RADIAN CORPORATION

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# SCREENING STUDY ON

# FEASIBILITY OF STANDARDS OF PERFORMANCE

# FOR WOOD CHARCOAL MANUFACTURING

EPA Contract No. 68-02-2608

Task 32

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# SUMMARY

The primary technical objective of this wood charcoal screening study was to evaluate the feasibility and need for standards of performance for the wood charcoal manufacturing industry. Background information was developed on the production and environmental aspects of this industry to serve as a basis for this evaluation. These objectives were accomplished by completion of the following tasks:

1) industry characterization,
2) environmental characterization, and
3) feasibility of standards.

The wood charcoal manufacturing industry was characterized with regard to present production sites, industry growth projections, and the processes used to manufacture charcoal by destructive distillation of wood. The environmental aspects of the industry were next examined including applicable emission regulations, pollutant emissions, control systems, and sampling and analytical methods. Two well-controlled plants that use different types of processes were visited during the project. The feasibility of standards of performance was evaluated based on the availability of control technology and the impact of the application of control technology on the wood charcoal industry.

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# 1.0 EXECUTIVE SUMMARY

## 1.1 INTRODUCTION

Section 111(b) of the Clean Air Amendments of 1977 requires the Administrator of the United States Environmental Protection Agency (EPA) to set standards of performance for new sources which, in his judgement, cause or contribute significantly to air pollution which may reasonably be anticipated to endanger public health or welfare. This report is a screening study addressing the feasibility of development of new source performance standards for the wood charcoal manufacturing industry.

Wood charcoal manufacture has a long and interesting history in the United States. The industry began as a result of the demand for charcoal for pig iron and gun powder manufacture during the Colonial period. Wood charcoal production for metallurgical purposes peaked in the 1880's. By-product recovery of wood chemicals, primarily methanol and acetic acid for the synthetic organic chemicals industry, became important to the wood charcoal industry at the close of the nineteenth century. Demand for wood chemicals stimulated growth in the industry with the charcoal relegated to a by-product role until the mid-1920's when less expensive and more efficient chemical synthesis routes were commercialized. Charcoal production then slowly declined until all wood chemical plants had ceased

operation and wood charcoal again became the primary product. As a result of the demand for a smokeless recreational cooking fuel in the 1950's, charcoal production again increased. Today wood charcoal is used primarily as a recreational cooking fuel. The industry is a wood scavenger industry and almost any type and form of wood and bark can be used.[1,2]

## 1.2 SCOPE OF WORK

### 1.2.1 Objectives

For this program, Radian Corporation was contracted by the Office of Air Quality Planning and Standards (OAQPS) of the United States Environmental Protection Agency to perform a screening study of the wood charcoal manufacturing industry. The purpose of this screening study is to develop background information on the manufacture of wood charcoal and to advise on the feasibility of standards of performance for this industry. This screening study was organized into three tasks which are outlined below.

### 1.2.2 Task 1 - Industry Characterization

For this task, the wood charcoal manufacturing industry was characterized with regard to present production facilities, industry growth projections, and the process used to manufacture charcoal by destructive distillation of wood.

The primary sources of information were:

(1) EPA,

(2) EPA Regional Offices,

(3) state regulatory and forestry agencies,

(4) U.S. Forest Products Laboratory,

(5) Barbecue Industry Association,

(6) operating companies,

(7) equipment manufacturers, and

(8) literature searches.

The results of this task effort can be found in Section 2.0 and Appendices A and B.

### 1.2.3 Task 2 - Environmental Characterization

For this task, the wood charcoal manufacturing industry was characterized as to applicable emission regulations, pollutant emissions, control systems, and sampling and analytical methods. The information sources identified in Task 1 also provided information pertinent to Task 2. Section 3.0 and Appendices C and D present the results of this effort.

### 1.2.4 Task 3 - Feasibility of Standards

Processes and pollutants, for which standards of performance should be developed were recommended based on Tasks 1 and 2. The technological and economic factors associated with pursuing standards development are given in Section 4.0.

## 1.3 CONCLUSIONS

The following conclusions were ascertained from this screening study of the wood charcoal manufacturing industry.

- The wood charcoal industry is a scavenger industry that consumes wood wastes as a raw material. Other methods

such as conical burners or open burning that have historically been used for disposal of wood wastes are less environmentally acceptable.

- Particulates, hydrocarbons, and carbon monoxide are the primary pollutants emitted from wood charcoal plants.
- Emission data required for determination of accurate emission factors is very limited. Without such data it is difficult to evaluate the need for establishment of a New Source Performance Standard (NSPS).
- Control technology currently exists which can be applied to new wood charcoal plants to control hydrocarbons, carbon monoxide, and particulates. Based on a very preliminary examination, afterburners appear to be the most feasible control method.
- Two discrete processes exist in the industry: batch and continuous. They differ in raw materials, operating conditions, and application of emission controls. They should be considered separately if a NSPS is established.
- An indiscriminant NSPS may result in the demise of a large segment of the industry. Small batch plants already in existence probably will not be able to replace kilns or expand capacity due to capital expenditures and fuel costs associated with the application of control equipment. Some of these plants can be expected to cease operation as a result. Larger batch plants may or may not be able to economically justify replacement of kilns or expansion

of capacity if controls are required. The plants using continuous processes will not be economically impacted as greatly with the application of control technology. More than half of the raw charcoal currently produced in the U.S. comes from plants using batch processes, primarily Missouri kilns.

- Costs per unit of production for control of emissions from a wood charcoal plant are variable depending on the type of charcoal plant, the moisture content of the raw material used, the type of fuel used in the afterburner, climatic factors, and operating methodology. Reported control costs for Missouri kilns range from $4 to $43 per metric ton of raw charcoal. This cost represents from 7 to 71 percent of the selling price of the raw charcoal. Cost estimates for the control of Herreshoff furnaces were not available but the impact per unit of production should be less than for Missouri kilns. Auxiliary fuel for control systems on Herreshoff furnaces may be only required during start-up or upset conditions whereas auxiliary fuel may be required throughout the entire burn cycle for batch kilns.
- Raw wood charcoal is used primarily to manufacture charcoal briquettes for recreational cooking. The demand for raw charcoal in the briquetting industry is apparently not increasing due to the substitution of other carbonaceous material such as lignite.

## 2.0 INDUSTRY CHARACTERIZATION

The wood charcoal industry was characterized as to the processes used, present production facilities, and the growth projections for the industry. Each of these topics is discussed in the following sections.

### 2.1 PROCESS DESCRIPTIONS

Charcoal is the solid residue remaining following the pyrolysis (carbonization or destructive distillation) of carbon-containing materials. Raw materials can be almost any carbon-containing material of either plant, animal, or mineral origin. The principal commercial raw materials are medium to dense hardwoods such as beech, birch, hard maple, hickory, and oaks. Other raw materials include softwoods (primarily longleaf and slash pine), nutshells, fruit pits, coal, vegetable wastes, sawmill residues (sawdust, wood chips, bark), and papermill residues.[1]

This report examines only the production of raw charcoal from the destructive distillation of wood. Other raw materials as well as further processing techniques (briquetting, activation, etc.) are not discussed.

Charcoal is produced primarily for use as a recreational fuel. In some instances, its manufacture may be considered a solid waste disposal technique. As noted above, many of the wood materials used for charcoal manufacture are wastes with charcoal manufacture also used as an

outlet for disposal of forest management refuse. Charcoal manufacture has been responsible for the elimination of many teepee burners used for the disposal of wood waste in the lumber industry.

Two types of processes are used for charcoal production--batch and continuous.

### 2.1.1 Batch Process

Present day batch processes incorporate two types of charcoal kilns. The most widely used kiln is the Missouri type shown in Figure 2-1.

#### 2.1.1.1 Missouri-type Kiln

The Missouri-type kiln is usually constructed of concrete, typically processing 45 to 50 cords of wood per cycle. A cycle includes loading the kiln, carbonizing the wood, allowing the charcoal to cool, and unloading the kiln. Time requirements for each component of the cycle differ greatly from plant to plant; however, the overall time period involved in a normal cycle is about 10 to 25 days.[1,3]

Once the kiln has been loaded, easily combustible materials usually placed near the steel door at the bottom center of the kiln are ignited. To obtain the heat level required for pyrolysis the starting fuel needs to combust rapidly. This requires a large amount of air which is supplied through ground level ports in the side walls of the kiln or through temporary openings under the kiln doors. In some cases, the kiln doors and auxiliary ceiling ports remain open until the burn is adequately started. Once started, combustion air inflow is limited to prevent the complete burning of the wood to ashes.[1,3]

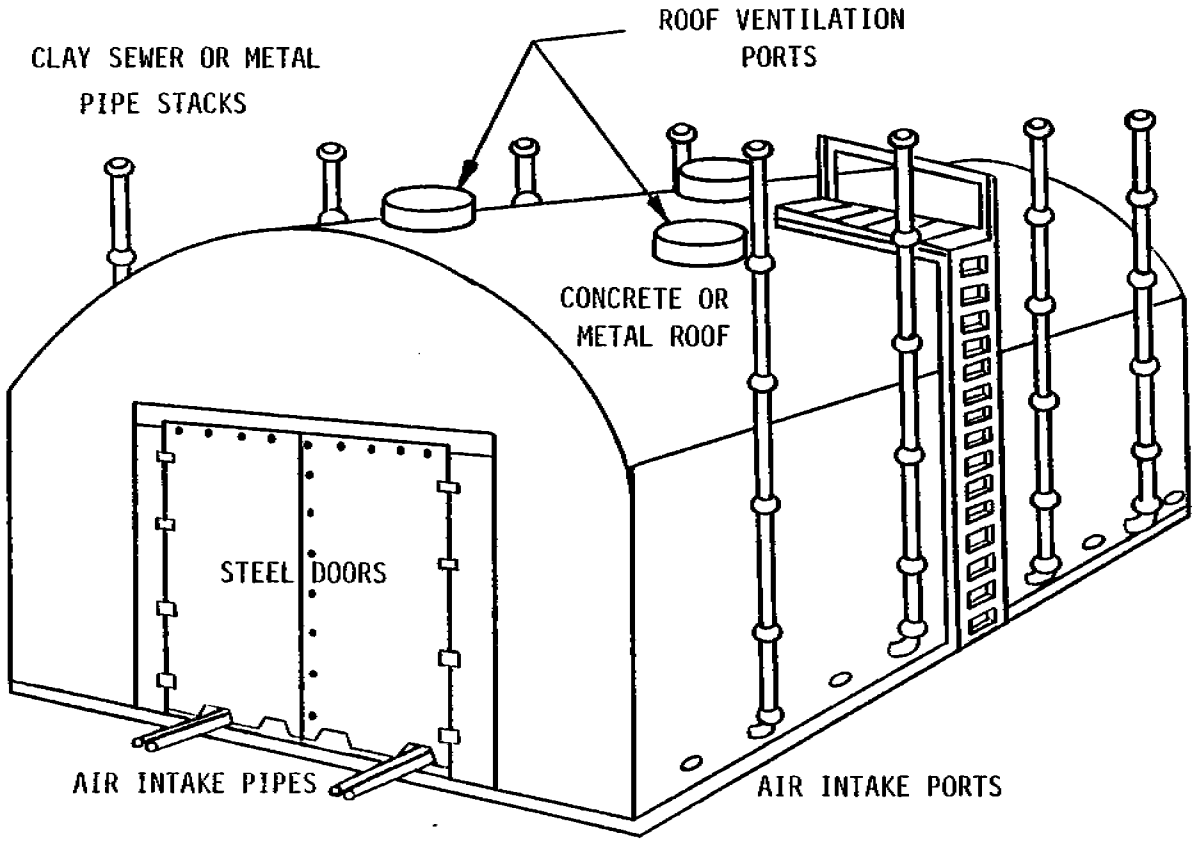


Figure 2-1. Typical Missouri-type charcoal kiln with multiple exhaust stacks.

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Maintaining proper burning conditions in the pyrolysis zone is the primary requirement for satisfactory carbonization. Sufficient heat must be generated to first dry the wood and then to maintain temperatures necessary for efficient carbonization. Combustion of a part of the wood volatiles generates the heat to sustain the carbonization process. By varying the size of the air port openings providing air for the combustion of these wood volatiles, control of the kiln temperature is achieved. Kiln temperatures of from about 450°C to 510°C (840°F to 950°F) are required for the production of good quality charcoal. Prolonged higher temperatures will reduce the yield of charcoal without necessarily upgrading it for recreational use. Also, if pyrolysis temperatures remain low the charcoal produced will contain larger than normal amounts of partially charred wood known as brands.[1,3]

The direction and spreading rate of the pyrolysis zone depends upon a number of factors including wood size and moisture content, piling of the charge, volume and velocity of the incoming air, and location of air ports and stacks as well as other kiln design factors. Pyrolysis generally proceeds at a faster rate at the upper part of the charge, where higher temperatures are available for longer periods of time. Less rapid pyrolysis takes place near the kiln floor, where the average temperature is usually the lowest. Carbonization progresses simultaneously from the top of the wood in the kiln to the floor, from the center to the walls, and from the front of the kiln to the back. Burn progression can be determined by the color of the smoke from the kiln, by the temperature along a vertical distance of the steel doors, or by visual inspection of

the charge through the ground-level air ports. The carbonization process is completed when the fire has reached the floor of the kiln as determined from visual inspection of the charge through the ground-level air ports. Process completion may also be indicated by a marked decrease in the volume of smoke and a color change from grayish yellow to bluish white. When the burn is complete all air ports are sealed. The stacks remain open until smoking has practically ceased to prevent the development of gas pressure in the kiln. Once the kiln is completely sealed, the charcoal is allowed to cool before being removed from the kiln. Yields of approximately 25 percent on a bone-dry wood basis are usually achieved.[1,3]

Missouri-type kilns typically have eight exhaust stacks along the side walls of the kiln. Other types of kilns have various numbers of exhausts. Burn time and emissions vary with kiln type and capacity, kiln operation, and wood species and moisture content.[1]

2.1.1.2 Beehive Kiln

The second type of charcoal kiln used presently is the beehive kiln, which is shown in Figure 2-2. This kiln is usually constructed of concrete and consists of a cylindrical wall with a dome-shaped ceiling. The kiln structure includes ground-level air and mid-level exhaust ports located around the periphery of the wall, a steel door in the side of the wall for loading and unloading, and an opening in the dome-shaped ceiling for loading and firing. Behive kilns typically process 50 to 90 cords of wood per cycle. The time period involved in a normal cycle is about 10 to 20 days. Once the kiln has been loaded, a 0.6 to 0.9 meter ( 2 to 3 foot) central core in the charge is filled with small and short length fuel almost to dome height for charge ignition.[4]

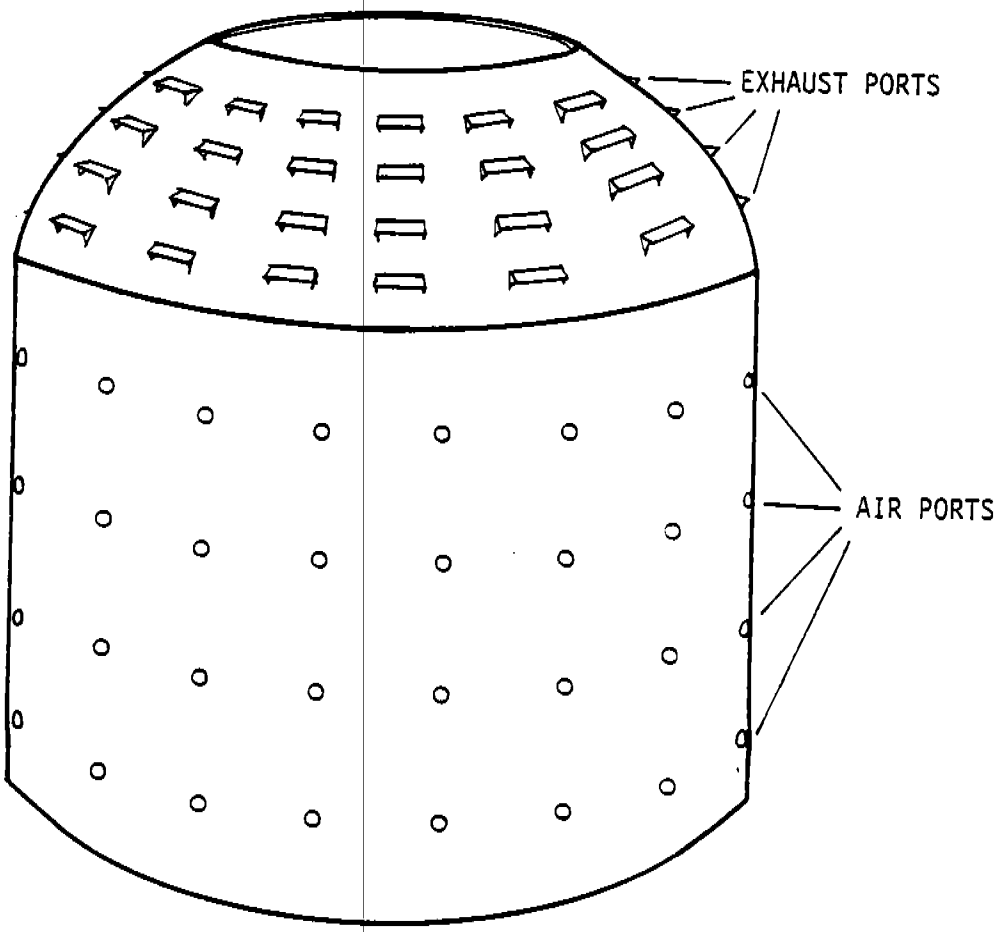


Figure 2-2. Typical Beehive Kiln.

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After ignition is well underway, the top is tightly closed and the bottom door made airtight. Inlet and exhaust ports must be skillfully operated to assure uniform coaling of the wood. Yields of approximately 25 percent on a seasoned (air-dry) wood basis are usually achieved.[4]

### 2.1.2 Continuous Process

One major type of continuous process is presently used--the Herreshoff multiple hearth furnace. An increasing percentage of charcoal is produced by multiple hearth furnaces. Advantages of multiple hearth furnaces include:

- Consistent yield and quality charcoal with control of product volatile and fixed carbon content,
- Feed of multiple forms of wood waste (sawdust, wood chips, bark, etc.),
- Operation by "art" reduced to a minimum, and
- Off-gases easily collected for further processing or usage.[1]

The Herreshoff multiple hearth furnace consists of several hearths or burning chambers stacked one on top of the other as shown in Figures 2-3 and 2-4. The number of hearths employed depends upon the process and the heat load. The hearths are contained in a cylindrical, steel, refractory-lined shell and are divided by refractory decks which function as the floor of one hearth and the roof of the hearth below. Passing up through the center of the furnace is a shaft to which two or four rabble arms per hearth are attached.[1]

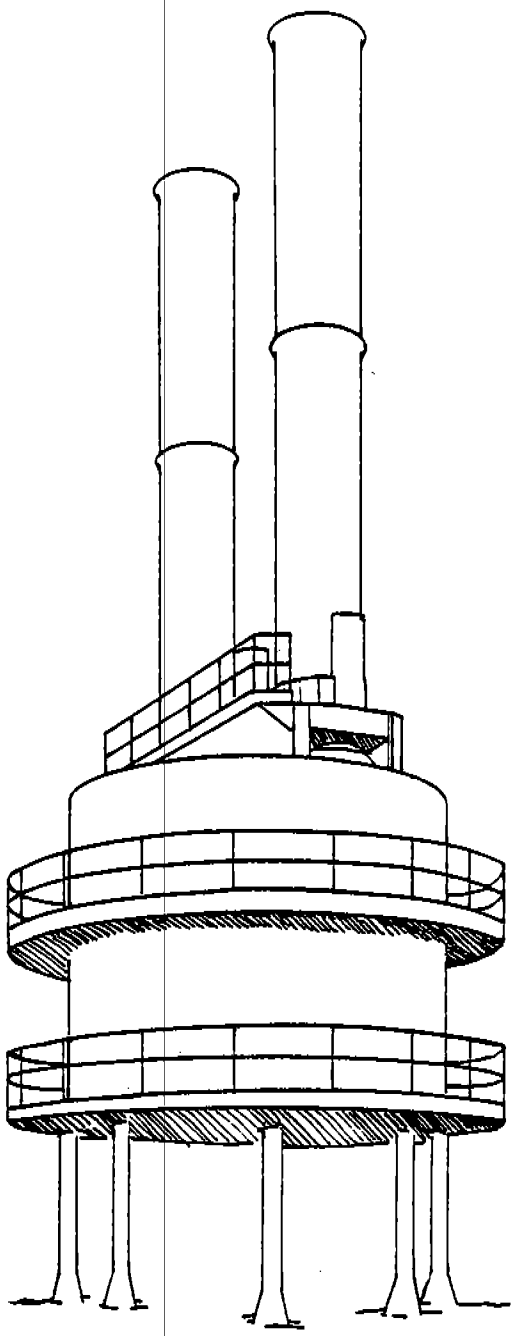

Figure 2-3. Exterior View of a Herreshoff Multiple Hearth Furnace.

