year as President of the United States when Rebecca Webb Pennock (Lukens) was born near Fallowfield, Pennsylvania, on January 6, 1794. The second child of Isaac and Martha Webb Pennock, she entered a well-to-do, established family of Quaker farmers with extensive holdings in western Chester County. At the time of Rebecca's birth, Isaac Pennock owned a gracious home and profitable iron works, the Federal Slitting Mill, on Buck Run tributary near the Coatesville-Unionville Road (Route 82). The mill produced much needed iron rods and strips for the fabrication of wagon wheel rims, barrel hoops and blacksmith iron.

Because Quakers believed daughters should be educated like sons, Isaac taught Rebecca to read, write, calculate and ride horseback. She was his constant companion as he tended to his iron business and properties. When Rebecca turned 12, she was sent to a Wilmington boarding school to complete her education.

"Now it was that life began to open new charms for me," wrote Rebecca in 1825. "I was rapidly improving, a favorite with my teachers and at the head of all my classes...my preceptor was the best of men. Every pain was taken to instill religious impressions into the minds of his pupils...I always look on this period of my life with pleasure and even now love to retrace it."

At age 16, Rebecca returned home to help with six younger siblings. "For a long time I felt lonely and isolated. I had no companions to mingle my thoughts with... Books I read or rather eagerly devoured their contents...and many, many is the night I have hid in my chamber, the light served me to indulge in my favorite pursuit till the morning's dawn." While Rebecca struggled at home, Isaac formed a partnership with Jesse Kersey, and on July 2, 1810, purchased the Moses Coates Farm on the West Branch of the Brandywine River near the Turnpike. Isaac converted an old sawmill on the property into any iron mill opened Brandywine Iron Works and Nail Factory.

Soon after, Isaac indulged his daughter and sent her back to school. "Oh what were the glad emotions of my heart when consent [for school] was obtained," recounted Rebecca. "Chemistry and the French language claimed my attention and I devoted myself with untiring zeal to their acquirement." In the spring of 1812, Rebecca, age 18, accompanied her father to Philadelphia and was introduced to Dr. Charles Lukens. The young doctor left a lasting impression for the last seven pages of Rebecca's autobiography describe every nuance of the courtship. "He bowed with a peculiar grace, and for a moment my eyes rested on his interesting face and his tall and

commanding figure. The next I bent them with confusion to the ground...I was left in a state of feeling, I could not understand.” The brief meeting also had a profound effect on Dr. Lukens. By early summer, he found an excuse to visit mutual friends and renew his acquaintance with Rebecca’s family. “Late [one] clear, beautiful day, I was sitting alone and...watching a most glorious sunset from the window...and scarcely noticed the approach of a step until a voice aroused me with a start of surprise and he [Dr. Lukens] stood in the parlour before me.” After many evening walks and discussion of poetry in the moonlight, Dr. Lukens pressed his suit and, with Rebecca’s consent, asked Isaac for his daughter’s hand. The couple was wed March 23, 1813. Their marriage certificate states “at a public meeting of Friends of Fallowfield, Charles Lukens (Doctor of Physic) and Rebecca Webb Pen-nock exchanged vows of fidelity and affection until death should separate them.

At first, the newlyweds lived near the Federal Slitting Mill, renamed Rokeby Iron Works in 1813. In 1814, Charles joined Rebecca’s father in the iron business and their first child, Martha, was born. After living and working with Rebecca’s family for two years, Charles seriously considered moving his family to Abington and re-viving his medical practice. It is probably not coincidence that Isaac purchased Jesse Kersey’s interest in the Brandywine Iron Works in 1816 and leased the property to Charles for \$20 a year. Shortly thereafter, the Lukens moved to the old Coates homestead. A diary entry by Rebecca recalled that “everything about the Brandywine Iron Works, including the house [Brandywine Mansion], mill and farm, was in a forlorn and wretched state.” While Rebecca tended the house, Charles upgraded the mill. By December 1818, Brandywine Iron Works was producing America’s first boiler plates, in addition to split rods and cut nails. During this time, the Lukens had three more children- Elizabeth (April 1817), Charles Edmund (February 1819) and Isaac (May 1821). Infant Isaac died in March 1822, and by the time Isabella was born (November 1822). Dr. Lukens had established a reputation for quality boiler plate with area shipbuilders. Brandywine Rolling Mill’s future looked bright in 1823, despite the Lukens’ indebtedness to Isaac. Change, however, was just around the corner.