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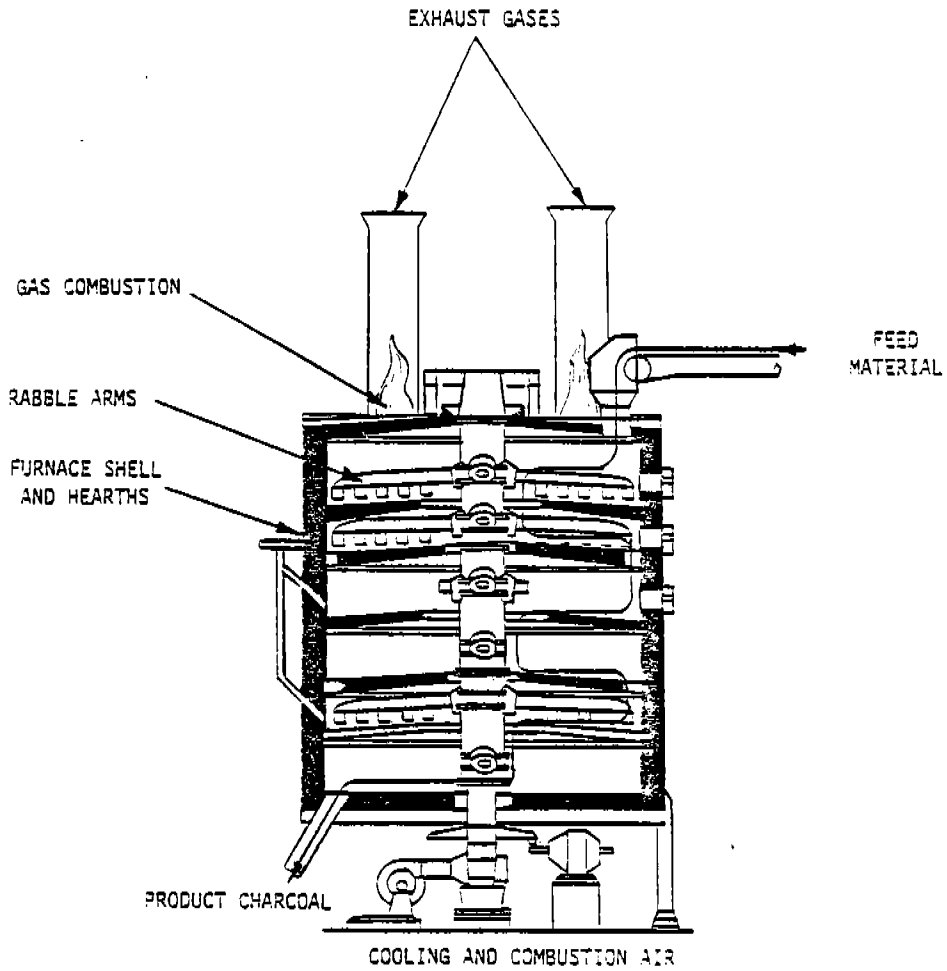


Figure 2-4. Cross Sectional View of a Herreshoff Multiple Hearth Furnace.

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As the shaft turns (usually 1 rpm to 2 rpm), the hogged (chipped) material resting on the hearth floors is continually agitated, exposing fresh material to the hot gases being evolved. Another function of the rabble arms is to move material through the furnace. On alternate hearths the teeth are canted to spiral the material from the shaft toward the outside wall of the furnace or from the outside wall toward the center shaft. Around the center shaft is an annular space through which material drops on alternate hearths, while on the remaining hearths material drops through holes in the outer periphery of the hearth floor. In this way, material fed at the top of the furnace moves alternately across the hearths at increasing temperatures until it discharges from the floor of the bottom hearth.[1]

Initial heat for start up is provided by oil- or gas-fired burners mounted in the sides of the hearths. When furnace operating temperature has been attained, the auxiliary fuel ceases, and combustion air is used to ignite a portion of the evolving wood gases to maintain the proper operating temperature. All off-gases exit from the top hearth. These gases may be flared directly to the atmosphere through stacks located on top of the furnace, or they may be further processed to use the available heat for predrying the incoming feed material, drying briquettes produced at an adjacent briquetting plant, or for producing steam in an adjacent waste heat steam boiler.[1]

Charcoal exiting from the furnace is usually cooled by water sprays. These sprays can be controlled automatically by a temperature regulator set for a given charcoal temperature.[1]

The furnace can operate with any wood or wood waste or combination of wastes, but it is important that the feed material does not have too great a size range so that carbonization will be even throughout. Conversion efficiency is about 25 percent on a dry wood basis.[2]

Multiple hearth furnaces require a large and steady source of raw materials. This criteria limits its use to areas where many small or fewer large sawmills and other wood waste producers are located. This criteria also eliminates the chance of replacing all batch-type processes with multiple hearth furnaces since most batch-type plants as well as their raw material sources are located in isolated areas.

## 2.2 PRODUCTION FACILITIES

A table of all known wood charcoal manufacturers located in the continental United States appears in Appendix A. Some plants that are listed in earlier reports do not appear in Appendix A for various reasons. Plants going out of business and the fact that this report dealt with only those plants which produce raw charcoal from some form of wood, account for this discrepancy. In California, for example, a large continuous-type process exists; however, the raw materials used are fruit pits and other agricultural wastes. Another example is North Dakota, where the raw material used in charcoal production is lignite coal. Again, this report dealt only with raw charcoal production from some form of wood.

Both production and capacity information for any plant was not available. A total minimum capacity for the continental United States was calculated in the following manner. For the plants in which the capacity was given as a range (e.g. 450 to 910 metric tons/yr) the lower

numbers of the ranges were summed. To this value, the capacities of the plants having single-valued capacity information were summed. Summed also was the total production of all the plants which had only production data. The resulting value for the total estimated minimum capacity for the continental United States is 418 gigagrams/yr (461,000 tons/yr).

An estimate of the current total production and capacity was desired. To obtain these numbers, the use of a utilization factor was required. Utilization factor as used in this report was defined as the ratio of the production of raw charcoal at a given plant to that plant's capacity. The utilization factor used for batch-type processes was 0.5. A utilization factor of 0.7 was used for continuous-type processes. A sound data base for arriving at these values was non-existent. Instead, limited individual plant information, information found in the literature, and engineering judgement were the bases for these utilization factors; therefore, the numbers generated using these factors are very rough estimations and should be treated as such. If capacity information was known for a plant, the capacity number was multiplied by its utilization factor to obtain an estimated production number. If production information was known for a plant, the utilization factor was divided into this known production number to obtain an estimated capacity.

In some instances the actual annual production or capacity numbers for a plant were not directly available from any source. For example, information such as the number and size of kilns at a particular plant or the hourly input rate of raw material to a Herreshoff furnace may have been the only information available. In these cases, only the plant

capacity was estimated using the assumptions given for batch-type processes below. Certain assumptions about the raw material as well as the process had to be made in order to estimate production. The assumptions were based upon actual data when available; however, when actual data were not available, information collected in the literature survey and engineering judgement were substituted as the bases for these assumptions. The assumptions made regarding the raw material are as follows:[1]

1) All raw material was some form of wood (logs, sawdust, wood chips, bark, etc.).
2) All wood used in raw charcoal manufacture contained 50% moisture as-is. For example, 100 kilograms (220 pounds) of wood as-is contained 50 kilograms (110 pounds) of bone-dry wood and 50 kilograms (110 pounds) of water.
3) The conversion of bone-dry wood to raw charcoal was 25%, i.e., for every 100 kilograms (220 pounds) of bone-dry wood fed to the process, 25 kilograms (55 pounds) of raw charcoal was produced.

Based on these assumptions, 12.5 kilograms (27.6 pounds) of raw charcoal are obtainable from 100 kilograms (220 pounds) of wood as-is. The following assumptions were made concerning batch-type processes:[1,3,5]

1) One cord of wood as-is had a mass of 1.81 megagrams (4000 pounds).
2) Each on-site kiln completed 27 cycles per year.

Using these assumptions, a plant with twelve 50-cord kilns would have an estimated capacity of 3.67 gigagrams/yr (4040 tons/yr) (27 cycles/yr x 50 cord/kiln/cycle x 1.81 megagrams/cord x 12 kilns x 0.5 kilograms bone-dry wood/kilogram wood as-is x 0.25 kilograms raw charcoal/kilogram bone-dry wood = 3.67 gigagrams/yr). The following assumptions were made concerning continuous processes:[1,6]

1) Such processes were operated 24 hours per day, 330 days per year.
2) No pretreatment of raw materials (e.g., predrying) was involved in the processes.

Using these assumptions, a continuous-type plant in which 5 megagrams/hr (5.5 tons/hr) of raw material were processed would have a capacity of 4.95 gigagrams/yr (5450 tons/yr) raw charcoal (5 megagrams/hr x 24 hr/day x 330 days/yr x 0.5 kilograms bone-dry wood/kilogram wood as-is x 0.25 kilograms raw charcoal/kilogram bone-dry wood = 4.95 gigagrams/yr).

Using these estimated capacities and the above mentioned utilization factors, values for the production from each type plant were calculated. Again, due to the lack of sufficient reliable data, all numbers generated by these estimating techniques should be interpreted as what they are--rough estimates only. The following capacity and production numbers resulted from the use of the estimating techniques mentioned above:

| | Capacity, | | Production, | |
|---|---|---|---|---|
| | gigagrams/yr | tons/yr | gigagrams/yr | tons/yr |
| All Missouri-type kilns: | 379 | 418,000 | 198 | 218,000 |
| All Beehive-type kilns: | 6 | 7,000 | 3 | 3,000 |
| All Continuous-type processes: | 235 | 259,000 | 175 | 193,000 |
| Totals for Missouri state: | 250 | 275,000 | 125 | 138,000 |
| Totals for Continental United States: | 620 | 683,000 | 376 | 414,000 |

Based upon these numbers, the minimum total capacity for the continental United States, 418 gigagrams/yr (461,000 tons/yr) appears to be reasonable. Once again, the technique used in arriving at these values should be kept in mind when using these capacity and production figures.

## 2.3 INDUSTRY PROJECTIONS

The outlook for the wood charcoal industry is highly variable, depending on future actions taken by the Environmental Protection Agency and on the regional availability of raw materials. If the EPA requires states to strictly enforce existing laws or if they establish a NSPS requiring afterburners for all new sources, all but large or ideally planned plants will be forced to close for financial reasons.[5,7] Residues from the lumber industry are currently the primary raw materials for wood charcoal manufacturing. Because of the increasing costs of purchased energy, however, there is a growing trend for the lumber industry and other industries to consume wood residues as an energy source.[8]

Although still plentiful in the South, wood residues for charcoal manufacturing are becoming scarce in the Northern states.

Wood charcoal production grew rapidly in the 1950's and 1960's due to the increasing popularity of outdoor recreational cooking. Today, nearly all wood charcoal is used to manufacture charcoal briquettes.[2] Statistical information of the production of wood charcoal in the 1970's is unavailable. Data on the production of charcoal briquettes, however, indicates continual growth in this industry. The briquette industry is expected to grow over the next five years at an annual rate of about 4 percent.[1] This is no indication, however, of a similar growth in the wood charcoal portion of the industry. Several briquette manufacturers use other carbonaceous materials, such as coal or lignite, in the formulation of their briquettes.[7] It seems reasonable to believe that use of these other materials will increase if problems develop with the availability or cost of production of wood charcoal.

A survey of the states (see Appendix B) indicates a general trend toward fewer but larger plants. None of the states predict the construction of new plants over the next five years. Overall levels of wood charcoal production appear to have remained fairly stable and there is no indication of future growth. In Missouri, for example, the number of wood charcoal plants dropped from 84 to 55 between 1964 and 1973. The total number of kilns dropped from 562 to 544. Production levels, however, stayed about the same. Several existing plants expanded and many kilns were replaced with larger kilns.[9] Since 1973, the Missouri industry has remained fairly unchanged, although levels of production have fluctuated from year to year.[10]

State air pollution regulations have taken a toll on many small charcoal plants with batch kilns. Plants and individual kilns in Florida, Illinois, Ohio, Oklahoma, and possibly other states have been forced to close down because of noncompliance. Two plants in Arkansas and one in Texas closed down recently after trying to operate with installed control devices. A few other plants are in the tenuous position of continuing to operate either marginally or completely out of compliance. Indeed, depending on the interpretation of Missouri state law, all charcoal plants in Missouri may currently be operating out of compliance.

A New Source Performance Standard requiring afterburners for all kilns may prohibit small plants from expanding or replacing deteriorated kilns. A Missouri-type kiln has an average life of 15 years. Over the next five years, roughly 1/3 of all Missouri-type kilns will have to be replaced. The typical plant in Missouri, for example, has 15 kilns. To continue current levels of production, the plant must build an average of one new kiln per year. The cost of afterburner installation is prohibitive except for large plants or plants with kilns constructed closely together on level land. Most plants in Missouri will be unable to afford afterburners.[7] Moreover, afterburners for batch-type kilns require supplementary fuel. If costs of fuel increase appreciably over the next few years, even batch-type plants with existing afterburner systems may be forced to close.

To illustrate the problem, plants in Missouri will have to replace kilns within the next two years.[7] Over the last two years Missouri has required controls for all new kilns. During this period, they received permit requests for the construction of about 40 new kilns. All requests

were denied because of the lack of controls. None of the plants have refiled requests with plans for emission control.[11]

The fate of large plants with Herreshoff-type furnaces has been quite different. These plants do not appear to have significant problems conforming to state regulations. Only one has been forced to close: Husky in Memphis, Tennessee, which closed in November 1976, because they lost their source of raw materials. Any loss in production from the small batch-type plants has probably been compensated by growth in production from the large continuous plants. This growth cannot be quantified, however, since most plants consider production data to be proprietary.

No new Herreshoff furnaces have been constructed for wood charcoal since 1969.[12,13] Kingsford probably constructed the most recent furnace in Dothan, Alabama, in 1972, by modifying used equipment from other industries.[6] Although no additional furnaces are planned for construction in the next five years, several plants have the capacity to double or triple production by adding predryers. A predryer was added last year at the Georgia-Pacific plant in Medford, Oregon. Addition of a predryer may be construed as being a significant modification within the meaning of the Clean Air Act. Any such plant should have little or no problem conforming to a NSPS, since a predryer can be constructed as an integral part of an efficient emission control system.

The availability of raw materials is the main physical limiting factor for growth in the wood charcoal industry. Most of the industry is dependent on wood residues from the lumber and associated wood industries. Even the kilns in Missouri, which were once primarily fueled with round wood, have become increasingly dependent on slab wood from the saw

mills: labor needed to collect round wood in the Missouri woods has become difficult to find.[9,10]

The availability of raw materials varies regionally. In general, wood residues have become more plentiful since the passage of regulations prohibiting open burning by the wood industries. The wood charcoal industry provides an acceptable route for the disposal of solid wood wastes.[6,7] However, only the residues remaining after needs for pulp, particle board, and energy production are satisfied are available for the charcoal industry. Increases in the cost of purchased energy have led to a recent trend in the wood industries to attain energy self-sufficiency by combusting their own residues.[a] Last winter wood residues became scarce in the North. The charcoal industry had to compete with other industries that were willing to travel long distances to gather wood residues for fuel.[8] In the South, however, a surplus of wood residues is still available for the charcoal industry, enough to allow for a growth in production. This surplus may disappear, though, if the rising costs of energy further increase the value of burning wood residues as an energy source.

[a]Furthermore, it is more energy efficient to combust wood directly than to first convert it to char. Charcoal production is only 30 to 40 percent energy efficient. With the added energy requirements for charcoal briquetting, the finished product may represent a net energy deficit.[8]

# 3.0 ENVIRONMENTAL CHARACTERIZATION

## 3.1 EMISSIONS

Determination of actual emissions from both batch- and continuous-type processes has been a major problem to date. No reliable emissions sampling data are available for either process. Most reported emissions have been based upon published emission factors. These emission factors, in turn, have been based upon experimental lab work and/or data obtained from charcoal plants which were operated primarily for the recovery of wood chemicals, with charcoal production being of secondary interest. In modern plants a portion of the wood chemicals is combusted within the retort (furnace or kiln). Therefore, calculations based on published emission factors do not accurately represent the emissions of modern-day kiln and furnace operations. The extent to which the wood chemicals are naturally combusted in the retort is not known. A greater proportion of the wood chemicals is probably combusted in a Herreshoff furnace than in a Missouri- or beehive-type kiln because of the following reasons:

1) A constant high temperature is maintained in a Herreshoff furnace, promoting the combustion of organics and CO. In a kiln operation, the temperature varies throughout the burn cycle.

2) A high concentration of organics and CO is maintained in a Herreshoff furnace, thus promoting combustion. In a kiln, the concentration of organics and CO varies greatly throughout the burn cycle.

Emission factors from AP-42 are presented in Table 3-1. These factors have been assigned a confidence rating of "C" or poor.[14] A range of published emission factors is hard to represent. Each table of emission factors groups the emissions into different categories. A range of factors would, therefore, be misleading. None of the emission factors account for the proportion of organics that are combusted within the retort. As a result, they are all too high. For this reason, national emission levels were not calculated. Such calculations would only compound the inaccuracy of the emission factors.

Material balances are provided below for uncontrolled batch-type and continuous-type processes. Calculations for the material balances are based on emission estimates used for the design of an afterburner for the Husky, Inc. plant in Hixton, Wisconsin.[15] The following general categories are considered:

1) Charcoal
2) Tar: Heavyweight condensables such as heavy oils and other heavy hydrocarbons.
3) Pyro-Acids: Primarily acetic acid and methanol; also includes other lightweight hydrocarbons.

4) Water: Water evaporated from the wood and water generated from the decomposition of wood.

5) Non-condensable Gas: $CO_2$, CO, $CH_4$, $C_2H_6$

Table 3-1. EMISSION FACTORS FOR CHARCOAL MANUFACTURING[c]
EMISSION FACTOR RATING: C

| Pollutant | Type of operation | | | |
|---|---|---|---|---|
| | With chemical recovery plant | | Without chemical recovery plant | |
| | lb/ton | kg/MT | lb/ton | kg/MT |
| Particulate (tar, oil) | - | - | 400 | 200 |
| Carbon monoxide | 320[a] | 160[a] | 320[a] | 160[a] |
| Hydrocarbons[b] | 100[a] | 50[a] | 100[a] | 50[a] |
| Crude methanol | - | - | 152 | 76 |
| Acetic acid | - | - | 232 | 116 |
| Other gases (HCHO, $N_2$, NO) | 60 | 30 | 60[a] | 30[a] |

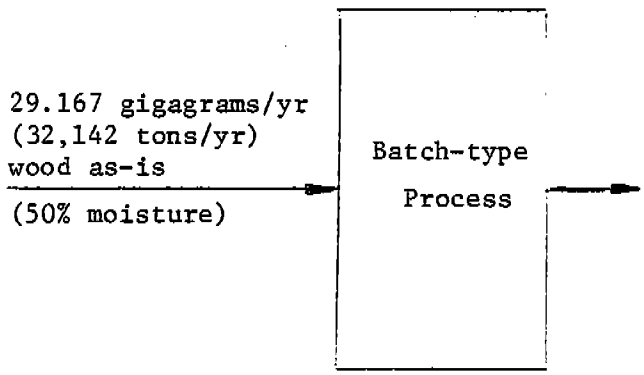
[a]Emissions are negligible if afterburner is used.

[b]Expressed as methane.

[c]Emission factors expressed in units of tons of charcoal produced.

Source: 14

The following material balance for a batch-type process is based upon on annual production of 3.5 gigagrams/yr (3,857 tons/yr) raw charcoal:




$CO_2$: 1.907 gigagrams/yr (2,102 tons/yr)

CO: 0.627 gigagrams/yr (691 tons/yr)

$CH_4$: 0.201 gigagrams/yr (222 tons/yr)

$C_2H_6$: 0.109 gigagrams/yr (120 tons/yr)

Pyro-Acids: 0.693 gigagrams/yr (764 tons/yr)

Tars: 0.729 gigagrams/yr (803 tons/yr)

Water:

1) Decomposition:

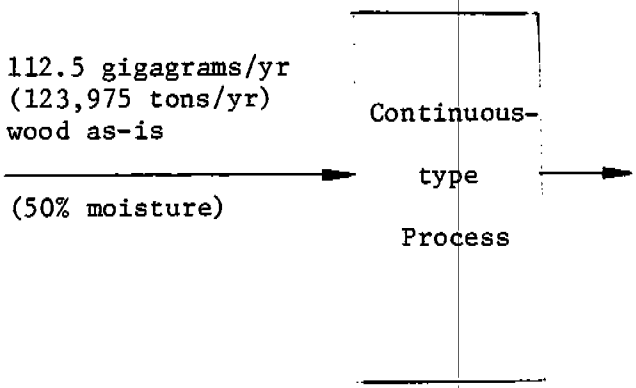
6.818 gigagrams/yr (7,513 tons/yr)

2) Evaporation:

14.583 gigagrams/yr (16,070 tons/yr)

Charcoal: 3.5 gigagrams/yr (3,857 tons/yr)

The following material balance for a continuous-type process is based upon an annual production of 13.5 gigagrams/yr (14,877 tons/yr) raw charcoal:




| | |
|---|---|
| $CO_2$: | 7.355 gigagrams/yr (8,105 tons/yr) |
| CO: | 2.419 gigagrams/yr (2,666 tons/yr) |
| $CH_4$: | 0.773 gigagrams/yr (852 tons/yr) |
| $C_2H_6$: | 0.422 gigagrams/yr (465 tons/yr) |
| Pyro-Acids: | 2.672 gigagrams/yr (2,945 tons/yr) |
| Tars: | 2.813 gigagrams/yr (3,100 tons/yr) |
| Water: | |
| 1) Decomposition: | 26.296 gigagrams/yr (28,978 tons/yr) |
| 2) Evaporation: | 56.250 gigagrams/yr (61,987 tons/yr) |
| Charcoal: | 13.5 gigagrams/yr (14,877 tons/yr) |

The production rates used above are not meant to depict typical plant operations. Again, the emission estimates do not account for combustion within the retort. The extent to which organics and CO are naturally

combusted before leaving the retort varies from plant to plant. Uncombusted tars may solidify to form particulate emissions, whereas uncombusted pyro-acids may form aerosol emissions.

Continuous processes may have another major source of particulate emissions. Many Herreshoff furnaces produce a very fine char from saw dust or other materials. The hot gases rising up through the furnace can pick up the fine char and carry it out the stack. The carry-over is significant enough in at least some plants to justify cyclones to recover the char for the product stream.

## 3.2 REGULATIONS

Most states have regulations applicable to particulate and visible smoke emissions from charcoal plants. A typical strict regulation for particulates is based on the following process weight rate formulas:

$$E = 3.59P^{0.62} \text{ for } P \leq 30 \text{ tons/hr}$$

$$E = 17.31P^{0.16} \text{ for } P > 30 \text{ tons/hr}$$

E is the allowable emission rate expressed in pounds of particulates per hour, and P is the process weight rate expressed in tons of raw material consumed per hour of process time. A strict regulation for visible emissions prohibits emissions darker than No. 1 on the Ringelmann chart or denser than 20% opacity. One state, Virginia, specifically requires complete combustion of all gases from a charcoal kiln. A few states also have CO regulations applicable to the wood charcoal industry. These regulations generally require complete secondary combustion.

State enforcement policies are variable. Most particulate regulations are unenforceable because of technical problems in measuring emissions from charcoal kilns and furnaces. Only the visibility regulations, therefore, are enforced by most states. Some states, however, enforce visibility regulations only when complaints are filed. An extreme case is represented by the state of Missouri, which completely exempts Missouri-type kilns from all visibility regulations. This inequity in enforcement policies and regulations has created a condition which permits the operation of a plant in one state while forcing the closure of a similar plant in a neighboring state.

A list of regulations from all of the states and Washington D.C. is included in Appendix C. Most of the particulate regulations are in the form of a process weight rate formula or table. A comparison of these regulations is provided in Table 3-2. The regulations are arranged in order based on allowable emissions for a process weight rate of 60,000 lbs/hr (30 tons/hr), a typical process weight rate for a Herreshoff-type furnace. The most severe regulations, listed as "a", "b", and "c" in Table C-1, apply to only one state each. The regulation "a" applies to all sources in West Virginia, "b" applies to new sources in Illinois, and "c" applies to new sources plus all sources in critical areas in Massachusetts. Regulation "d", although still strict, is much more common. It applies to new and/or existing sources in 11 different states.

Particulate regulations for several states are listed as solids loading limitations. They range from 0.02 grains/scf of dry exhaust gas in New Jersey and Kentucky to 0.3 grains/scf in Minnesota and Missouri.

Table 3-2. COMPARISON OF STATE PARTICULATE EMISSION REGULATIONS

| Process weight rate | Allowable particle emission rates | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | a | b | c | d | e | f | g | h | i |
| 100 | 0 | 0.55 | 0.28 | 0.55 | 0.50 | 0.46 | 0.55 | 0.55 | 0.68 |
| 1,000 | 0.1 | 1.75 | 1.29 | 2.25 | 2.30 | 2.80 | 2.58 | 2.58 | 3.17 |
| 5,000 | 0.8 | 4.14 | 3.79 | 6.34 | 6.70 | 6.67 | 7.58 | 7.58 | 9.35 |
| 10,000 | 1.8 | 6.00 | 6.0 | 9.73 | 10.80 | 10.00 | 12.0 | 12.0 | 14.85 |
| 20,000 | 4.0 | 8.70 | 9.6 | 14.99 | 17.4 | 16.19 | 19.2 | 19.2 | 23.62 |
| 60,000 | 12.6 | 15.60 | 20.0 | 29.60 | 36.1 | 40.0 | 40.0 | 40.0 | 49.31 |
| 80,000 | 16.9 | 18.20 | 21.2 | 31.19 | 43.7 | 40.0 | 42.5 | 48.4 | 51.03 |
| 100,000 | 21.2 | 20.50 | 22.3 | 32.37 | 50.0 | 40.0 | 44.6 | 56.4 | 53.49 |
| 120,000 | 21.2 | 22.61 | 23.2 | 33.28 | 51.7 | 40.0 | 46.3 | 63.5 | 55.55 |
| 160,000 | 21.2 | 26.37 | 24.5 | 34.85 | 54.1 | 40.0 | 49.0 | 77.0 | 58.88 |
| 200,000 | 21.2 | 29.50 | 25.6 | 36.11 | 56.1 | 40.0 | 51.2 | 89.7 | 61.53 |

[a] Table C-3

[b] $E = 2.54P^{0.534}$ for $P \leq 250$ tons/hr

[c] $E = 2.05P^{0.67}$ for $P \leq 30$ tons/hr; $E = 27.5P^{0.11}-20$ for $P > 30$ tons/hr

[d] $E = 3.59P^{0.62}$ for $P \leq 30$ tons/hr; $E = 17.31P^{0.16}$ for $P > 30$ tons/hr

[e] $E = 3.76P^{0.665}$ for $P \leq 50$ tons/hr; $E = 72.7P^{0.082}-50$ for $P > 50$ tons/hr

[f] Table C-2

[g] $E = 4.10P^{0.67}$ for $P \leq 30$ tons/hr; $E = 55.0P^{0.11}-40$ for $P > 30$ tons/hr

[h] $E = 4.10P^{0.67}$ for all sources

[i] $E = 5.05P^{0.67}$ for $P \leq 30$ tons/hr; $E = 66.0P^{0.11}-48$ for $P > 30$ tons/hr

Visible emission regulations in 24 states prohibit emissions darker than No. 1 on the Ringelmann chart or denser than 20 percent opacity during normal operation. Only the regulation in Washington D.C. is stricter, prohibiting all visible emissions during normal operation. Most states permit periods of deviation during start-up, cleaning, or malfunction. The strict regulations in Connecticut, West Virginia, and Wyoming prohibit emissions darker than No. 2 on the Ringelmann scale or denser than 40 percent opacity for deviation periods accumulating to no more than 2-6 minutes per hour. Deviation periods are further limited to 12 minutes per day in West Virginia.

A few additional regulations are mentioned in the footnotes to Table C-1 in Appendix C. Arizona, Ohio, and Wisconsin have CO regulations applicable to the wood charcoal industry. They generally require complete secondary combustion. New York state law also has regulations specifically limiting the emission of aerosols (liquid particulates). The law requires 70-99.9 percent efficient control depending on the environmental rating and the emission potential of the source.

## 3.3 EMISSION CONTROL METHODS

Various conventional emission control methods such as wet scrubbing, electrostatic precipitation, gas condensation, and incineration may be considered for application to wood charcoal plants. Except for incineration, however, the above methods do not control noncondensable air pollutants such as CO.[1,3,7,16] Furthermore, recovered pollutants may create a disposal problem such as the waste water from a wet scrubber.[1] As a

consequence of the above, incineration with an afterburner is the only control method that will be discussed further.

The undesirable gases from a wood charcoal plant consist largely of the noncondensable gases CO, $CH_4$, $C_2H_6$ and condensable hydrocarbons referred to as tar and tar acid. With the continuous Herreshoff furnaces, the particulate matter is most likely a combination of carbon fines and the droplets or particles of heavy hydrocarbons which have condensed or solidified with cooling. With the batch type kilns, particulates should be limited to the condensable hydrocarbons or tars. Since the vast majority of batch type kilns are the "Missouri type", control of the "Missouri type" kiln will be emphasized in the discussion of batch processes.

### 3.3.1 Control of Batch Processes

Control of emissions from batch charcoal kilns is difficult due to the cyclic nature of the process and, as a result, the cyclic nature of the emissions. During the carbonization cycle, both the emission composition and the rate change as discussed previously in Section 3.1. Typically, emission rates peak early in the cycle at an actual flow rate over 40 percent greater than the actual flow rate near the end of the cycle.[1] Variations in the type of feed material, the moisture content of the feed material, and in operating practice also influence emission composition and rate.

A direct fired afterburner capable of incinerating the kiln off gases and condensables by subjecting them to direct flame contact for a sufficient time and at a sufficient temperature, is the most feasible control method for a Missouri kiln. Destruction of most hydrocarbons occurs very

rapidly at temperatures in excess of 650°C (1200°F). However, afterburner temperatures of about 750°C (1400°F) with a residence time of .2 to .4 seconds may be required to achieve complete oxidation of carbon monoxide.[17]

This type of afterburner system has been successfully used on charcoal kilns and is in wide use for industrial and commercial applications such as flue-fed refuse incinerators, paint baking ovens, rendering cookers, meat smokehouses, and asphalt blowing stills.[3] A schematic of a direct-fired afterburner is shown in Figure 3-1.

Husky Industries has applied direct-fired afterburners on kilns in Wisconsin and Minnesota. The Wisconsin plant is described in a trip report presented in Appendix D. Each afterburner which services two kilns is fired directly with natural gas or fuel oil. A temperature of about 650°C (1200°F) is maintained in the afterburner throughout the kiln burn by automatic controls which cycle the fuel fed to the afterburner on and off. The afterburner is then shut down as soon as the burn is complete.

The design and operation of the Missouri kiln previously described in Section 2.2.1 must be modified to accomodate application of afterburners. The primary design modification is the conversion from multiple exhaust pipes (see Figure 2-1) to one large exhaust manifold at the back of the kilns as shown in Figure 3-2. The ground level air intake ports still provide the oxygen required to carbonize the wood. Visual observations through these ports also become the primary method for following the

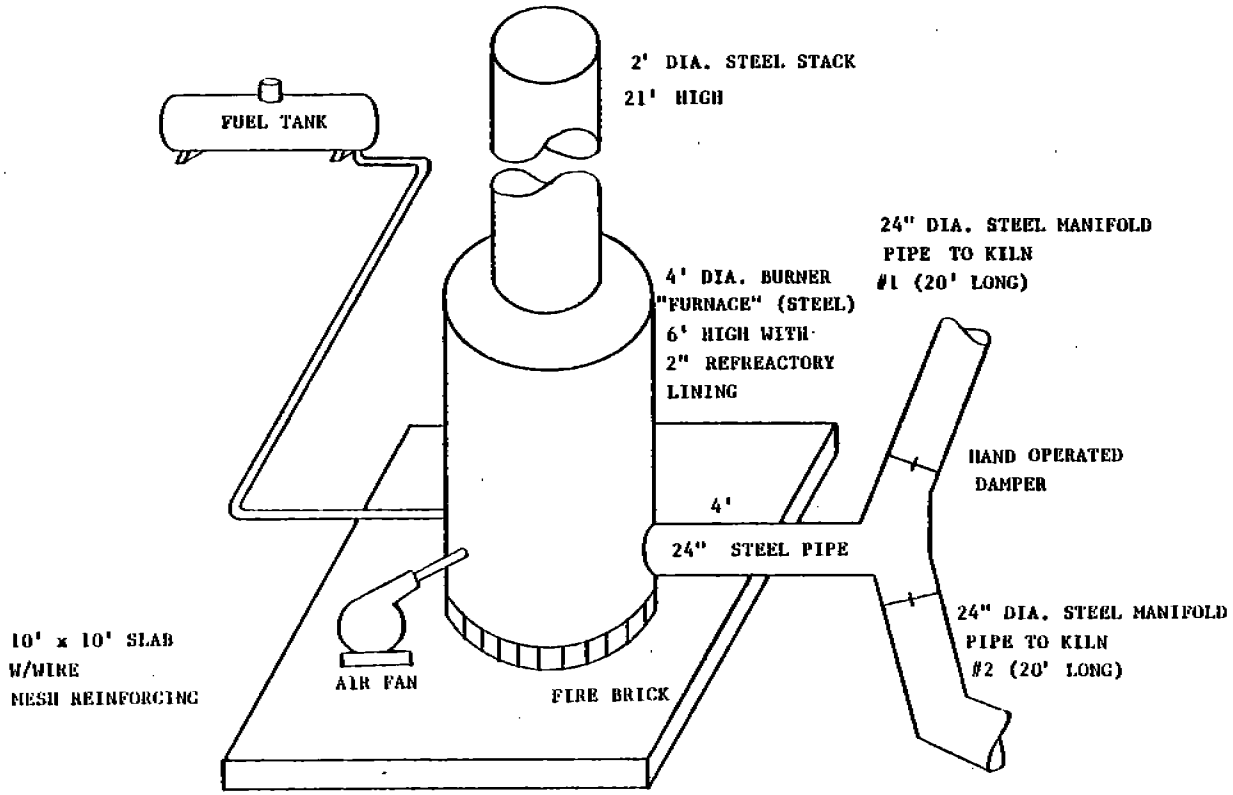



Figure 3-1. Basic design of direct fired afterburner control system for controlling two kilns.

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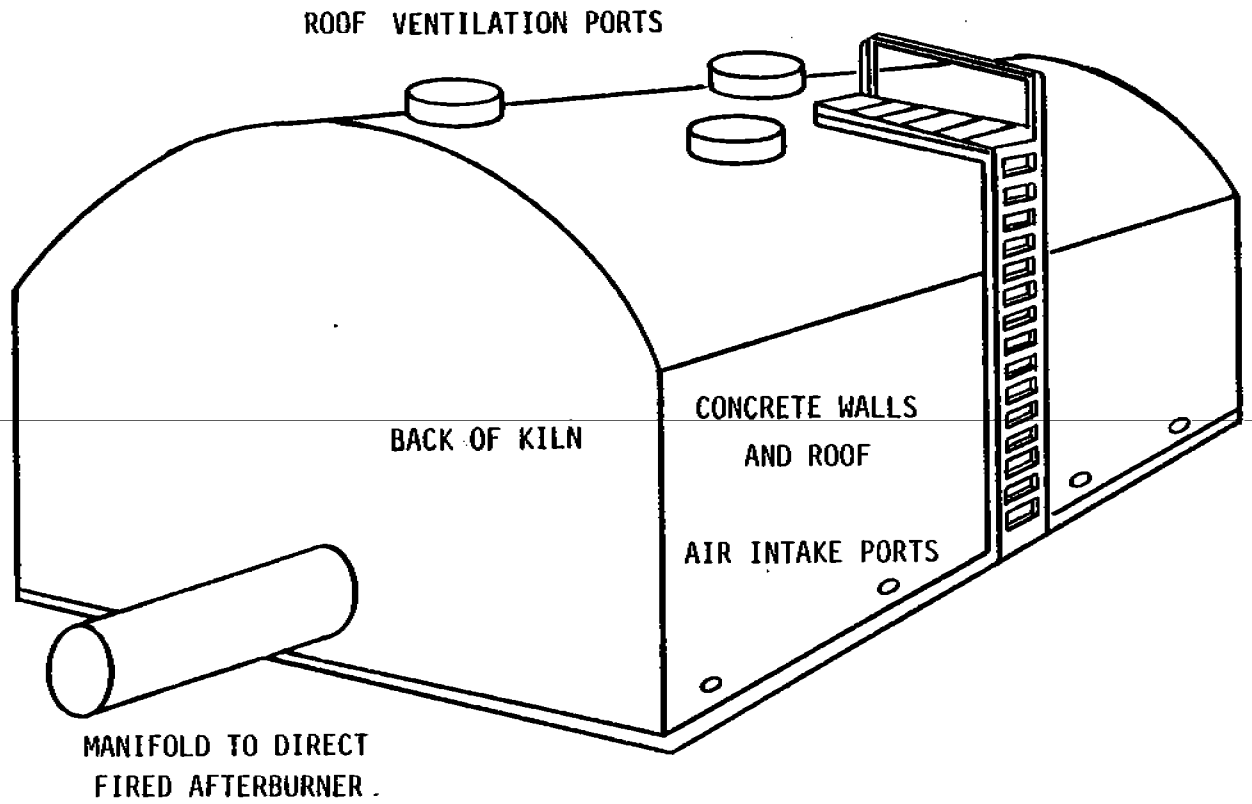


Figure 3-2. Modified Missouri-type charcoal kiln with single exhaust to an afterburner.

02-3189-1

kiln burn because it can no longer be followed by observing the color and density of the smoke from the multiple exhaust pipes. A short burn cycle may also result due to a higher and more even draft throughout the kiln.[7,16]

The economics of emission control for a Missouri kiln will be analyzed on the basis of its incremental cost on production of a megagram (1.1 tons) of charcoal. The total installed cost for a direct-fired afterburner treating gases from two or three kilns has been estimated to be over $15,000 (1977 dollars). The total cost of emission control per megagram of charcoal was also estimated to be $3.72 to $4.45 with about 80 percent of these charges due to fuel costs.[15] Another recent study has estimated overall costs at about $13 per megagram.[7] Information obtained for Husky Industries' plant in Hixton, Wisconsin indicated costs of $8 to $43 per megagram of charcoal just for the fuel oil to fire the afterburner (see Appendix D).

Assuming briquette grade raw charcoal at a selling price of $60 per megagram, the price increase due to emission control could range from about $4 to about $43 per megagram of raw charcoal (an increase ranging from about 7 to 71 percent of the selling price). Industrial grade charcoal at $77 per megagram would incur a price increase ranging from 6 to 56 percent due to emission control.

One concern expressed by kiln operators is that the application of an afterburner will impact the quality of the raw charcoal produced. Air flow through the kiln is increased when the kiln has a single exhaust to an afterburner thereby resulting in a shorter burn cycle. A shorter burn cycle reportedly does not allow for a sufficient sustained high-temperature

(230°C to 300°C or 450°F to 570°F) carbonization to maximize production of industrial grade charcoal. Usually less than one third of a batch will qualify as industrial charcoal with the shorter burn cycle. However, other operators have noted that even with a long burn cycle the yield of industrial grade charcoal is not much higher.

It should also be noted that most industrial grade charcoal comes from round wood. One operator burning slab wood in single exhaust kilns with afterburners indicated that burning round wood results in a longer burn cycle due to the difference in the feed material. More high grade charcoal might be expected as a consequence.[1,16]

### 3.3.2 Control of Continuous Processes

Herreshoff furnaces generate an off gas that has a relatively constant composition and is produced at a relatively constant rate. As a result, control of emissions is easier with the Herreshoff furnaces than with Missouri kilns.

The furnace off-gas can be burned in refractory-lined stacks on top of the furnace by admitting combustion air through adjustable doors in the base of the stack as previously shown in Figure 2-4.[1,18] Operation in this manner without an afterburner or incinerator reportedly provides satisfactory emission control where the pollution regulations are not stringent. However, where regulations are more strict or where use of the energy in the off-gas (about 29 gigajoules per megagram of charcoal or 25 Btu per thousand tons of charcoal) is desirable, an incinerator or afterburner is used.[1,18,19,20]

Afterburner systems similar to that shown in Figure 3-3 have been used successfully on Herreshoff furnaces. The Kingsford plant in Dothan, Alabama which has an afterburner treating the Herreshoff furnace off-gas was visited during the course of this study. This plant which is reportedly one of the best controlled in the U.S. is described in a trip report presented in Appendix D. An afterburner system can reportedly reduce emissions from a Herreshoff furnace by 95 percent.[1]

The primary differences between the afterburner systems on the Missouri kilns and those on Herreshoff furnaces include: (1) use of a fan to move the off-gas through the afterburner on a Herreshoff furnace, (2) a higher temperature in the Herreshoff furnace afterburner (about 1100°C (2000°F) versus about 650°C (1200°F)), and (3) supplemental fuel for the afterburner is only required for start-up or upsets of the Herreshoff furnace. The ability to operate the afterburner without supplemental fuel is a significant cost and energy saving relative to application on Missouri kilns.