Early in 1824, Isaac died leaving a will that did not clearly pass ownership of the Brandywine Iron Mill to Charles and Rebecca Lukens. Rebecca’s mother laid claim to the property the young couple worked so hard to improve. The loss of Isaac was quickly followed by the death of their first son, Charles Edmund. A year later, Dr. Charles Lukens died suddenly at the age of 39. He left Rebecca pregnant and grieving with three small daughters, heavy debts to a callous mother and disputed rights to the mill.

“In the summer of 1825, I lost my dear and excellent husband,” wrote Rebecca. “During the period our being here the iron business had been very poor...in our constant expense in repairing the Works, it was utterly impossible there should be support left for the young and helpless family now dependent solely on me... [Dr. Lukens] was sanguine in his hopes for success, and this was his dying request – he wished me to continue and I promised to comply. Indeed I knew well I must do something for the

children around me... I will not dwell on my feelings, when I began to look around me... {but} Necessity is a stern task mistress; and my every want gave me courage; besides, where else could I go and live...Dr. Lukens had many good and firm friends, and they all stood by me...the workmen were tried and faithful, and so with some fear but more courage, I began to struggle for a livelihood...now I look back and wonder at by daring.”

Five months after Dr. Lukens’ death, Rebecca had her sixth child, a daughter she named “Charlesanna” in memory of her husband. With Charles’ brother, Solomon, overseeing the mill operations, Rebecca managed the commercial side buying materials and supplies, making contracts and negotiating sales. Nine years after Charles’ death, Rebecca had paid her creditors’ and mother’s accounts. Then in 1832, Rebecca’s second daughter, Elizabeth, die at 15. Rebecca handled her grief by burying herself in work.

“[By 1834] the mill had been entirely remodeled and rebuilt from the very foundation. Dam entirely newly built, wheels put in, castings, furnaces, mill head, mill house much larger, all were build anew; not a vestige of the old remained...I have thoroughly repaired the mansion house, built good and substantial tenant houses for my workmen, and put much time and fencing on the farm and have been at the whole expenses of defending the property from an attempt made to destroy the water right...I had built a very superior mill, though a plain one, and our character for making boiler plate stood first in the market, hence we had as much business we could do.”

During 1834, Rebecca also opened a store, warehouse and freight agency at the Coatesville depot providing access to Philadelphia and Pittsburgh. The Panic of 1837 weathered with common sense. After rolling a complete inventory of boiler plate, she stopped the mill and set the men to repair equipment and build walls. When faced with declining cash flow, she paid workers with fresh produce and dairy products from her farm. Through the 1840’s, Rebecca battled against railroad tariffs. A plate incised with rebellious verse was mounted by the Turnpike to protect the exorbitant freight rates levied on manufactured goods. Authorship is attributed to an angry Rebecca.

“We fondly hope for better days when every furnace fire shall blaze...And streaming to the midnight sky proclaim to all – prosperity.”

The marriage of Martha Lukens to Abram Gibbons, Jr., took place in October 1841 at Fallowfield Meeting and was celebrated on the porch of the Brandywine Mansion. Rebecca’s new son-in-law joined the firm in 1842 and was made full partner in 1844. In 1847, Isabella married Dr. Charles Huston who, like Dr. Lukens before him, abandoned medicine to join the iron business. With two capable sons-in-law to manage the business, Rebecca became a silent partner. Charlesanna married Dr. William Tingley of Philadelphia in April 1848 and died 11 months later in childbirth. And, a grief-stricken Rebecca returned to Brandywine Mansion with her infant granddaughter. The next six years were spent raising Annie – “the light of my home, the bright sunbeam of my dreary life” – building a house for

Isabella's family and studying the Bible. One petulant diary entry shows Rebecca seeking reasons for the tragic events of her life, but she finishes with "I dare not murmur; I fear to repine, lest I offend Him, the Great and good Creator." Rebecca's faith sustained her to the end. She died December 10, 1854, at age 60. The family buried her near Fallowfield Friends Meeting down the road from the graves of her beloved husband and three children.

The values Rebecca instilled in her heirs are still part of the mill today. She listened to customers' needs, embraced technology, reinvested in her business during good times and bad, pursued specialty markets, and above all maintained profitability. So successful were her children that by 1892, Locomotive Engineering remarked that "[Lukens] has adhered to their specialty of making plate; they have demonstrated the greatest care and attention to the production of the best article that could be made, and their customers admit that no better plate is to be found on the market. They appear to take particular pride in the uniform quality of their steel." Today, the mill is the oldest continuously operating steel mill in North America. Much of the company's success is linked to the legacy left by a courageous and determined woman named Rebecca Webb Pennock Lukens.

## Questions for Reading 2

1. How did Rebecca Lukens become involved in the iron business?
2. In what ways did she improve the mill?
3. How did she contribute to the development of the Coatesville community?
4. How did national events affect Rebecca and her employees?
5. Because Rebecca Lukens was owner as well as ironmaster at Brandywine Iron and Nail Factory, she was actively involved in both managing the day-to-day work of the furnace and making policy decisions. Do you think combining these two roles would help the success of the furnace? Why or why not?

*Reading 2 was adapted from Remarkable Past Promising Future (The Graystone Society, 2010).*



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## Determining the Facts

### Reading 3: The Lukens Community

For more than 200 years, from the early 19th century until today the mill is the center of a larger community of 10,000-15,000 people, all of whose work was directly or indirectly related to the production of iron and steel. Many of these people lived in houses furnished by the company others built and sold houses for workers independent of the company. Much of the food was sold in local stores to employees and their families. The company even had a store and sold everything from meats to shoes. The heart of the community was the glowing mill, whose cycles of filling, tapping and rolling set the pace of life.

The daily lives of the workers varied with the work they performed; their skills and responsibilities determined their social positions. From his comfortable home overlooking the entire mill, the ironmaster made policy decisions, assumed responsibility for the successful operation of the enterprise, and largely controlled the lives of the furnace employees, their families and those that supported them. The ironmaster's mansion was at once family home, business headquarters, boarding house, and social center. The ironmaster and his family lived in the fashionable style of country gentry, wearing fine clothing and enjoying expensive furniture and other luxuries. A large staff of household servants, drawn largely from the wives and daughters of mill workers, worked at the Ironmaster's House.

The mill clerk was second only to the ironmaster in importance. He kept the books, acted as paymaster, and placated unhappy customers. He also managed the company store, ordering supplies and charging workers' purchases against their wages. He was trusted with setting priorities for filling orders and could extend credit. The clerk also managed the furnace in the ironmaster's absence. Besides his considerable salary, the clerk was provided with room and board and travel expenses.

Below the ironmaster level, the most important man in the community was the works manager, the person responsible for the efficient operation of the mill. He had immediate oversight of the iron workers and was accountable for the quality of the plate. Because of his important position, he and his family held considerable prestige in the community.

The majority of other iron workers labored in 12-hour shifts at grimy, often dangerous tasks. The noisy, reeking, fiery hot furnaces defined their work. Skilled craftsmen such as rollers and melters enjoyed higher earnings and greater prestige than ordinary mill workers or ancillary workers such as laborers, teamsters, cutters, grinders, and household servants. Rollers, the elite of the mill workforce, received higher rates than the melter. Men who filled the furnaces had the most dangerous jobs and received less pay than the skilled workmen. Blacksmiths, mill and wheelwrights, and other skilled artisans provided indirect, but essential services to the furnace. Farmers and farm workers developed the arable land of the village and grew much of its food.

Many women found paid employment, skilled women earned wages as seamstresses, cooks and candle makers for the Ironmaster's House. Others added to the family income by boarding single men, selling eggs and chickens, marketing home-baked or home-preserved products, and sewing, repairing, or laundering clothing. Many women and children helped with farm work at harvest time. Children were apprenticed at early ages or went to work to help support their families. During World War Two many women entered the mill to work hard jobs for the war effort.

African Americans were also employed at the mill and received equal pay with white workers for the same jobs. They were, however, most often working at the less skilled jobs. Neither living quarters nor social activities were segregated. The forests of southeastern Pennsylvania were known as a shelter for runaway slaves. And with the Quaker connections to the ownership it is possible runaway slaves were provided with jobs until they could move on to safer areas further north. African Americans have long been a proud and important part of the workforce at Lukens.

While a class system did exist within the workplace, there was also a strong sense of community in Coatesville. Everyone else found that their social lives ebbed and flowed with the rhythms of the mill. When a long shift, or turn, ended the people celebrated their temporary freedom from its demands. They held "entertainments," went fishing or hunting, skating or sleighing. At special times, Election Day or the Fourth of July, civic duties were combined with social duties. There was even a Lukens Athletic League with teams from departments that competed in Basketball, Baseball, Golf and Bowling. For Lukens Steel workers, life was a mixture of hard work and play.