Energy recovered from the combustion of the Herreshoff furnace off-gas can be used to generate steam, predry raw material fed to the carbonizer, for briquette-drying if an adjacent plant exists, or in numerous other ways.[19,20] The most immediate use for the hot gases may be to predry green wood. A predryer can reduce the moisture of green wood from the normal 50 percent to about 10 percent. This has the effect of doubling the throughput capacity of the carbonizer, since little or no residence time is required to dry the wood in the carbonizer. If an afterburner is not required for pollution control, however, it is cheaper to double

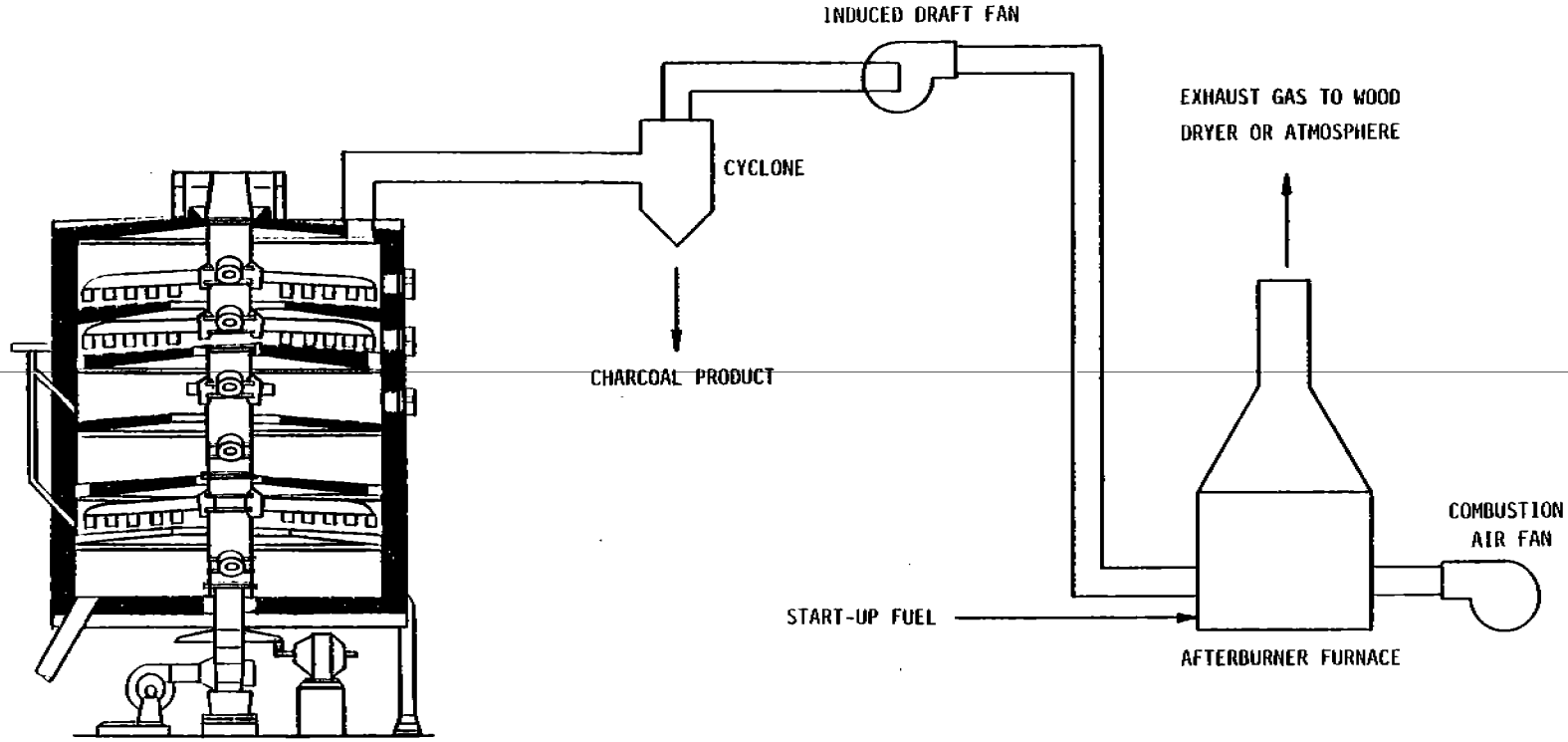


Figure 3-3. Herreshoff Multiple Hearth Furnace with afterburner.

02-3199-2

the throughput capacity by doubling the size of the carbonizer than by installing an afterburner and a predrying system.[19] Use of a predrying system probably facilitates the combustion of carbonizer off-gases, since the off-gases are less diluted with water vapor if the carbonizer feed material is predried.

## 3.4 IDENTIFICATION OF BEST CONTROLLED PLANTS

Best controlled plants have been identified as those plants that provide for the most complete combustion of all off-gases. The best controlled batch-type plants are the Husky Briquetting, Inc., plants in Isanti, Minnesota and Hixton, Wisconsin. The Isanti plant employs a gas-fired afterburner, while the Hixton plant employs an oil-fired afterburner.[8]

The best controlled plant with a Herreshoff type furnace is the Kingsford Company plant in Dothan, Alabama. The plant was recommended by Kingsford as their best controlled plant. All off-gases are combusted in an incinerator. Most other plants with Herreshoff-type furnaces incinerate only a portion of their off-gases and flare the remainder. An incinerator provides more efficient combustion than a flare.

Visits were made to the Hixton and Dothan plants. Trip reports are provided in Appendix D. Names of principal contacts, addresses, and telephone numbers are provided in the list of contacts in Appendix E.

## 3.5 SAMPLING AND ANALYTICAL METHODS

Sampling of batch and continuous wood charcoal plants using afterburners is feasible using an EPA Method 5 train for particulates and an

orsat/GC for hydrocarbons and carbon monoxide. Sampling uncontrolled batch kilns with multiple stacks is much more difficult due to the low intermittent flow through these exhaust stacks. Gas composition and flow rate vary erratically from stack to stack. Sampling must also be done over the entire burn cycle to arrive at an overall average emission per unit of production for a batch process. Sampling gases emitted by Herreshoff furnaces with combustion chambers directly on top of the furnaces is also a problem. Temperatures can reach about 2100°F and there is reportedly a potential safety hazard from the gas combustion flame being blown over on the sampling point.

A significant portion of emissions from wood charcoal production is wood tars and oils. These materials will pass through the EPA Method 5 filter and condense in the first water impinger of the Method 5 train. EPA Method 5 currently does not include procedures for recovery and quantitation of these materials.

Three problem areas, legal, political, and economic, have an impact on the technical area in the interpretation of results and application of control technology. The materials cover a wide range of volatility and atmospheric reactivity. Isolation and characterization of individual components can be carried out with procedures currently in use. The cost is about $240-300/sample. Simpler and less expensive procedures involving sample extraction and gravimetric determination of weight quantities (no speciation) is being done by many laboratories. The problem again is in interpretation of results.

The quantity of material recovered is dependent on such factors as drying time, drying temperature, and volatility. Therefore, the procedures must be defined in light of the particular compliance goal.

Some comments on specific points related to sampling and analytical methods for wood charcoal production are summarized below.

1. The current EPA Method 5 is sufficient for particulate source sampling.
2. Analytical methods are presently available for pollutants from wood charcoal manufacture but are not compliance methods.
3. These methods can be adapted for compliance activities, but only after the desired compliance strategy is defined.
4. Any firm recommendation of analytical procedure is dependent upon a more detailed definition of what is to be controlled. With present information, a simple extraction and drying method would be the method of choice. The exact procedure would have to be defined by a study program.
5. Precision and accuracy of these methods are usually two to five times better than the sampling procedures (i.e., at least ± 1 percent and ± 5 percent respectively). The exact precision will be dependent upon establishment of procedures. Accuracy will be dependent on choice of pollutant, and the corresponding standard or "absolute" analytical method, as well as the procedure.

# 4.0 FEASIBILITY OF STANDARDS DEVELOPMENT

Standard support studies should be undertaken to study control of particulates, hydrocarbons, and carbon monoxide emissions from batch and continuous wood charcoal plants. The industry may be contributing to national levels of air pollution. Accurate estimates of emissions, however, need to be established before the need for controlling the industry can be properly ascertained. Discrepancies in state regulations and enforcement policies are currently unfair to segments of the industry.

Control technology which is technically feasible currently exists. However, the economic impact of a performance standard must be further examined in future work.

Based on this screening study, implementation of a standard for the wood charcoal industry would be devastating to the smaller, independent batch operations. Capital and fuel costs associated with controls for Missouri kilns, for example, will probably prohibit construction of replacement or expansion kilns. The plants with continuous processes will be affected to a much lesser degree. As a consequence, production can be expected to move more to larger plants with continuous furnaces if a standard is set. These large, continuous plants can be operated more easily and economically with controls than can Missouri kilns.

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# APPENDIX A

# PRODUCTION FACILITIES

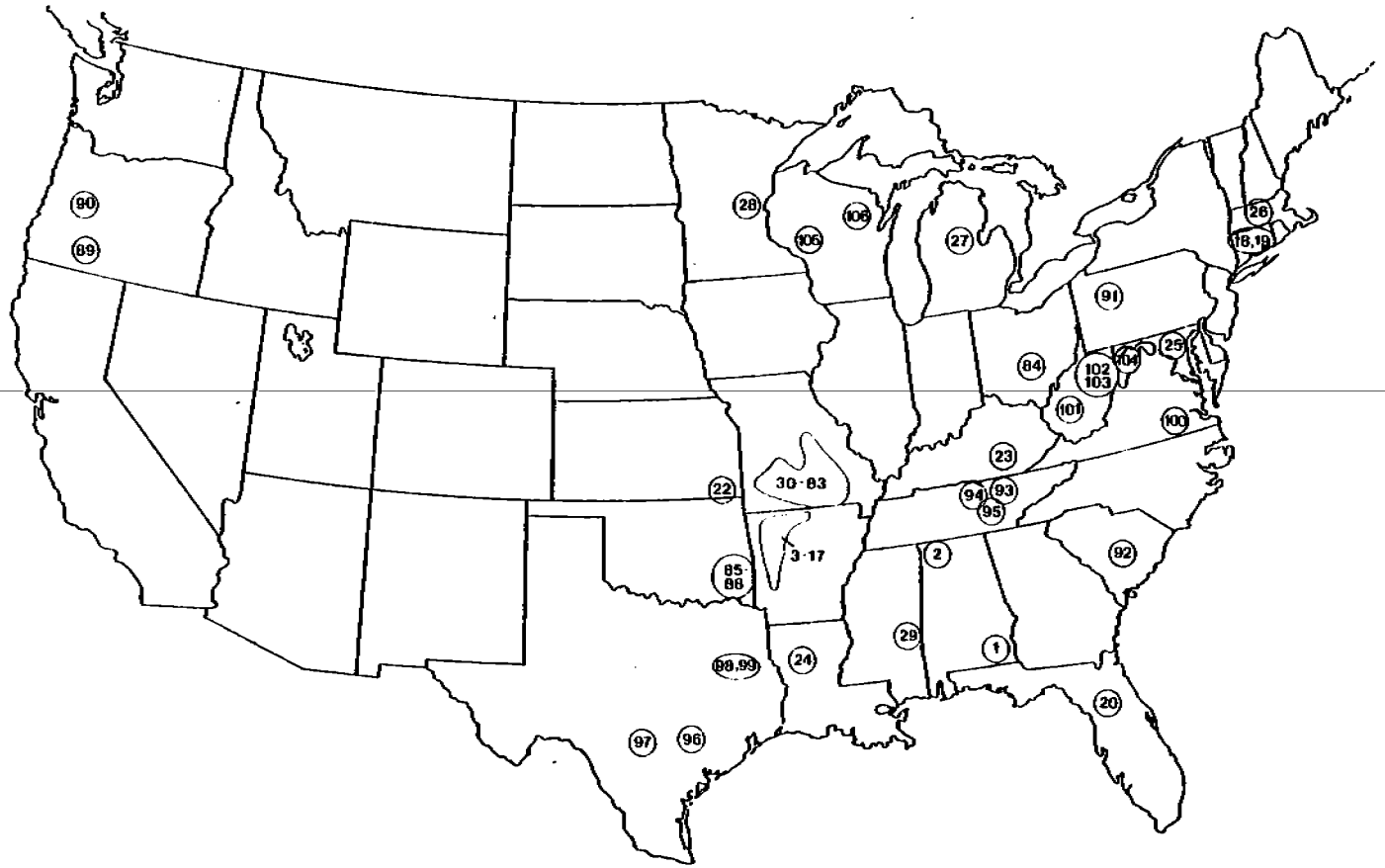


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Figure A-1. Location of wood charcoal plants.
(For key to numerals, see Table A-1)

## Table A-1. WOOD CHARCOAL PRODUCERS IN THE CONTINENTAL UNITED STATES

| State | Number | City | Producer | Type of process | Annual Capacity gigagrams | Annual Capacity tons | Annual Production gigagrams | Annual Production tons | Reference |
|---|---|---|---|---|---|---|---|---|---|
| Alabama | 1 | Dothan | Kingsford Company | Herreshoff furnace | - | - | 4.45 | 4,900 | 1, Appendix B |
| " | 2 | Tuscumbia | Malone Charcoal Co. | - | - | - | - | - | 1 |
| Arkansas | 3 | Dierks | Weyerhaeuser Co. | Herreshoff furnace | - | - | 11.98 | 13,200 | 21 |
| " | 4 | Omaha | Keeter Charcoal | Missouri-type kilns | - | - | 3.70 | 4,100 | 1, Appendix B |
| " | 5 | Green Forest | Keeter Charcoal | " | - | - | 5.21 | 5,700 | 1, Appendix B |
| " | 6 | Paris | Ozark Charcoal | " | - | - | 4.00 | 4,400 | 1, Appendix B |
| " | 7 | Paris | Paris Charcoal | " | - | - | 3.63 | 4,000 | 21 |
| " | 8 | Scranton | Arkansas Charcoal | " | - | - | 2.77 | 3,050 | 1, Appendix B |
| " | 9 | Huntsville | Keeter Charcoal | " | - | - | 5.95 | 6,550 | 1, Appendix B |
| " | 10 | Bull Shoals | Martin Charcoal | " | - | - | 2.00 | 2,200 | 1, Appendix B |
| " | 11 | Jasper | Jasper Charcoal | " | - | - | 4.96 | 5,460 | 1, Appendix B |
| " | 12 | Waldron | Waldron Charcoal | " | - | - | 3.68 | 4,050 | 1, Appendix B |
| " | 13 | Hatfield | Hatfield Charcoal | " | 1.63 | 1,800 | - | - | Appendix B |
| " | 14 | Mena | Polk County Enterprises | " | - | - | - | - | Appendix B |
| " | 15 | Cotter | Twin Lake Charcoal | " | 7.54 | 8,310 | - | - | Appendix B |
| " | 16 | Mountain Home | Province Charcoal | " | 1.21 | 1,330 | - | - | Appendix B |
| " | 17 | Osage | George Charcoal | Missouri-type kilns | 4.45 | 4,900 | - | - | Appendix B |
| California | (No reliable information available) | | | | | | | | |
| Connecticut | 18 | Sterling | Hadfield Hardwood Charcoal | Kilns | 0.19 | 180 | - | - | Appendix B |
| " | 19 | Union | Connecticut Charcoal Co. | Kilns | 6.35 | 7,000 | - | - | Appendix B |
| Florida | 20 | Ocala | Husky Industries | Herreshoff furnace | 9.88 | 10,900 | - | - | Appendix B |
| " | 21 | Romeo | Husky Industries | - | - | - | - | - | Appendix B |
| Kansas | 22 | Chetopa | Jayhawk Charcoal Co. | - | - | - | - | - | Appendix B |
| Kentucky | 23 | Burnside | Cumberland Charcoal | Herreshoff furnace and Missouri-type kilns | - | - | 15.88 | 17,500 | 21 |
| Louisiana | 24 | Winnfield | Masonite Corporation | Herreshoff furnace | - | - | 13.61 | 15,000 | Appendix B |
| Maryland | 25 | White Church | Kingsford Company | Kilns | - | - | 5.00 | 5,500 | 1, Appendix B |
| Massachusetts | 26 | North Leverett | Pioneer Valley Charcoal | Beehive-type kilns | - | - | 0.09 | 100 | Appendix B |
| Michigan | 27 | Gladwin | Sugartown Charcoal Co. | - | - | - | - | - | Appendix B |
| Minnesota | 28 | Isanti | Husky Industries | Missouri-type kilns | - | - | 7.40 | 8,100 | 1, Appendix B |
| Mississippi | 29 | Pachuta | Masonite Corporation | Herreshoff furnace | - | - | 45.36 | 50,000 | Appendix B |

Table A-1 (continued). WOOD CHARCOAL PRODUCERS IN THE CONTINENTAL UNITED STATES

| State | Number | City | Producer | Type of process | Annual Capacity gigagrams | Annual Capacity tons | Annual Production gigagrams | Annual Production tons | Reference |
|---|---|---|---|---|---|---|---|---|---|
| Missouri | 30 | Purdy | Heaser Charcoal Co. | Missouri-type kilns | 0.91 to 4.54 | 1,000 to 5,000 | - | - | 1, Appendix B |
| " | 31 | Centralia | L&A Dalling Charcoal Co. | " | 0.91 to 4.54 | 1,000 to 5,000 | - | - | 1, Appendix B |
| " | 32 | Van Buren | Kerr Charcoal Co. | " | 0.91 to 4.54 | 1,000 to 5,000 | - | - | Appendix B |
| " | 33 | Ellsinore | Leach Bros. Charcoal Co. | " | - | - | 1.46 | 1,600 | 1, Appendix B |
| " | 34 | Ellsinore | Rozark, Inc. | " | - | - | 5.00 | 5,500 | 1, Appendix B |
| " | 35 | Henley | Louis Stegeman Charcoal Co. | " | 0.91 to 4.54 | 1,000 to 5,000 | - | - | 1, Appendix B |
| " | 36 | Jefferson City | Rich Stegeman Charcoal Co. | " | 0.91 to 4.54 | 1,000 to 5,000 | - | - | 1, Appendix B |
| " | 37 | Steelville | Hardwood Charcoal Co. | " | - | - | 3.00 | 3,300 | 1, Appendix B |
| " | 38 | Wesco | Fordell Development Corp. | " | 0.91 to 4.54 | 1,000 to 5,000 | - | - | 1, Appendix B |
| " | 39 | Greenfield | Pringle Charcoal Co. | " | - | - | 3.00 | 3,300 | 1, Appendix B |
| " | 40 | Salem | Hobson Charcoal Co. | " | - | - | 0.23 | 250 | 1, Appendix B |
| " | 41 | Salem | Carty Charcoal | " | - | - | 0.17 | 190 | 1, Appendix B |
| " | 42 | Salem | Floyd Charcoal Co. | " | - | - | 35.70 | 39,000 | 1, Appendix B |
| " | 43 | Salem | Wieberg Charcoal Co. | " | - | - | 3.00 | 3,300 | 1, Appendix B |
| " | 44 | Owensville | Gene's Charcoal | " | 0.91 to 4.54 | 1,000 to 5,000 | - | - | 1, Appendix B |
| " | 45 | Wheatland | J&E Charcoal Co. | " | 0.91 to 4.54 | 1,000 to 5,000 | - | - | 1, Appendix B |
| " | 46 | Mt. View | Carr Forest Products | " | 0.91 to 4.54 | 1,000 to 5,000 | - | - | 1, Appendix B |
| " | 47 | West Plains | Nubbin Ridge Charcoal Co. | " | - | - | 3.00 | 3,300 | 1, Appendix B |
| " | 48 | Peace Valley | Peace Valley Charcoal Co. | " | - | - | 4.67 | 5,150 | 1, Appendix B |
| " | 49 | Mt. View | Craig Charcoal Co. | " | - | - | 5.00 | 5,500 | 1, Appendix B |
| " | 50 | Mt. View | Robert Bay Charcoal Co. | " | - | - | 0.42 | 460 | 1, Appendix B |
| " | 51 | Hocomo | Bakersfield Charcoal Co. | " | 0.91 to 4.54 | 1,000 to 5,000 | - | - | 1, Appendix B |
| " | 52 | Meta | Barnhart Charcoal Co. | " | - | - | 3.00 | 3,300 | 1, Appendix B |