## Questions for Reading 3

1. Compare the duties of owner, ironmaster, clerk, melter and roller. If you had to choose, which of these jobs would you prefer? Why?
2. Which mill workers were considered the most important and were paid the most?
3. Which jobs were the most dangerous? Why? How well were these jobs paid? Why do you think that was so?
4. What paid work did women and children perform? What unpaid work do you think they provided? How important do you think this unpaid work was to the community?
5. The reading suggests that there was a degree of equality at Lukens Steel. How would you compare that “equality” with today’s definition?

*Reading 3 was adapted from Remarkable Past Promising Future (The Graystone Society, 2010).*



## Visual Evidence

### Illustration 1: 20th-century steel company in operation



(National Iron and Steel Heritage Museum)

#### Questions for Illustration 1

1. How many smoke stacks can you count? What effect do you think this had on the town?
2. Which building are the furnaces in? Why?
3. How did steel move around the plant and town?
4. Where are the offices and workers houses? What was it like to work or live there?
5. How many people work in the plant? Which area do you think was the dirtiest? Cleanest?

*The illustration on this page has a resolution of 72 dots per inch (dpi), and therefore will print poorly. You can obtain a larger version of Illustration 1 by clicking on the illustration and downloading a higher resolution image from our website.*

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## Visual Evidence

### Photo 1: Spinning Head 1968.



*(National Iron and Steel Heritage Museum)*

Spun heads, measuring up to 20 feet in diameter, were made by first melting scrap in the furnace and pouring the heat into an ingot mold before taking the ingot to the plate mill. Once rolled, a plate was cut by a torch, or flame-cut, to size. The plate would then be heated in the furnace to about 2,500 degrees Fahrenheit so it could be worked, or bent, and then placed on one of three machines depending on the size needed. The plate would then supported on the machine and rotated around while a roll would slowly press the edge down creating a dome shaped object. A plate needed to be worked on before it cooled down and could no longer be formed. It usually took about an hour to generate a plate on the spun head machine.

This photo shows Lafayette Houck, one of the last of spinners at Lukens Steel in 1968. The spun heads division was sold to a Texas steel company in the 1970's. Mr. Houck is signaling with his hand for the machine operator either to press the roll down or up.

#### Questions for Photo 1

1. What were some of the challenges associated with being a steel worker?
2. Molten iron and steel can reach a temperature of 3,000 degrees Fahrenheit while iron and steel being rolled needs to be around 2,000 degrees Fahrenheit. What protective clothing do the workers shown in the illustration wear? What other protection would you want if you were working at a steel mill?

3. Before this process was developed at Lukens, heads were made by digging a hole in the ground, placing a plate over it and hammering it to the size and shape of the hole. These were called bumped heads. What difficulties do you think were encountered? What resources were saved by spinning?

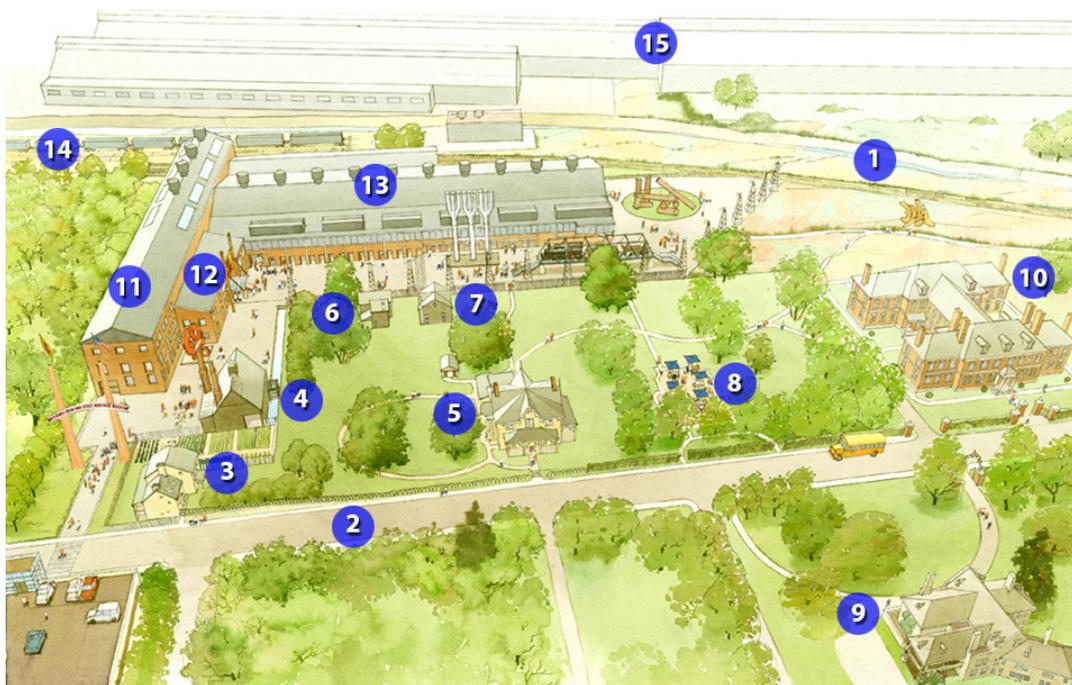
4. How else can you make an object like this?

*The photo in this section has a resolution of 72 dots per inch (dpi), and therefore will print poorly. You can obtain a larger version of Photo 1 by clicking on the photo and downloading a higher resolution image from our website.*



## Visual Evidence

### Illustration 2: Artist's view of Lukens National Historic District



*(National Iron and Steel Heritage Museum, Peter Saylor)*

In 1984, the Graystone Society began its mission to preserve and restore homes related to the family of Rebecca Lukens and the leaders of Lukens Steel on South 1st Avenue in Coatesville. This view shows the Lukens National Historic District as it stands today, with the addition of the plans of the future National Iron & Steel Heritage Museum planned for building 11, 12 & 13.

#### **Key to Illustration 2**

1. Brandywine River
2. Roads used to carry raw minerals to the plant and finished products to market
3. Brandywine Mansion (1739): Home of Dr. Charles and Rebecca Lukens
4. 1800's mill reconstruction
5. Terracina (1849): Home to Dr. Charles and Isabella Lukens Huston
6. Tenant House (Circa 1880)
7. Barn: Safety equipment
8. Charles Lukens Huston Sr. house site
9. Graystone Mansion (1889): Home to Abram Francis Huston
10. Lukens Executive Office Building (1902)
11. 120 inch Mill Motor House
12. 120 inch Mill Motor shed
13. 120 in Mill/Distribution building
14. Transportation: Rail yard
15. Open Hearth furnace buildings

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## Questions for Illustration 2

1. Locate the ironmaster's mansion and the tenant houses. Why do you think the ironmaster and the workers lived so close to the mill? What do you think it might have been like to live so close to the mill?
2. How is the drawing different from or similar to what you imagined the site would look like based on the readings?
3. This drawing represents the appearance of the restored Lukens National Historic Site. How would it differ from a drawing showing the village when the mill was in operation? What do you think it would have been like to live there then?

*The illustration in this section has a resolution of 72 dots per inch (dpi), and therefore will print poorly. You can obtain a larger version of Illustration 2 by clicking on the illustration and downloading a higher resolution image from our website.*



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## Visual Evidence

### Photo 2: Ironmaster's House



*(National Iron and Steel Heritage Museum)*

### Photo 3: Tenant Houses



*(National Iron and Steel Heritage Museum)*

Photo 2 shows Terracina (Number 5 on Illustration 2).

Photo 3 shows the Tenant House (Number 6 on Illustration 2).

### Questions for Photos 2 and 3

1. Compare the view of the Ironmaster's House in Photo 2 with the view in Illustration 2. What differences can you find? Which gives you a better idea of the size of the house? How many people do you think lived here?
2. Examine Photo 3. Rent was deducted from the workers' pay. How do you think that might have affected relations between workers and owners? How many people do you think lived here?
3. Do the illustrations or the photographs give you a better understanding of the site? Explain your answer.

*The photos in this section have a resolution of 72 dots per inch (dpi), and therefore will print poorly. You can obtain a larger version of Photo 2 and Photo 3 by clicking on the photo and downloading a higher resolution image from our website.*



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## Visual Evidence

### Photo 4: Typical Lukens Steel Products.



*(National Iron and Steel Museum Collection)*

#### Questions for Photo 4

1. This photo shows Lukens Steel product dating from the 1960s: The USS Nautilus. Examine it carefully. Where do you think Lukens Steel was used? Why would you need strong steel on a product like this?
2. Look at the photo of the Lukens Steel product. Was this made in Coatesville? Why or why not? What type of company would make this product and where would it be located? How would you get them steel?