## Table A-1 (continued). WOOD CHARCOAL PRODUCERS IN THE CONTINENTAL UNITED STATES

| State | Number | City | Producer | Type of process | Annual Capacity gigagrams | Annual Capacity tons | Annual Production gigagrams | Annual Production tons | Reference |
|---|---|---|---|---|---|---|---|---|---|
| Missouri | 53 | Meta | Ripka Charcoal & Lumber | Missouri-type kiln | 0.91 to 4.50 | 1,000 to 5,000 | - | - | Appendix B |
| " | 54 | Vienna | Wolff Charcoal Co. | " | - | - | 8.70 | 9,500 | 1, Appendix B |
| " | 55 | High Gate | Kingsford Charcoal Co. | " | - | - | 8.70 | 9,500 | 1, Appendix B |
| " | 56 | Belle | W. B. Stockton | " | 0.91 to 4.50 | 1,000 to 5,000 | - | - | 1, Appendix B |
| " | 57 | Belle | H&D Charcoal | " | 0.45 to 0.91 | 500 to 1,000 | - | - | 1, Appendix B |
| " | 58 | Hayden | Curtis & Hayes Charcoal | " | 0.45 to 0.91 | 500 to 1,000 | - | - | 1, Appendix B |
| " | 59 | Iberia | Louis Stegeman Charcoal Co. | " | - | - | 3.80 | 4,200 | 1, Appendix B |
| " | 60 | St. Elizabeth | Kirkweg Charcoal Co. | " | - | - | 0.11 | 120 | 1, Appendix B |
| " | 61 | Neosho | Neosho Charcoal Products | " | - | - | 3.00 | 3,300 | 1, Appendix B |
| " | 62 | Gainsville | Ozark Forest Charcoal Co. | " | - | - | 5.00 | 5,500 | 1, Appendix B |
| " | 63 | St. Louis | Greer Springs Co. | " | 0.91 to 4.54 | 1,000 to 5,000 | - | - | Appendix B |
| " | 64 | Freeburg | Sylvester Wieberg Charcoal | " | - | - | 3.00 | 3,300 | 1, Appendix B |
| " | 65 | Freeburg | Al Luecke Charcoal Co. | " | 0.91 to 4.54 | 1,000 to 5,000 | - | - | 1, Appendix B |
| " | 66 | Meta | Charkol, Inc. | " | 0.91 to 4.54 | 1,000 to 5,000 | - | - | 1, Appendix B |
| " | 67 | Belle | Gene Noblett Charcoal Co. | " | 0.45 to 0.91 | 500 to 1,000 | - | - | 1, Appendix B |
| " | 68 | Lake Spring | Lenox Charcoal | " | 0.91 to 4.54 | 1,000 to 5,000 | - | - | 1, Appendix B |
| " | 69 | St. James | Parry Charcoal Co. | " | - | - | 3.00 | 3,300 | 1, Appendix B |
| " | 70 | Vienna | Tackett Charcoal Co. | " | - | - | 3.00 | 3,300 | |
| " | 71 | Lesterville | Black River Charcoal Co. | " | 0.91 to 4.54 | 1,000 to 5,000 | - | - | 1, Appendix B |
| " | 72 | Reynolds | Copeland Charcoal Co. | " | - | - | 1.23 | 1,350 | 1, Appendix B |
| " | 73 | Summersville | Craig Charcoal Co. | " | - | - | 9.00 | 9,900 | 1, Appendix B |
| " | 74 | Round Springs | Robert Hamilton | " | 0.91 to 4.54 | 1,000 5,000 | - | - | 1, Appendix B |
| " | 75 | Birch Tree | Kerr Chemical | " | 0.91 to 4.54 | 1,000 5,000 | - | - | 1, Appendix B |

## Table A-1 (continued). WOOD CHARCOAL PRODUCERS IN THE CONTINENTAL UNITED STATES

| State | Number | City | Producer | Type of process | Annual Capacity gigagrams | Annual Capacity tons | Annual Production gigagrams | Annual Production tons | Reference |
|---|---|---|---|---|---|---|---|---|---|
| Missouri | 76 | Round Springs | Round Springs Charcoal | Missouri-type kilns | 0.91 to 4.54 | 1,000 to 5,000 | - | - | 1, Appendix B |
| " | 77 | Winona | Dailey Charcoal | " | - | - | 0.12 | 130 | 1, Appendix B |
| " | 78 | Bradleyville | Horner Charcoal Co. | " | - | - | 4.20 | 4,600 | 1, Appendix B |
| " | 79 | Branson | S&S Charcoal Co. | " | - | - | 5.00 | 5,500 | 1, Appendix B |
| " | 80 | Raymondville | Thomason Charcoal Co. | " | - | - | 2.69 | 3,000 | 1, Appendix B |
| " | 81 | Licking | Wulff Charcoal Co. | " | - | - | 5.00 | 5,500 | 1, Appendix B |
| " | 82 | Plato | H. O. Charcoal Co. | " | 0.91 to 4.54 | 1,000 to 5,000 | - | - | 1, Appendix B |
| " | 83 | Freeburg | Ben Berhorst | " | 0.91 to 4.54 | 1,000 to 5,000 | - | - | 1, Appendix B |
| Ohio | 84 | McArthur | Roseville Charcoal | Beehive-type kilns | - | - | - | - | Appendix B |
| Oklahoma | 85 | Idadel | K-V Charcoal | Metal kilns | 0.36 | 400 | - | - | Appendix B |
| " | 86 | Clayton | Forest Products Charcoal Co. | Missouri-type kilns | 0.48 | 530 | - | - | Appendix B |
| " | 87 | Talihina | Forest Products Charcoal Co. | Missouri-type kilns | 1.45 | 16,000 | - | - | Appendix B |
| " | 88 | Heavener | Forest Products Charcoal Co. | Missouri-type kilns | (Presently shut down) | | - | - | Appendix B |
| Oregon | 89 | White City | Georgia-Pacific | Herreshoff furnace | 16.33 | 18,000 | - | - | Appendix B |
| " | 90 | Springfield | Kingsford | Herreshoff furnace | - | - | - | - | Appendix B |
| Pennsylvania | 91 | Brookville | Humphrey Charcoal Corp. | Beehive-type kilns | 4.90 | 5,400 | - | - | Appendix B |
| South Carolina | 92 | Lake City | T. S. Ragsdale Company, Inc. | Herreshoff furnace | - | - | - | - | Appendix B |
| Tennessee | 93 | Jamestown | Jamestown Charcoal | Modified Missouri-type kilns | - | - | 10.70 | 11,800 | 1, Appendix B |
| " | 94 | Red Boiling Springs | Kingsford | Modified Missouri-type kilns | 7.26 | 8,000 | - | - | Appendix B |
| " | 95 | Mayland | Hickory Charcoal Co. | Modified Missouri-type kilns | - | - | - | - | 21 |
| Texas | 96 | Flatonia | B&B Charcoal Co. | Kilns | 0.47 | 520 | - | - | Appendix B |
| " | 97 | San Antonio | National Charcoal Co. | - | 0.59 | 650 | - | - | Appendix B |
| " | 98 | Jacksonville | Pine-O-Pine Co.[a] | Kilns | - | - | - | - | Appendix B |
| " | 99 | Jacksonville | Kingsford Company | Kilns | - | - | - | - | Appendix B |
| Virginia | 100 | Kenbridge | Imperial Briquet | - | - | - | 28.20 | 31,000 | 1 |

## Table A-1 (continued). WOOD CHARCOAL PRODUCERS IN THE CONTINENTAL UNITED STATES

| State | Number | City | Producer | Type of process | Annual Capacity gigagrams | Annual Capacity tons | Annual Production gigagrams | Annual Production tons | Reference |
|---|---|---|---|---|---|---|---|---|---|
| West Virginia | 101 | Dixie | Roseville Charcoal | Beehive-type kilns | 1.21 | 1,330 | - | - | Appendix B |
| " | 102 | Bellington | Kingsford Charcoal | Missouri-type kilns | - | - | - | - | Appendix B |
| " | 103 | Parsons | Kingsford Charcoal | Herreshoff furnace | 16.68 | 18,400 | - | - | Appendix B |
| " | 104 | Beryl | Kingsford Charcoal | Herreshoff furnace | - | - | - | - | Appendix B |
| Wisconsin | 105 | Hixton | Husky Industries | Missouri-type kilns | - | - | 4.1 | 4,500 | 1, Appendix B |
| " | 106 | Antigo | The Rusch Bros. | (Having operational problems) | | | | | |

[a]Possibly out of business

The capacity and production as estimated for the continental United States were 620 gigagrams/yr (683,000 tons/yr) and 376 gigagrams/yr (414,000 tons/yr), respectively. These totals were generated somewhat independently of the above table and are not simply the summation of the information found therein. The assumed utilizations of plant capacity for batch-type and continuous-type processes were 50 percent and 70 percent, respectively. For a more detailed discussion of these results see Section 2.2 of this report.

# APPENDIX B

## PERSONAL COMMUNICATIONS

WOOD CHARCOAL INDUSTRY QUESTIONNAIRE

The following questionnaire format was used in all telephone conversations. Some of the telephone call record sheets merely have the information received organized by the number assigned to each of the following questions:

1) Plant location and owner's name
2) Capacity of each plant and number of people working at each plant.
3) Type of process used and a brief process description.
4) Existing Controls, if any--what type of controls; if any emissions data has been taken, a copy is requested.
5) Economic information in general and specifically the price of the raw charcoal produced and the price of the raw materials.
6) Is the area saturated, is any growth or decline expected in the next five years. Also, ten years ago how many plants were operating.
7) Local (non-state) regulations--Does the nearest town have its own regulations, etc.
8) Other state agencies familiar with the wood charcoal industry.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 6/2/78 | Time: 3:00 p.m. |
| Person Calling: R. D. Delleney | Activity: Radian |
| Person Called: Steve Adiletta | Activity: Nichols Engineering (201) 359-8200 |
| General Subject: Herreshoff wood charcoal furnaces | |

TOPICS DISCUSSED AND ACTION TAKEN

Steve said Nichols still manufactures Herreshoff type furnaces but the last wood charcoal was in 1969 and there is presently no interest on the part of industry. He felt the industry was just holding its own. Herreshoff plants make charcoal for briquetting only. The wood gases are combusted in the furnace to generate heat to carbonize the wood. Excess wood gases are incinerated (afterburner) at 1400-1600°F or sent to a waste heat boiler to generate steam. A typical material flow is:

1000 lb feed (50% $H_2O$) $\xrightarrow{dry}$ 500 lb wood + 500 lb steam

500 lb wood $\xrightarrow{carbonize}$ 125 lb charcoal + 375 lb wood gas.

Wood gas is burned not the wood itself.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| Project No. | | Distribution |
|---|---|---|
| 200-187-32 | | |
| Project Name | | |
| Wood Charcoal | | |
| Date | Time | |
| 6/14/78 | 2:00 p.m. | |
| Person Calling | Activity | |
| Dean Delleney | Radian | |
| Person Called | Activity | |
| G. F. Kroneberger | Envirotech Systems, Inc. (415) 592-4060 | |
| General Subject | | |
| Control of Herreshoff furnace off-gases | | |

TOPICS DISCUSSED AND ACTION TAKEN

Envirotech builds Herreshoff furnaces and associated control systems. Off-gases at 1000-1200°F pass through a cyclone to recover charcoal entrained in the gas. An ID fan moves the gas to an afterburner operating at about 2300°F with the gases exhausted up a stack after they are combusted. The hot exhaust gases may be used to dry feed material or in an associated briquetting plant if one exists. A natural draft stack is said not to combust gases as completely as this system with a fan. Auxiliary fuel is required only for start-up or upset conditions. Kingsford in Oregon has an afterburner with a bark dryer. Ragsdale in South Carolina has a waste heat boiler. Georgia-Pacific in Oregon has a hybrid system with a waste heat boiler. There has been little demand for new Herreshoff furnaces for the wood charcoal industry since the late 1960's. The power gas system with a fan was said to cost about 50% more than a natural draft system.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 5/22/78 | Time 2:00 p.m. |
| Person Calling R. D. Delleney | Activity Radian |
| Person Called John Floyd | Activity EPA Reg. Office - Denver (303) 837-4261 |
| General Subject Information on wood charcoal industry | |

TOPICS DISCUSSED AND ACTION TAKEN

John said there may be a confidential file at OAQPS with info from the states and Kingsford. Also Gary McCutchen should have data previously gathered on industry projections. John gave me two leads:

1) John Haasis - Missouri Dept. of Natural Resources, Jefferson City, Mo. (314) 751-3241.

2) Paul Boys - Reg. 10 EPA, Seattle, Wa. (206) 442-1106.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 5/12/78 | Time 9:30 |
| Person Calling Peter Hulman | Activity Radian |
| Person Called Andrew Baker | Activity U.S. Forest Products Lab, Wisconsin, (608) 257-2211 x480 |
| General Subject | |

TOPICS DISCUSSED AND ACTION TAKEN

There is one set of kilns currently in operation in Wisconsin:

Husky Industries
Hixton, Wisconsin (near Black River Falls)

It has 12 40-50 cord Missouri type kilns that are operated at "pretty much full capacity".

Another operation has been set up, but is still having operation problems:

The Rusch Bros.
Antigo, Wisconsin

The operator (President of Rusch Bros.) is Jack. The plant uses a non-Herreshoff-type retort. It is having mechanical problems.

Most pollution problems no longer exist. Herreshoff retorts burn the offgas. Some Missouri-type kilns burn the gas in afterburners-fuel costs approximately $10/ton charcoal, which is about 20% of the cost of charcoal. Controllability of Missouri-type kiln is site specific. In Wisconsin, the kilns were built with control in mind. They are close together and are mounted on level land. In Missouri, the kilns are on hillsides and are far apart, making it difficult ot collect gases. The State of Missouri considers that emissions from these kilns is uncontrollable. Beehive-type kilns are also very difficult to control. (There are not many beehive kilns in operation).

There are no fluid bed carbonizers in commercial operation. There is, however, one pilot plant in operation. It is being operated by Tech-Aire, Atlanta, Georgia (main office).

In addition to the states listed in the "Screening Study for Charcoal Kilns", the following states have a charcoal industry:

| | |
|---|---|
| Minnesota | Pennsylvania |
| Connecticut | Maine |
| Mississippi | Texas (probably) |
| North Dakota | Other states (possibly) |

It was suggested that we contact the State Utilization Board in every state. There is a State Forester in every state who would be familiar with the charcoal industry in that state. He could be found in the state's Department of Natural Resources or Forestry Commission.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☐ Outgoing Call

| | |
|---|---|
| Project No. | Distribution |
| Project Name | |
| Date / Time | |
| Person Calling | Activity |
| Person Called | Activity |
| General Subject | |

TOPICS DISCUSSED AND ACTION TAKEN

There is a report on the use of gases from a Herreshoff furnace. It was presented at the September '76 Denver meeting of the Forest Products Research Society.

Economics of the Herreshoff furnace can probably be obtained from its manufacturer.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 5/12/78 | Time 3:30 p.m. |
| Person Calling C. S. Collins | Activity Radian |
| Person Called Arthur Seeds | Activity Exec. VP Barbecue Industry Assoc. (312) 654-4010 |
| General Subject | |

TOPICS DISCUSSED AND ACTION TAKEN

I asked for information on the industry. He quizzed me quite extensively about who we are, what we want and why we want it. He then said to put it all in a letter and he will do what he can.

He seemed cooperative and also asked for more general information on Radian in case he might need our services.

A letter was sent immediately.

His address is: Barbecue Industry Associates
1100 Jorie Blvd., Suite 225
Oak Brook, Illinois 60521

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 5/12/78 | Time: 1:30 p.m. |
| Person Calling: Peter Hulman | Activity: Radian |
| Person Called: Bureau of Census and Commerce Dept. (214) 749-1518 | Activity: |
| General Subject | |

TOPICS DISCUSSED AND ACTION TAKEN

Only information available is in the 1972 Census of Manufacturers, 1977 census information will not be available until at least next summer.

No information in Current Industrial Reports. No other source of information available. However, there is a possible helpful organization in Texas:

Western Wood Products Assoc.
2511 Wedgeley Drive, Apt. 216
Dallas, Texas 75211
214/941-5428
Regional Manager: Frank D'Augustine

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 5/23/78 | Time |
| Person Calling Steve Killingsworth | Activity |
| Person Called Glen Golsen | Activity Air Pollution Control Commission, AL (205) 834-6570 |
| General Subject Wood charcoal industry in Alabama | |

TOPICS DISCUSSED AND ACTION TAKEN

Mr. Golsen informed me that there was a regulation or law stating that information could not be given out but that their files were open to public inspection.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 6/6/78 | Time: 3:00 p.m. |
| Person Calling: Peter Hulman | Activity: |
| Person Called: Mr. Demke | Activity: Kingsford Dothan, Alabama (205) 794-8547 |
| General Subject: Wood charcoal industry in Alabama | |

TOPICS DISCUSSED AND ACTION TAKEN

3) Herreshoff furnace

4) All off-gases combusted and diverted to Kingsford's own user

Mr. Demke considered that use of the off-gases and capacity of the plant were proprietary information. In general, he seemed suspicious and unreceptive.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 5/24/78 | Time |
| Person Calling Steve Killingsworth | Activity |
| Person Called Bob Wright | Activity Air Quality Control, Arizona (602) 271-5306 |
| General Subject Wood charcoal industry in Arizona | |

TOPICS DISCUSSED AND ACTION TAKEN

Mr. Wright referred me to Southwest Forest Industries, phone number (602) 279-5381; however, no information was available.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 5/24/78 | Time |
| Person Calling Steve Killingsworth | Activity Radian |
| Person Called Wilson Tolefree | Activity Dept. of Pollution Control & Ecology, Air Section (501) 371-1136 |
| General Subject Wood Charcoal Industry in Arkansas | |

TOPICS DISCUSSED AND ACTION TAKEN

Eight plants in Arkansas. Information will be given separately.

First Plant:

1) Location and name: Keeter Charcoal, Huntsville, Arkansas
2) Owner: James P. Keeter
3) Capacity: Missouri-type kiln(s)
4) Existing Controls: none
5) Economic Information: no info
6) Past, Present, Future: no info
7) Local Regulations: none
8) Other State Agencies: no info

Second Plant:

1) Location and name: Hatfield Charcoal, Hatfield, Arkansas
2) Owner: Andrew Sigel
3) Capacity: 1800 ton lump charcoal/yr; Missouri-type kilns using scrub wood and wood waste
4) Existing Controls: none
5) Economic Information: no info
6) Past, Present, Future: no info
7) Local Regulations: none
8) Other State Agencies: no info

Third Plant:

1) Location and name: Polk County Enterprises, Mena, Arkansas
2) Owner: Andrew Sigel
3) Capacity: Missouri-type kilns
4) Existing Controls: no controls
5) Economic Information: no info
6) Past, Present, Future: no info
7) Local Regulations: none
8) Other Agencies: no info

(continued)

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☐ Outgoing Call

| | |
|---|---|
| Project No. | Distribution |
| Project Name | |
| Date / Time | |
| Person Calling | Activity |
| Person Called | Activity |
| General Subject | |

TOPICS DISCUSSED AND ACTION TAKEN

Fourth Plant:

1) Location and name: Twin Lake Charcoal, Cotter, Arkansas
2) Owner: John A. Crain
3) Capacity: 3.5 ton briquettes/hr
4) Existing Controls: No controls on kilns; dust collector on briquetting plant
5) Economic Information: no info
6) Past, Present, Future: no info
7) Local Regulations: none
8) Other Agencies: no info

Fifth Plant:

1) Location and name: Province Charcoal, Route 1, Mountain Home, Arkansas
2) Owner: Glen R. Voss
3) Capacity: 4 50 cord Missouri-type kilns
4) Existing Controls: no controls
5) Economic Information: no info
6) Past, Present, Future: no info
7) Local Regulations: none
8) Other Agencies: no info

Sixth Plant:

1) Location and name: George Charcoal, Osage, Arkansas
2) Owner: R. L. Stephens
3) Capacity: 5000 tons lump charcoal/yr; Missouri-type kilns
4) Existing Controls: no controls
5) Economic Information: no info
6) Past, Present, Future: no info
7) Local Regulations: none
8) Other Agencies: no info

Seventh Plant:

1) Location and name: Martin Charcoal, Bull Shoals, Arkansas
2) Owner: Ray Martin
3) Capacity: 6 50 cord Missouri-type kilns
4) Existing Controls: no controls
5) Economic Information: no info
6) Past, Present, Future: no info
7) Local Regulations: none
8) Other Agencies: no info



(continued)

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☐ Outgoing Call

| | | |
|---|---|---|
| Project No. | | Distribution |
| Project Name | | |
| Date | Time | |
| Person Calling | Activity | |
| Person Called | Activity | |
| General Subject | | |

TOPICS DISCUSSED AND ACTION TAKEN

Eight Plant:

1) Location and name: Arkansas Charcoal, Scranton, Arkansas
2) Owner: no info
3) Capacity: Missouri-type kilns
4) Existing Controls: Scrubber manufactured by Chlortrol, Russelville, Arkansas (501)555-1212 (Out of business according to W. Tolefree, 6-5-78) Mr. Tolefree is sending a copy of test data taken.
5) Economic Information: no info
6) Past, Present, Future: no info
7) Local Regulations: none
8) Other State Agencies: no info

Ninth Plant:

1) Location and name: Mountain Home
2) Owner: no info
3) Capacity: 75 cord kiln(s) Missouri-type
4) Existing Controls: Scrubber and incinerator; Mr. Tolefree is sending a copy of test data taken; Charley Kelley, manufacturer.
5) Economic Information: no info
6) Past, Present, Future: no info
7) Local Regulations: none
8) Other State Agencies: no info

STATE OF ARKANSAS
DEPARTMENT OF POLLUTION CONTROL AND ECOLOGY
8001 NATIONAL DRIVE
LITTLE ROCK, ARKANSAS 72209

501 371-1701 GEN. OFF.
501 371-1136 AIR DIV.