*The photo on this page has a resolution of 72 dots per inch (dpi), and therefore will print poorly. You can obtain a larger version of Photo 4 by clicking on the photo and downloading a higher resolution image from our website.*



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## Putting It All Together

The work performed at The Lukens Steel Company was interdependent; each man and woman depended on other workers to make his or her own job possible. Farmers, teamsters, woodcutters, and homemakers were as essential as the ironmaster, the roller, spinner, and melter. The following activities are designed to help students illustrate their understanding of this fact.

### Activity 1: Working at Lukens

Divide students into three groups: (1) mill work (creating iron products), (2) office work (tracking production), and (3) domestic work (growing crops, caring for livestock, cooking and cleaning). Have each group use lesson materials to make a list of all the jobs in their category they have read about, and have them make assumptions about jobs not described.

On the board draw three large circles, labeling each as mill, office, or domestic. As each group reports its list, write the occupations in the appropriate circles. Ask students how particular workers could be identified as “links” to the other groups (e.g., teamster, roller, clerk). Use arrows to show ties between groups. Ask what would happen if anyone neglected to do his or her assigned work. Ask if one set of jobs is more important than the others. If they cannot decide on an answer to that question, the point of interdependence is clear.

Then ask students to research a local industry or business to find out if workers there are as interdependent as those at Lukens and explain why or why not. You may be able to have the owner or manager of a local firm speak to the class about the interdependence involved in that business. Many such people are happy to provide students with copies of their managerial flow charts.

### Activity 2: Economic History in the Local Community

Ask students to research the economic history of their own state and local community to find out how it resembled or differed from colonial Pennsylvania and Hopewell. Some questions students might investigate include:

1. Coatesville is an example of a “company town,” that is, a town built by a single company that dominated all aspects of life in the community. Were such communities parts of the economic history of your state?
2. Iron-making is considered a “heavy industry,” which is defined as an industry producing or refining basic materials used in manufacturing. Are there, or were there, heavy industries in your community or nearby? What happened to them?
  - a. Was one heavy industry replaced by another heavy industry? Why did this happen?
  - b. Has all heavy industry died out in your area? If so, why?
  - c. Has the disappearance of any local industry caused widespread unemployment? How has your community responded?
3. If your community or the nearby area has never had heavy industry, determine why not. What is the community’s economic base today? Is it stable? Ask students to present their findings in a written or oral report.



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## Lukens Steel:

### A Pennsylvania Steel Company

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### Supplementary Resources

By looking at *Lukens Steel: A Pennsylvania Steel Company*, students explore how Lukens functioned as a productive work unit and how work defined social relationships in this community. Those interested in learning more will find that the Internet offers a variety of interesting materials.

#### **Lukens National Historic District**

Lukens National Historic District is managed by the Graystone Society. Visit the [LNHD web site](#) to learn more about the district's history and visiting the site.

#### **National Park Service History**

Units of the National Park System include resources that are of such national significance as to justify special protection and recognition by various acts of the United States Congress. Lukens Steel is recognized as being of national significance under the theme of industry. Visit [this page](#) to understand why.

#### **Pennsylvania Historical and Museum Commission**

The [PHMC website](#) contains information on the role of the iron and steel industry in the history of the state and on Cornwall Furnace and the Scranton Iron Furnaces, historic sites administered by the Commission.

#### **American Iron and Steel Institute**

The Steel Learning Center has a useful section on [modern steelmaking technologies](#).

#### **Library of Congress**

Search the Library of Congress's [American Memory web site](#) for primary resources on iron making and early National period America.

#### **The Historic American Buildings Survey/Historic American Engineering Record Collection**

The [Historic American Buildings Survey/Historic American Engineering Record Collection](#) contains information, photographs, and drawings of historic iron making furnaces and other related installations across the country.

#### **For Further Reading**

Students and educators wishing to learn more about Lukens Steel and the Coatesville community may want to read: *Remarkable Past Promising Future* (The Graystone Society, 2010) or *Coatesville* by Bruce Mowday (Arcadia Publishing, 2005).