May 30, 1978

Mr. Steve Killingsworth
Radian Corporation
8500 Shoal Creek
Post Office Box 9948
Austin, TX 78766

Dear Mr. Killingsworth:

Enclosed are the two reports on the test results conducted at two charcoal kilns in Arkansas.

If we can be of assistance in the future, please contact us.

Sincerely yours,

Wilson Tolefree

Wilson Tolefree
Manager of Administrative Services
Division of Air Pollution Control

WT/db

Enclosures (2)

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 8/2/78 | Time: 2:00 p.m. |
| Person Calling: Dean Delleney | Activity: Radian |
| Person Called: John Mitchell | Activity: Arkansas Div. of Air Pollution Control (501) 371-1136 |
| General Subject: Economics of Afterburners on Missouri-type charcoal kilns | |

TOPICS DISCUSSED AND ACTION TAKEN

I called John about two evaluations the state of Arkansas did on controls for Missouri-type charcoal kilns. The evaluations which were done in 1973 stated that afterburners on Missouri-type kilns were economically feasible. Information Radian received during the screening study indicated that the economic impact of an afterburner system may be significant. I called John to discuss the Arkansas evaluations. John indicated that since 1973 the cost of fuel for the afterburners has increased dramatically (about four times the 1973 price for propane). Therefore, while the conclusion on the economic feasibility of afterburners was valid in 1973, such a control may not be feasible for a Missouri kiln today.

STATE OF ARKANSAS
DEPARTMENT OF POLLUTION CONTROL AND ECOLOGY
8001 NATIONAL DRIVE
LITTLE ROCK, ARKANSAS 72209

501 371-1701 GEN. OFF.
501 371-1135 AIR DIV.

September 6, 1973

MEMORANDUM TO: Jarrell Southall, Chief, Division of Air Pollution Control

SUBJECT: Source Tests of Charcoal Kilns

Test results from a scrubber controlled kiln and a scrubber-incinerator controlled kiln are attached. The scrubber controlled kiln is owned by Arkansas Charcoal and is located at Scranton, Arkansas. The scrubber was developed by Chlortrol, Inc. of Russellville. The scrubber-incinerator controlled kiln is located at Mountain Home, Arkansas and was developed by Charlie Kelly, of Whiteville. The scrubber controlled kiln did not receive the intensive test and evaluation as did the scrubber-incinerator unit because it is a recent development and test facilities were not adequate for prolonged sampling.

The accompanying report may appear as being somewhat informal. However, as you know, a rather convincing report has been published and distributed which claims that control technology for "Missouri Type" Charcoal kilns does not exist and we wish this report to conclusively show that a technology does exist.

We request that you review this report and solicit your criticism.

John A. Mitchell
Division of Air Pollution Control

John B. Gardner
Division of Air Pollution Control

JAM:JBG:dm

## Stack Test of Controlled 75 Cord Charcoal Kiln
## Mountain Home, Arkansas

From August 14 through August 20, 1973 two staff members of the Department of Pollution Control and Ecology made extensive emission tests of a control apparatus attached to a "Missouri type" charcoal kiln located near Mountain Home, Arkansas. This evaluation was made in accord with Section 82-1935 (b) and (c) of the Arkansas Water and Air Pollution Control Acts and were for the specific purpose of establishing the fact that an economically practical control technology exists for "Missouri type" charcoal kilns.

### Test Methods

Two to five thirty minute samples were taken each day and accumulated as two separate tests. Test 1 totaled 420 minutes and test 2 totaled 390 minutes. Orsat analysis were made at intervals throughout the period and averaged for calculating gas density. The particulate matter test was performed according to method number 5 of Federal Register Volume 36, number 159 of Tuesday, August 17, 1971 [illegible].

### Test Results and Evaluation

The charcoal kiln was fired at approximately 7:00 am Tuesday August 14, 1973 and was closed off at approximately 9:00 pm August 21, 1973. Due to a mechanical failure in the test equipment, our sampling could not be performed on the last day of the cooling operation. The following tabulation shows sampling periods.

| | | | | | |
|---|---|---|---|---|---|
| August 14, 1973 | 11:30 am | 5:00 pm | 9:00 pm | 11:30 pm | |
| August 15, 1973 | 8:00 am | 11:30 am | 4:00 pm | 8:45 pm | 11:30 pm |
| August 16, 1973 | 10:00 am | 12:00 am | 4:00 pm | 9:00 pm | 10:30 pm |
| August 17, 1973 | 11:30 am | 4:00 pm | 8:10 pm | 11:00 pm | |
| August 18, 1973 | 11:00 am | 12:00 noon | 4:30 pm | 10:00 pm | 12:00 pm |
| August 19, 1973 | 11:00 am | 7:15 pm | | | |
| August 20, 1973 | 10:00 am | 3:30 pm | | | |

The attached computer print-out shows the emission rates calculated from the test data. Equation (26c) of the Arkansas Engineering Guide on Dispersion was used to calculate the maximum downwind concentration in $ug/_m3$ of particulate matter and (26b) was used for carbon monoxide concentration. It should be emphasized that these equations are designed to give the point of highest ground level concentration that can occur under the most unfavorable dispersion conditions and that at all other points and under all other dispersion conditions the concentrations will be less.

The highest concentration possible with the emission rate from test 1 is 10.83 $ug/_m3$. For test 2 the highest concentration would be 11.52 $ug/_m3$. For carbon monoxide the highest level would be .701 parts per million.

The developers of the control apparatus asked that this report show how the device performs with respect to air quality regulations of Missouri and Oklahoma as well as those of Arkansas. This will be attempted but it must be pointed out that the interpretation of regulations for states other than Arkansas may be in error.

Arkansas Air Pollution Control Code

Section 4. Visible Emissions

allowable: New equipment No. 1 Ringelman or 20% opacity.

performance: No visible emissions

Section 6. Incinerators - Same as Missouri Regulation S-IV

Section 7. Emission of Particulate Matter from Equipment

allowable: 75 $ug/m^3$ average for any 24 hour period

performance: 11.17 $ug/m^3$ average of two tests

approximately 15% of allowable

Section 10. Emission of Air Contaminats such as to constitute air pollution

allowable: Such that no nusiance is created.

performance: No odors, negligible fugitive emissions

Section 11. Control of Fugitive Emissions

allowable: No more than necessary

performance: Fugitive emissions infrequent and negligible

Missouri Air Conservation Commission

"Missouri type" charcoal kilns exempt from regulations. If exemption were canceled, the following regulations would apply.

Regulation S-IV Incinerators

allowable: (D) (1) (a) 0.2 grains/SCF corrected to 12% carbon dioxide.

performance: Test 1

(.046 gr/SCF) $\frac{12}{12}$ = .046 gr/SCF

Test 2

(.040 gr/SCF) $\frac{12}{5.2}$ = .092 gr/SCF

avg = .069 gr/SCF

34.5% of allowable

(D) (2) (a)

allowable: Ringelman 1, 20% opacity

performance: No visible emissions

Regulation S-V Restriction of Emission of Particulate Matter from Industrial Processes.

allowable: (D) (1) 2000 lb/hr Process weight 4.10 lb/hr Emission rate

performance: 2060 lb/hr Process weight .209 lb/hr Emission rate

5% of allowable

(D) (2)

allowable: Less than 7,000 SCFM air volume, emission rate 0.1 gr/SCF

performance: .043 gr/SCF average

43% of allowable emission rate

Regulation S-VIII Restriction of Emission of Visible Air Contaminants

(D)

allowable: Ringelman No 1 or 20% opacity

performance: No visible emissions

Regulation S-IX Restriction of Emission of Odors

allowable: Violation occurs when odor can be perceived after diluting one volume of odorous air with

seven volumes of odor free air for 2 trials to be conducted at least fifteen minutes apart within a one hour period.

performance: Very slight wood burning odor occurring infrequently at plant site.

Oklahoma Clean Air Act and Air Pollution Control Regulations

Regulation 5 Incinerators

allowable: 5.1 Ringelman 1 or 20% opacity

performance: No visible emissions

5.2

allowable: .4 lb/hr for less than 100 lb/hr charge rate

performance: .209 lb/hr average

52% of allowable emission

5.3 operation provisions

Device is primarily for elimination of smoke and gaseous hydrocarbons and should be capable of complying with provisions of this part.

Regulation 7 Visible Emissions

allowable: Ringelman No 1 or 20% opacity

performance: No visible Emissions

Regulation 8 Particulate Matter from Processes

8.1 Process emission limitations

allowable: Process weight rate 2000 lb/hr

Emission rate 4.10 lb/hr

performance: Process weight rate 2069 lb/hr Emission rate .209 lb/hr

5% of allowable

Regulation 15 Emission of Hydrocarbons (Non Methane)

15.26 Fuel Burning and Refuse Burning Equipment

allowable: None

performance: Emissions negligible - gaseous effluents pass through gas burner.

Regulation 17 Emission of Carbon Monoxide

allowable: Such that air quality is not degraded

performance: Most orsat readings taken over the 7 day testing period showed no carbon monoxide. All CO detections were during the first three days of the test, these averaged 0.7% and dispersion calculation shows a maximum ground level concentration of 0.701 ppm. This should satisfy the purpose of the regulation.

## Conclusions

In March of 1972, staff members from this Department made a source test of this same type device on a 15 cord kiln. At that time, the device required a great deal of adjustment to keep it in proper operation. This problem has apparently been solved and the operator now seldom adjusts the controls. It appears that the developers are now prepared to market the machine and we understand some orders have been received.

It seems logical to assume that if an effluent control apparatus is available, that sawmills or other wood product plants having a large amount of wood waste might consider charcoal operations as a paying method of disposing of these

wastes. With this in mind we have asked for a more detailed dispersion print-out for the purpose of showing that this device offers sufficient control to allow charcoaling operations in densely populated areas.

After our last test we attempted to look at the economics of operating controlled charcoal kilns. Conditions have changed so we will update that attempt. We assume that a yield of 850 pounds of charcoal could be expected from a cord of unseasoned wood. This would yield approximately 32 tons of coal for a 75 cord kiln. The operation price of the control device is probably about $15.00 a day including gas and electricity, or $120.00 per coaling cycle for this size kiln. This would be $3.75 per ton of coal produced. This would be reduced considerably if two kilns were run simultaneously. This operation has the necessary hardware in place to attempt doubling the load on the control device and may try to do so at a later date.

We have no reservations in stating that the device is highly efficient for the control of emissions from this type of process.

Dispersion Calculations

Test 1

$$Q(lb/hr) = (13.2 \times 10^{-6})\ (C_m)\ V_s d_s^2 \left[1.5 + 0.82 d_s \frac{\Delta T}{T_s}\right] h_s$$

$$C_m = \frac{Q(lb/hr)}{(13.2 \times 10^{-6})\ (V_s)\ (d_s)^2 \left[1.5 + .82\ (d_s) \frac{\Delta T}{T_s}\right] h_s}$$

$C_m$ = maximum downwind ground level concentration in micrograms/$m^3$

$V_s$ = 14.50 feet per second velocity out stack

Q = .221 stack emission rate in pounds per hour

$d_s$ = 1.333 stack diameter in feet

T = 1145 - 548 = 597°R = Difference air and stack temp.

$T_s$ = 1145°R = Temperature stack

$h_s$ = 32 Height of stack in feet

$$C_m = \frac{.221}{(13.2 \times 10^{-6})\ (14.50)\ (1.333)^2 \left[1.5 + .82\ (1.333) \frac{1.35T}{1145}\right] 32^2}$$

$10.83 ug/_m3$

Test 2

$$C_m = \frac{Q(lb/hr)}{(13.2 \times 10^{-6})\ (V_s)\ (d_s)\ \left[1.5 + .82(d_s)\ \frac{\Delta T}{T_s}\right] h_s}$$

$$C_m = \frac{.197}{(13.2 \times 10^{-6})\ (12,24)\ (1.333)\ \left[1.5 + .82(1.33)\ \frac{385}{935}\right] 32} =$$

$11.52\ ug/_m3$

Carbon Monoxide

The average carbon monoxide concentration in pounds per hour during the first test was 17.01. No carbon monoxide was present during the second test.

This concentration was determined by the following calculation.

$$\frac{(.007)\ (28)\ (1208)\ (60)\ (520)}{(379)\ (1145)} = 17.02$$

Where:

| | |
|---|---|
| .007 | Orsat reading of 0.7% |
| 28 | lbs/mole of carbon monoxide |
| 1208 | flow rate in cubic feet per minute, stack conditions |
| 60 | minutes/hour |
| 520 | standard temperature, degrees Rankin 460 + 60°F |
| 379 | Volume in cubic feet of 1 lb mole of gas at 60°F, 29.92 in H |
| 1145 | stack temperature degrees Rankin 460 + 685°F |

Equation (26b) of Arkansas Engineering Guide on Dispersion is used to get maximum downwind concentration ($C_m$) in parts per million.

$$C_m = \frac{Q(lb/hr)}{(5.56 \times 10^{-4})\ (MW)\ (V_s)\ (d_s)\left[1.5 + 0.82\ (d_s)\ \left(\frac{T_s}{T_s}\right)\right] h_s}$$

$$C_m = \frac{17.02}{(5.58 \times 10^{-4})\ (28)\ (14.50)\ (1.33)\left[1.5 + 0.82\ (1.333)\ \frac{1052}{1145}\right]}$$

$C_m$ = .701 ppm at 88°F ambient temp (avg) during test

$$mg/m^3 = (.701)\ \left(\frac{28}{.0224}\right)\ \left(\frac{492}{548}\right) = 786.7$$

Nomenclature is the same as particulate equation and MW = molecular weight of gas, for CO MW = 28

STATE OF ARKANSAS
DEPARTMENT OF POLLUTION CONTROL AND ECOLOGY
8001 National Drive
Little Rock, Arkansas 72209

April 3, 1972

MEMORANDUM TO: S. Ladd Davies, Director
Jarrell Southall, Chief-Air Division

Test results and evaluation of a prototype control device for charcoal kilns are attached to this memorandum. The developers of this device feel that it can be modified to control cotton gin emissions as well as a number of other applications.

John A. Mitchell _____
Chemist II

Calvin Ed. White _____
Ecologist II

mar

# SOURCE TEST OF CHARCOAL KILN CONTROLLED EMISSIONS

On March 15, 1972, two staff members of the Department of Pollution Control and Ecology made tests to determine the effectiveness of a control device attached to a fifteen cord capacity "Missouri type" charcoal kiln. The kiln was located approximately three miles northeast of Gassville, Arkansas, on property owned by Charles Kelly.

## Test Methods

The tests were made during the first eighteen hours of a five and one half day process. The test were of two types: (1) An Orsat analysis for the determination of gases--oxygen, carbon dioxide and carbon monoxide and (2) A particulate matter test performed according to method number 5 of Federal Register Volume 36, Number 159 of Tuesday, August 17, 1971.

## Test Results and Evaluation

The first period of testing started at approximately 7:00 the morning of March 15, 1972. Preliminary tests and calculations required slightly less than two hours. The particulate matter test consisted of six separate ten minute tests--the first starting at 9:05 a.m. and ending at 9:15 a.m., the remaining five test periods were started at successive one hour intervals leading to the end of the last period at 2:05 p.m. The second period of tests started at 6:20 p.m. and ended at 11:30 p.m. Orsat tests were made between each particulate sampling interval.

The attached data sheets show the emission rates calculated from the test data. The maximum downwind concentrations calculated using the Arkansas Engineering Guide on dispersion show the average particulate concentration to be approximately one fifth of the 75 ug/$M^3$ allowed by the Arkansas Air Code. These figures were produced using equation 26c of the Engineering Guide. The maximum carbon monoxide reading from the Orsat analysis was used in equation 26b of the Engineering Guide to calculate the maximum downwind concentration in parts per million. The figure was 1.46 parts per million (1678 ug/$M^3$). This is compared to 8 ppm which is the 8 hour average ambient standard set by EPA.

Interest was expressed by developers of the device as to its efficiency with respect to the Air Quality regulations of Missouri and Oklahoma as well as those of Arkansas. It has already been noted that the 75 ug/$M^3$ 24 hour average downwind concentration regulation of the Arkansas Air Code is

easily met. The Number 1 Ringelmann or 20% opacity visible emissions requirement for new installations is also easily met.

The Number 1 Ringelmann, Regulation No. 7, of the Oklahoma Clean Air Act is easily met.

The Oklahoma Clean Air Act contains a process weight table, Regulation No. 8. The charcoal kiln under study was of fifteen cord capacity. This kiln was filled with unseasoned hardwoods. An arbitrary weight of 3500 pounds per cord will be used for calculation purposes. The time of the coaling process was 131 hours. Therefore, the process weight per hour was approximately 400 pounds. The emission rate of the second test was 0.180 lbs per hour. This would be less than one seventh of the 1.40 lb/hr allowed by Regulation No. 8.

The authors of this report are not in possession of a Missouri Air Code; however, we shall assume that visible emissions are no more stringent than the No. 1 Ringelmann of Arkansas and Oklahoma and that particulate matter regulations are no more stringent than those of the process weight table on page 15496 of Federal Register Volume 36, Number 158 of August 14, 1972. This table allows 1.32 lbs per hour for a process weight rate of 400 lbs per hour. The second test rate is well below this amount.

## Conclusions

If these tests were made simply to determine whether or not an industry is operating in compliance with air quality regulations, our findings would certainly establish that it is. However, our tests were made on a prototype device which will likely find its greatest use on kilns with eight times the process weight rate of the demonstration kiln; that is, two sixty cord kilns in simultaneous operation which will require no more coaling time than the 15 cord kiln. While the authors of this report have been assured that the device will perform as well under the higher rate conditions, it should be pointed out that the builder and operator of the prototype machine is widely respected for his expertise in the charcoaling industry and that the effectiveness of the device might suffer in less experienced hands.

While the undersigned feel that the above facts should be pointed out, they are not meant to cast doubt upon the integrity of the test conditions. To the contrary, the type of test and the times of tests were of our own choosing; our only limitation was that we were not allowed to examine the device due to the fact that patent rights have not been established.

Based on a figure of 850 pounds of charcoal per cord, $9 per cord for unseasoned wood stacked in a 60 cord kiln, and a price of $37.50 per ton of charcoal at the briquette plant, a sixty cord kiln should yield approximately $900 before operating and handling expenses. Assuming that good management practices yield $500 net profit per kiln as the industry is now conducted and a kiln is coaled 15 times per year, the yearly net profit for two simultaneously operating kilns would be $15,000.00. If we take an installed price of $7,500 for the control device and assume a useful life of six years, then the cost per burn would be approximately $42.00. An additional operating cost of at least $0.50 per hour will be used for calculation purposes although the developers of the device feel that it can be operated for much less and that this will be off-set by an increased yield of charcoal. These figures will give a total cost of approximately $110 per burn. If we assume that the device gives no additional yield of charcoal, an additional charge of $2.20 per ton to the briquette plant would be necessary to off-set the operating expense increase to the industry.

The above estimates of yields of charcoal from unseasoned wood were made using "Forest Products Laboratory Report No. 2213", July 1961, as reference.

In view of the fact that complaints concerning charcoal kilns have increased, and the fact that all "Missouri type" kilns are operating in violation of the Arkansas Air Code, it is recommended that this Department encourage the manufacture and distribution of this or similar devices.

Equation (26c) is used to find $C_m$ in ug/M$^3$

Test #1

$$C_m = \frac{\text{Emission Rate lb/hr}}{13.2 \times 10^{-6}(V_s)(d_s)[1.5+0.82(.667)(\frac{770}{1300})]22}$$

$$C_m = \frac{0.106}{(13.2 \times 10^{-6})(28.9)(.667)[1.5 + 0.82(.667)(\frac{770}{1300})]22}$$

$C_m = 10.38$ ug/M$^3$

Test #2

$$C_m = \frac{\text{Emission Rate lb/hr}}{13.2 \times 10^{-6}(V_s)(d_s)[1.5 + 0.82(d_s)(\frac{\Delta T}{T_s})]a_s}$$

$$C_m = \frac{0.180}{13.2 \times 10^{-6}(24.2)(.667)[1.5 + 0.82(.667)(\frac{600}{1330})]22}$$

$C_m = 21.00$ ug/M$^3$

A maximum reading during the tests of 1.6 percent (wet basis) carbon monoxide was recorded. Due to the magnitude of this reading with respect to all others made during the tests, its validity is questionable. However, this concentration is approximately 14.7 pounds per hour as determined by flow data of second test..

1.6% (Orsat reading adjusted to wet basis)
28 lb mole
359 ft$^3$ occupied by lb mole
198 ft$^3$/min flow rate-standard conditions
60 min/hr

$\frac{(.016)(28)(198)(60)}{(359)}$ = 14.7 lb/hr CO Emission Rate

Equation (26b) of Arkansas Engineering-guide on Dispersion is used to get $C_m$ in parts per million

$$C_m = \frac{\text{Emission rate lb/hr}}{5.58 \times 10^{-7}\ (28)(24.2)(.667)[1.5 + 0.82(.667)(\frac{600}{1330})]22}$$

$C_m = 1.46$ ppm or 1678 ug/M$^3$

This is far below the national standard of 9 ppm.

JOB Charles Kelly Kiln DATE March 15, 1972

SAMPLING LOCATION Mountain Home RUN NO. 1

## GAS VELOCITY DATA

A. Average Velocity (Traverse) Ft/Sec. 29.5 (Pitot corrected)

B. Pitot Correction Factor .855

C. Gas Density Correction Factor .98

D. Corrected Velocity, AxBxC, Ft/Sec. 28.9

E. Area of Flue, Sq. Ft. .349

F. Flow Rate, DxE:60, CFM 600

G. Flow Rate, 520xF/($T_s$+460), SCFM $\frac{(520)(605)}{1300} = \frac{314,500}{1300} = 242$

## SAMPLING TRAIN DATA AND CALCULATIONS

MATERIAL COLLECTED

WEIGHT COLLECTED, GRAMS:

| | |
|---|---|
| Filter & Glass | 0.09346 |
| Condensables | 0.05259 |
| Probe | 0.03127 |
| | .18732 |

A. Total Weight 0.18732

B. Stack Gas Flow Rate, SCFM 240

C. Condensate Volume, ML. 67.6

D. Condensate Vapor Volume, .00047 x C x (460+$T_m$)/(29.9-$P_m$), Cu. Ft. 3.3

E. Total Sampled Volume, $V_m$ + D, Cu.Ft. 50.2

F. Sampled Volume, 520xDx(29.9-$P_m$)/29.9x(460+$T_m$), SCF $\frac{(520)(50.2)}{547} = 50.$

G. Concentration, 15.43xB/F, Grains/SCF $\frac{(15.43)(.18726)}{50.3} = .051$

F. Material Flow Rate, 60xGxB/7000, Lbs./Hr. $\frac{(60)(.0513)(242)}{7000} = 0.106$

JOB Charles Kelly Kiln DATE ~~March 15, 1973~~

SAMPLING LOCATION Mountain Home RUN NO. 2

## GAS VELOCITY DATA

A. Average Velocity (Traverse) Ft/Sec. 23.95 (Pitot corrected)

B. Pitot Correction Factor .855

C. Gas Density Correction Factor 1.01

D. Corrected Velocity, AxBxC, Ft/Sec. (23.95)(1.01) = 24.2

E. Area of Flue, Sq. Ft. .349

F. Flow Rate, DxEx60, CFM (24.2)(.349)(60) = 506

G. Flow Rate, $520xP/(T_s+460)$, SCFM $\frac{(520)(506)}{1320} = 198$

## SAMPLING TRAIN DATA AND CALCULATIONS

MATERIAL COLLECTED

WEIGHT COLLECTED, GRAMS:

| | |
|---|---|
| Filter & Glass | .07337 |
| Condensables | .02977 |
| Probe | .10533 |
| | .20847 |

A. Total Weight .20847

B. Stack Gas Flow Rate, SCFM 198

C. Condensate Volume, ML. 118.8

D. Condensate Vapor Volume, $.00267 \times C \times (460+T_m)/(29.9-P_m)$, Cu. Ft. 5.76

E. Total Sampled Volume, $V_m + D$, Cu.Ft. 31.64

F. Sampled Volume, $520xEx(29.9-P_m)/29.9x(460+T_m)$, SCF $\frac{(520)(31.64)}{532} = 30$

G. Concentration, 15.43xC/F, Grains/SCF $\frac{(15.43)(.20847)}{30.9} = .101$

H. Material Flow Rate, 60xGxB/7000, Lbs./Hr. $\frac{(60)(.101)(198)}{7000} = .172$

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 5/30/78 | Time 5:00 p.m. |
| Person Calling Peter Hulman | Activity |
| Person Called Paul Cox | Activity Dept. of Forestry (Sacramento) (916) 322-4898 |
| General Subject Wood charcoal industry in California | |

TOPICS DISCUSSED AND ACTION TAKEN

Will mail available information.

Basically, there was once a fairly large industry that has been cut into by cheap Mexican charcoal. Local farmers have pretty much stopped production. Much charcoal is imported from Oregon. Most remaining charcoal is made by wood by-products industry, e.g., sawmills and pulpmills. Some of the industry uses agricultural products such as peach pits and rice hulls.

Suggests that State Department of Forestry may have more information than air control department.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 6/26/78 | Time: |
| Person Calling: Peter Hulman | Activity: |
| Person Called: Troy Smith | Activity: Kingsford in Elk Grove, CA (916) 685-3925 |
| General Subject: Wood charcoal industry in California | |

TOPICS DISCUSSED AND ACTION TAKEN

Raw materials are:

Walnut shells
Almond shells
Peach pits
Apricot pits

San Jose (Milpitas) plant still in operation. Retorts use same materials as Elk Grove plant.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 6/30/78 | Time |
| Person Calling Peter Hulman | Activity |
| Person Called Terry McGuire | Activity Stationary Source Emissions Dept., California Air Resource Board |
| General Subject California Air Regulations | |

TOPICS DISCUSSED AND ACTION TAKEN

Will send me a list of district regulations. Might not be current. Suggests calling up each district.

In general,

CO - Few districts have regulations. Usually 2000 ppm CO from stack.

Particulate - all have two or three of following:

1) Stack gas concentration limit varies from .1 to .3 grains/scf
2) Process weight rate tables and charts very complex
3) Visible emissions - Ringlemann #1 or #2

HC - all pretty high.

STATE OF CALIFORNIA—RESOURCES AGENCY EDMUND G. BROWN JR., Governor

DEPARTMENT OF FORESTRY
1416 NINTH STREET
SACRAMENTO, CALIFORNIA 95814
(916) 445-5571

RESOURCE MANAGEMENT
Improved Timber Harvesting

May 31, 1978

R/16 - 5/31

Mr. Peter Hulman
Radman Corporation
P. O. Box 9948
Austin, Texas 78766

Dear Mr. Hulman:

I am enclosing copies of three publications on charcoal manufacturers and charcoal bricquet manufacturers in California. Unfortunately, the last survey was the one done in 1961. Many on the list are out of business by now, I am sure. One additional producer is C. B. Hobbs Company located in both Milpitas and Elk Grove. Phone numbers are: (408) 262-3550 and (916) 685-3925 respectively.

I hope this information is of some help.

Sincerely,

J. C. Denny, Chief
Resource Management

By:
Mark R. Stanley
Forester II
(Improved Timber Harvesting)

nr

Encls.

# CHARCOAL PRODUCTION IN THE UNITED STATES

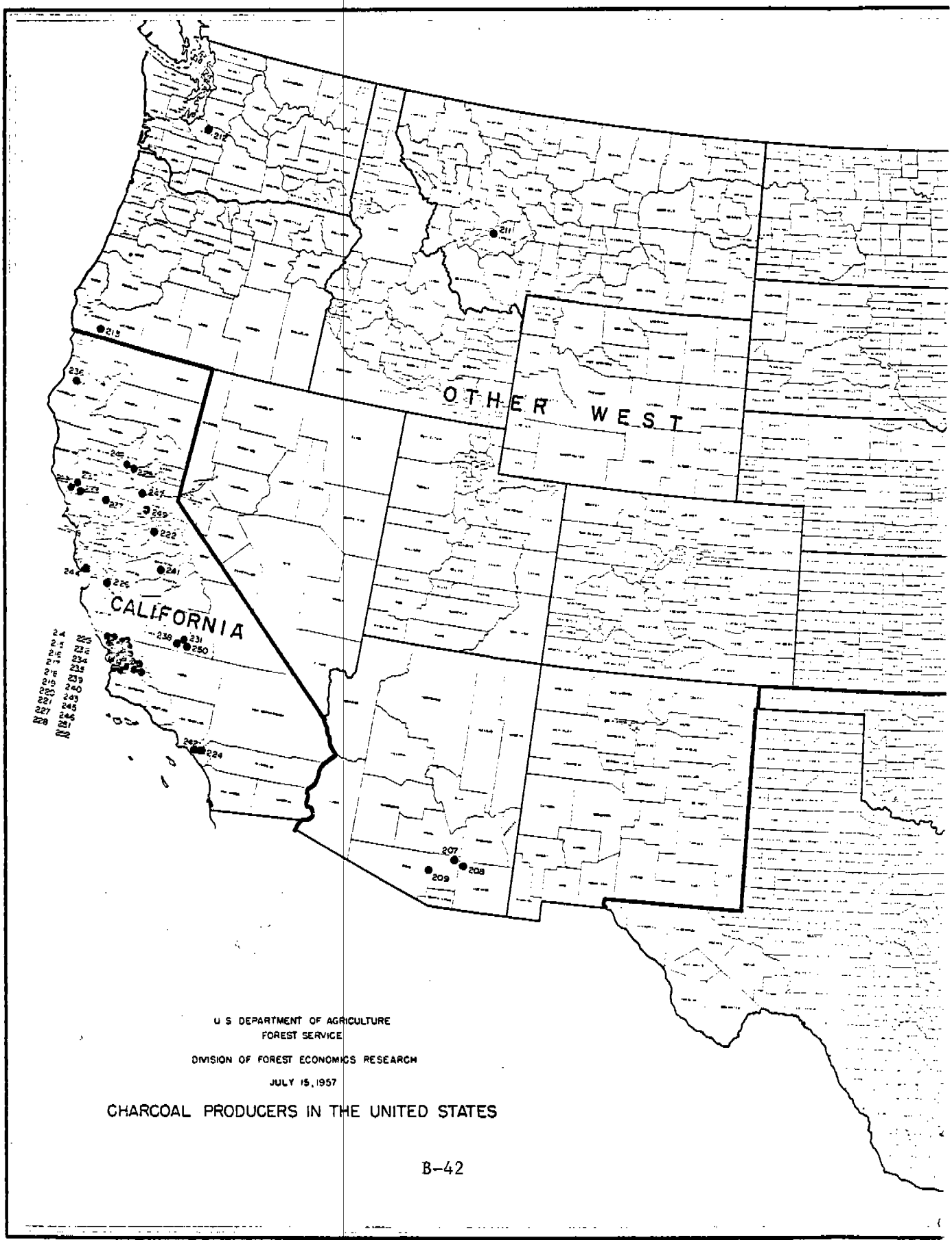

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
DIVISION OF FOREST ECONOMICS RESEARCH
JULY 1957

| Producers No. | Name | Post Office Address | Plant Location |
|---|---|---|---|
| | PACIFIC NORTHWEST (Continued) | | |
| | Oregon: | | |
| 213 | Jigg's Charcoal | Rt. 1, Box 596, Cave Junction | Illinois Valley |
| | CALIFORNIA | | |
| | California: | | |
| 214 | Alvarez, Frank | Rt. 1, Box 309, Atascadero | Same |
| 215 | B & H Charcoal Co. | Box 40, Templeton | Same |
| 216 | Ballasteros, Ubaldo | Box 23, Paso Robles | Same |
| 217 | Barajas, Mike | Rt. 1, Box 315, Atascadero | Paso Robles |
| 218 | Baroglio, Miles | Paso Robles | Same |
| 219 | Barraza, Pedro Molina | 1126 19th St., Paso Robles | Same |
| 220 | Bassi, Fred | Rt. 1, Box 119, Templeton | Same |
| 221 | Busi, Jim | RFD, Box 97, Templeton | Paso Robles |
| 222 | Calaveras Firewood Corp. | Box 814, Murphys | Altaville |
| 223 | California Charcoal Co. | 10437 Redwood Hgwy., Healdsburg | Same |
| 224 | California Charcoal Products | 1121 National Ave., National City | Santa Ysabel |
| 225 | Chudas, Martin | Adelaida | Same |
| 226 | Flores, Juan C. | 1109 Lime Kiln Rd., Hollister | Same |
| 227 | Franklin Bros | Creston Star Rt., Paso Robles | Same |
| 228 | Galbreath, O. W. | Corbett Canyon Rd., Arroyo Grande | Same |
| 229 | Gates, LeRoy | Rt. 1, Templeton | Same |
| 230 | Gregory, Lawrence | Box 62, Healdsburg | Geyserville |
| 231 | Griswold, A. O. | Star Rt. 2, Springville | Same |
| 232 | Heaton, Alfred | Rt. 1, Box 66A, Paso Robles | Same |
| 233 | Hooper, D. B | 1867 North Fitch Mt. Rd., Healdsburg | Geyserville |
| 234 | Iversen, Roland E. | Bank of America Bldg., Paso Robles | Union |
| 235 | James Bros. | Box 337, Atascadero | Same |
| 236 | Jones, Weldon, & Bardo Estrado | 1440 Railroad Ave., Paso Robles | Willow Creek and Dover Canyon |
| 237 | Kelly Wood Products. | Box 118, Madison | Same |
| 238 | Killian, Roland R. | Star Rt. 2, Springville | Same |
| 239 | Lopez, Victor & Pilar Maduena | 1146 1/2 19th St., Paso Robles | Same |
| 240 | Maduena, Juan | Box 201, Paso Robles | Same |
| 241 | Mariposa Charcoal Co. | Box J., Mariposa | Same |
| 242 | Nehu, Delmar | Santa Ysabel | Same |
| 243 | Padilla, Pascual | Box 371, Paso Robles | Same |
| 244 | Palomar Charcoal Co | Box 457, Pauma Valley | Rincon |
| 245 | Pena, A. M. | Rt. 1, Templeton | Same |
| 246 | Pesenti, Frank | Rt. 1, Templeton | Same |
| 247 | Placer Charcoal Co. | Box 16, Applegate | Same |
| 248 | Rosales, Jacinto[3]/ | Adelaida | Same |
| 249 | Stollmeyer, Henry | Rt. 3, Box 267, Placerville | Same |
| 250 | Talbot, Courtney | Springville | Same |
| 251 | Thomas, Dorman | Rt. 1, Templeton | Same |
| 252 | Walker, Everett E. | Adelaide Rt., Paso Robles | Same |

[1] Idle in 1956.
[2] Under construction.
[3] Reported to be out of business in 1957.



GPO - 928000


OTHER WEST
CALIFORNIA
U S DEPARTMENT OF AGRICULTURE
FOREST SERVICE
DIVISION OF FOREST ECONOMICS RESEARCH
JULY 15, 1957
CHARCOAL PRODUCERS IN THE UNITED STATES

1954

Wood Charcoal Operators in California

| County | City | Name and Address |
|---|---|---|
| Calaveras | Murphys | Harold Kreisher, Calaveras Firewood Corp., Box 814 |
| Eldorado | Placerville | Henry Stollmeyer, Rt. 3, Box 267 |
| Humboldt | Ft. Seward | McAlister Duncan |
| Los Angeles | Compton | Cross-Pacific Co., 19506 S. Alameda St. |
| " " | San Ferrando | Larry Collins, United Rubbish Co., P.O. Box 477 |
| " " | Venice | Carmen Vasquez |
| " " | West Los Angeles | Roy Industries, 1643 Westwood |
| Mariposa | Mariposa | Mariposa Charcoal Co., Box J. |
| Monterey | Seaside | Ignacio Flores, 14 Lakeview Terrace |
| Placer | Applegate | Placer Charcoal Co., Rt. 3, Box 16 |
| Sacramento | Rio Linda | A. G. Richter, Pelco Sales Corp., Box 147 |
| San Benito | Hollister | Juan C. Flores, 1109 Lime Kiln Rd. |
| San Diego | National City | California Charcoal Products, 1121 National Ave. |
| " " | Romaland | Smith |
| " " | Santa Ysabel | Delmar Nehu |
| San Francisco | San Francisco 3 | Charcoal Specialties, Inc., 288 - 7th Street |
| San Luis Obispo | Adelaida | Martin Chudas |
| " " " | Arroyo Grande | O. W. Galbreath, Corbett Canyon Rd. |
| " " " | Atascadero | Frank Alvarez, Rt. 1, Box 309 |
| " " " | " | Mike Barajas, Rt. 1, Box 315 |
| " " " | " | James Bros., Box 337 |
| " " " | Paso Robles | Ubaldo Ballasteros, Box 23 |
| " " " | " " | Miles Baroglio |
| " " " | " " | Pedro Molina Barroza, 1116 - 19th St. |

| County | City | Name and Address |
|---|---|---|
| San Luis Obispo | Paso Robles | Comstock Limited, Wilsonia Rd. |
| " " " | " " | Franklin Bros., Creston Star Rd. |
| " " " | " " | Alfred Heaton, Rt. 1, Box 66A |
| " " " | " " | Roland E. Iverson, Bank of America Bldg. |
| " " " | " " | James, Weldon & Bardo Estrado, 1440 Railroad Ave. |
| " " " | " " | Lopez, Victor & Pilor Maduena, 1146 1/2 - 19th St. |
| " " " | " " | Juan Maduena, Box 201 |
| " " " | " " | Pascual Padilla, Box 371 |
| " " " | " " | Art Trussler, Charcoal Industries, P.O. Box 182 |
| " " " | " " | Everett E. Walker, Adelaide Rt. |
| " " " | Templeton | B & H Charcoal Co., Box 40 |
| " " " | " | Fred Bassi, Rt. 1, Box 119 |
| " " " | " | Jim Busi, RFD, Box 97 |
| " " " | " | LeRoy Gates, Rt. 1 |
| " " " | " | A. M. Pena, Rt. 1 |
| " " " | " | Frank Pesenta, Rt. 1 |
| " " " | " | Dorman Thomas, Rt. 1 |
| Santa Clara | Alviso | Colliers |
| " " | San Jose | Margil Products, 695 Lincoln Ave. |
| Shasta | Redding | Actures Manufacturing Co. |
| " | " | Jess Graves, Shasta Forests Co., Athens Ave. |
| Sonoma | Healdsburg | California Charcoal Co., 10437 Redwood Hwy. |
| " | " | D. B. Hooper, 1867 N. Fitch Mountain Rd. |
| " | " | Lawrence Gregory, Box 62 |
| Tulare | Porterville | William Dye, Rt. 4, Box 140 |

| County | City | Name and Address |
|---|---|---|
| Tulare | Springville | A. O. Griswold, Star Rt. 2 |
| " | " | Roland R. Killian, Star Rt. 2 |
| " | " | Courtney Talbot |
| Yolo | Madison | Kelly Wood Products, Box 118 |
| | | Country Club Charcoal Corp. |

# Charcoal and Charcoal Briquette Production in the United States, 1961

U. S. DEPARTMENT OF AGRICULTURE.....FOREST SERVICE
DIVISION OF FOREST ECONOMICS AND MARKETING RESEARCH

FEBRUARY 1963

| State, name, and producer No. | Post office address[1] |
|---|---|

SOUTHERN (continued)

| | |
|---|---|
| Texas: | |
| B. & B. Charcoal Co. | P. O. Box 314, Flatonia |
| Campfire Charcoal Co., Inc.[2] | Navasota |
| Craven, Wallace | Route #1, Box 175, Roanoke |
| Forest Research Co.[3] | 3810 Westheimer Road, Houston (College Station) |
| Lone Star Charcoal Co.[4] | P. O. Box 546, Quitman |
| Lone Star Charko[4] | P. O. Box 1551, Wells |
| McCombs Charcoal Co. | Pittsburg (Dukes Chapel Road) |
| Moore Charcoal Co.[2] | Route #10, Box 120, Tyler |
| National Charcoal Co. | P. O. Box 4123, San Antonio (Muldoon) |
| Smith, Derwood[4] | P. O. Box 1077, Wells |

OTHER WEST

| | |
|---|---|
| Arizona: | |
| 289. Charkete Products Co. | Redington |
| 290. Tucson Tallow Co.[3] | 2938 N. Fairview Road, Tucson |
| Kansas: | |
| 291. Chetopa Charcoal Co.[2] | Chetopa |
| 292. Jayhawk Charcoal Co.[2] | Chetopa |
| Montana: | |
| 293. Big Bear, Inc.[2] | Pablo |
| Oregon: | |
| 294. Jigg's Charcoal Co. | Route #1, Cave Junction |
| Utah: | |
| 295. D. & C. Charcoal Co. | P. O. Box 727, Cedar City |
| 296. Pyrmid Charcoal Briquette Co.[3] | Cedar City |
| Washington: | |
| 297. Elbe Charcoal | Box 334, Elbe |
| 298. King County Charcoal, Inc.[3] | P. O. Box 524, Auburn |

CALIFORNIA

| | |
|---|---|
| California: | |
| Alvarez, Frank | Route #1, Box 155, Atascadero |
| Bar-B-Glo Co. | Tulare (Springfield) |
| Bergman, Louis | R.D. #1, Box 88, Paso Robles |
| Bidstrup, Walter | Eldorado |
| Busi, Jim | R.D. Box 173, Templeton |
| Calaveras Firewood Corp. | Box 356, Murphys (Bear Mtn. Ranch) |
| California Charcoal Products | 1121 National Avenue, National City (Santa Ysabel) |
| Chaides, Frank | 1523 Pine Street, Paso Robles (Adelaide District) |
| Dunham, Marion and Charles Ritchie | Route #1, Box 198, Templeton (Dover Canyon) |
| Flores, Juan C. | 1109 Limekiln Road, Hollister |
| Fort Seward Hardwood Mfg. Co.[3] | Box 80, Fort Seward |

e footnotes page 25.

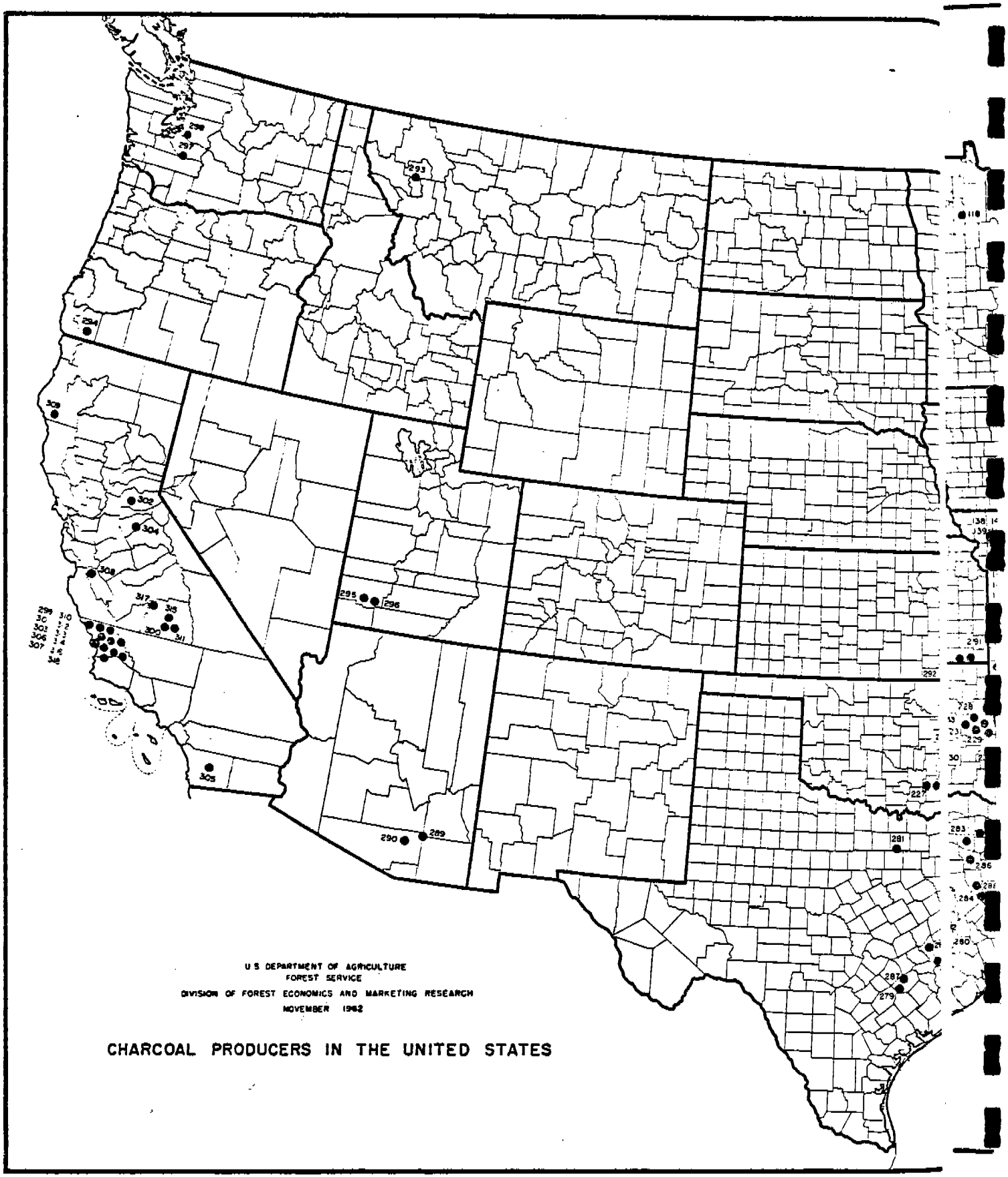
| State, name, and producer No. | Post office address[1] |
|---|---|

CALIFORNIA (continued)

California (con't.):

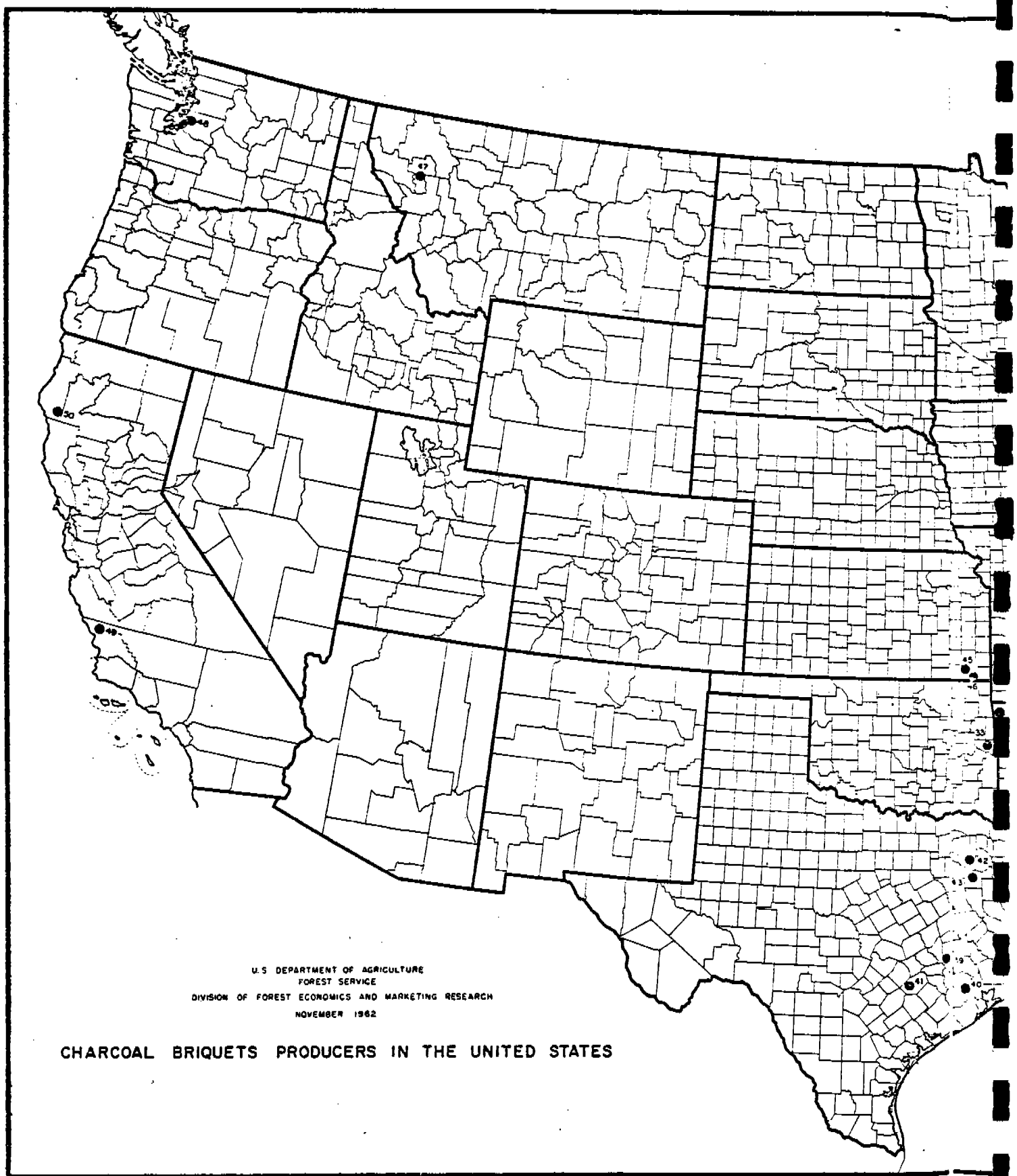
| | | |
|---|---|---|
| [redacted] | Gates, Leroy | R.D. Route #1, Box 187, Templeton |
| [redacted] | Griswold, A. O. & Son | Route #2, Box 255, Springville |
| [redacted] | Galbreath, O. W. | Corbett Canyon Road, Arroyo Grande |
| [redacted] | Glenbrook Charcoal | Route #1, Box 196, Templeton (York Mtn. Road) |
| [redacted] | Guerero, Jose | Santa Margarita |
| [redacted] | Linder, Reynold | 100 Oakmore, Tulare (Yokohl Valley) |
| [redacted] | Maduena, Juan | 2630, Riverside Avenue, Paso Robles |
| [redacted] | McGee & Son | Star Route, Orosi |
| [redacted] | Walker, Everett E. | Route #1, Box 197-B, Paso Robles |

[1] Towns in parenthesis show plant location.
[2] Manufactures briquettes.
[3] Idle in 1961.
[4] Did not report 1961 production.
[5] New in 1962.
[6] Plant operated in 1961, but individual plant data unavailable.


U S DEPARTMENT OF AGRICULTURE
FOREST SERVICE
DIVISION OF FOREST ECONOMICS AND MARKETING RESEARCH
NOVEMBER 1962
CHARCOAL PRODUCERS IN THE UNITED STATES

| State, name, and producer No. | Post office address[1] |
|---|---|
| **OTHER WEST** | |
| Kansas: | |
| 45. Chetopa Charcoal Co. | Chetopa |
| 46. Jayhawk Charcoal Co. | Chetopa |
| Montana: | |
| 47. Big Bear, Inc. | Pablo |
| Washington: | |
| 48. Western Charcoal Corp. | 2423 1st Street, Seattle (Renton) |
| **CALIFORNIA** | |
| California: | |
| [redacted] Charcoal Industries | P. O. Box 182, Paso Robles (Adalaide Road) |
| [redacted] Fort Seward Hardwood Mfg. Co. | Box 80, Fort Seward |

[1] Towns in parenthesis show plant location.
[2] New in 1962.




CHARCOAL BRIQUETS PRODUCERS IN THE UNITED STATES

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 7/2/78 | Time: |
| Person Calling: Peter Hulman | Activity: |
| Person Called: | Activity: Air Pollution Control Division |
| General Subject: Wood charcoal industry in Colorado | |

TOPICS DISCUSSED AND ACTION TAKEN

No industry.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 5/31/78 | Time: |
| Person Calling: Steve Killingsworth | Activity: |
| Person Called: John Eichler | Activity: Air Enforcement Section, Division of Environmental Quality, Dept. of Environmental Protection (203) 566-3233 |
| General Subject: Wood charcoal industry in Connecticut | |

TOPICS DISCUSSED AND ACTION TAKEN

Mr. Eichler requested that a letter be sent. A letter was written to Mr. Eichler and the attached letter was his response.

STATE OF CONNECTICUT

DEPARTMENT OF ENVIRONMENTAL PROTECTION

STATE OFFICE BUILDING HARTFORD, CONNECTICUT

June 14, 1978

Mr. Steven Killingsworth
Radian Corporation
8500 Shoal Creek Blvd.
P.O. Box 9948
Austin, Texas 78766

Dear Steve:

As requested in your letter to me on June 6th, enclosed is all the available information we have on file regarding our two Wood Charcoal Manufacturing Firms in Connecticut.

Since both companies are EPA major sources and already in C.D.S, additional information can be obtained by contacting EPA Region 1 telephone #617-223-5610 c/o Steven P. Fradkoff.

Sincerely yours,

John J. Eichler
Principal APC Engineer
Air Enforcement Stection
Room 133
203-566-3223

JJE:bw
enc.

| ITEM | COMPANY ONE | COMPANY TWO |
|---|---|---|
| 1 | Hadfield Hardwood Charcoal<br>Pine Hill Rd., Sterling | Connecticut Charcoal Company<br>623 Buckley Hwy., Union |
| 2 | Myron Hadfield<br>203-564-8907 | Ruth G. Rome<br>203-684-3208 |
| 3 & 4 | (8) 4 cord capacity kilns<br>1 week cure cycle<br>2 T per kiln product | (7) 150 cord capacity kilns<br>1 week cure cycle<br>75 T per kiln product |
| 5 | None | None |
| 6 | N/A | N/A |
| 7 | No | No |
| 8 | N/A | N/A |

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| Project No. | Distribution |
|---|---|
| 200-187-32 | |
| **Project Name** | |
| Wood Charcoal | |
| **Date** | **Time** |
| 6/7/78 | |
| **Person Calling** | **Activity** |
| Steve Killingsworth | |
| **Person Called** | **Activity** |
| Robert R. French | Manager of Air Resources, Delaware (302) 678-4791 |
| **General Subject** | |
| Wood charcoal industry in Delaware | |

**TOPICS DISCUSSED AND ACTION TAKEN**

No charcoal industry in Delaware according to Robert R. French.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 6/7/78 | Time 9:30 a.m. |
| Person Calling Steve Killingsworth | Activity Radian |
| Person Called Jim Shaw | Activity Orlando area office, Air Quality Management, Bureau, Dept. of Environmental Regulation (305) 894-7114 |
| General Subject Husky Industries, Ocala, Fla. Herreshoff furnace | |

TOPICS DISCUSSED AND ACTION TAKEN

1) Location and name: Husky Industries, Ocala, Florida
2) Owner: Husky Industries
3) Capacity: 5.5 tons/hr wood chips input to the Herreshoff furnace (8 hearth, 54 inch diameter furnace); sawdust and off gases used to fire furnace; diesel used in cold start-up
4) Existing Controls: 2 flares on top of furnace; have been meeting standards by all visible emissions; no emissions data
5) No economic information
6) Past, future: no information
7) Local regulations: no information
8) Other Agencies: no information

Comments:

Briquetting plant adjacent to furnace; saw mill close by is source of raw materials.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 6/9/78 | Time |
| Person Calling Peter Hulman | Activity Radian |
| Person Called Bill Brown | Activity Tampa Office, Dept. of Environmental Regulations |
| General Subject Husky Industries, Romeo, Fla. | |

TOPICS DISCUSSED AND ACTION TAKEN

3) 2 Rotary kilns, 15,000 lbs input/hr, operate 7 days/week, 24 hrs/day, 52 wks/yr Used to make activated carbon. They used to use a lot of wood, but now they use any source of carbon. Currently, they list bark boiler ash as their source. The kiln used to be gas fired, but is now probably oil fired.
4) Baghouse for transport to storage - 99% efficient
6) They have old beehive kilns which have been shut down. They may have others elsewhere.

Comments:

Suggested calling to plant at (904) 489-3336 and talking to Mr. Duffy.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 5/24/78 | Time: |
| Person Calling: Steve Killingsworth | Activity: |
| Person Called: Paul Butz | Activity: Georgia Forestry Commission (912) 744-3241 |
| General Subject: Wood charcoal industry in Georgia | |

TOPICS DISCUSSED AND ACTION TAKEN

According to Mr. Butz, there is no charcoal industry in Georgia today; the last major charcoal producer went out of business 15 years ago; one small beehive-type plant operated for a short period of time ten years ago.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date | Time |
| Person Calling Peter Hulman | Activity |
| Person Called Richard Johnson | Activity Bureau of Air Quality (208) 384-2390 |
| General Subject Wood charcoal industry in Idaho | |

TOPICS DISCUSSED AND ACTION TAKEN

None on inventory. Never permitted yet, nor expected to in future.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date | Time |
| Person Calling: Peter Hulman | Activity |
| Person Called: Bill Miller | Activity: EPA, Division of Air Pollution Control, Springfield, IL (217) 782-2113 |
| General Subject: Wood charcoal industry in Illinois | |

**TOPICS DISCUSSED AND ACTION TAKEN**

As far as he can figure, there is no wood charcoal industry in Illinois. He believes that there used to be 1 plant that was closed down in 1972, probably due to noncompliance.

1) None
6) One closed done in 1972

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 6/7/78 | Time: |
| Person Calling: Steve Killingsworth | Activity: |
| Person Called: Bob Ondrusek | Activity: Air Pollution Control Division, IN (317) 633-0600 |
| General Subject: Wood charcoal industry in Indiana | |

TOPICS DISCUSSED AND ACTION TAKEN

No charcoal industry in Indiana as per Bob Ondrusek.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 6/7/78 | Time: |
| Person Calling: Steve Killingsworth | Activity: |
| Person Called: Rich Mercer | Activity: Air Quality Management Division, Iowa (515) 281-8922 |
| General Subject: Wood charcoal in Iowa | |

TOPICS DISCUSSED AND ACTION TAKEN

No wood charcoal industry in Iowa as per Rich Mercer.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| Project No. | Distribution |
|---|---|
| 200-187-32 | |
| Project Name: Wood Charcoal | |
| Date: 6/9/78 | Time: |
| Person Calling: Steve Killingsworth | Activity: Radian |
| Person Called: Howard Duncan | Activity: Environmental Sanitation, (913) 862-9360 |
| General Subject: Wood Charcoal Industry in Kansas | |

TOPICS DISCUSSED AND ACTION TAKEN

1) Location and name: Jayhawk Charcoal Co., Inc.
412 Maple
Chetopa, Kansas (316) 236-7256

No more information.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 6/20/78 | Time 2:00 p.m. |
| Person Calling Steve Killingsworth | Activity Radian |
| Person Called David Gravely | Activity Division of Air Pollution, Kentucky |
| General Subject Herreshoff furnace off-gas usage at Burnside, Kentucky plant | |

TOPICS DISCUSSED AND ACTION TAKEN

Exit gases are combusted in an incinerator which has a stack (some emissions out of this stack during start up); the hot combusted gases from the incinerator are used to dry sawdust and wood chips going to the furnace; from the dryer these gases are exited through a cyclone to the atmosphere.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| Project No. | |
|---|---|
| 200-187-32 | |
| **Project Name** | |
| Wood Charcoal | |
| **Date** | **Time** |
| 5/24/78 | 9:30 |

Distribution

| Person Calling | Activity |
|---|---|
| Steve Killingsworth | Radian |
| **Person Called** | **Activity** |
| Daniel Gravely | Division of Air Pollution (502) 564-6844 |

General Subject: Wood Charcoal Industry in Kentucky

**TOPICS DISCUSSED AND ACTION TAKEN**

1) Location: Burnside, Kentucky (1 mile outside of city limits)
2) Owner: Kingsford Co.
3) Capacity and Type: 20 concrete rectangular kilns with cylindrical roofs (probably Missouri type) with a capacity of 20 cords of wood per kiln; takes approximately 1 week for each run. One Herreshoff 5 hearth furnace which uses sawdust and wood chips, capable of producing 100 tons/day; continuous process. 50-60 employees; operates round the clock.
4) Existing Controls: Concrete Rectangular Kilns - oil-fired afterburners; one afterburner connected to 4 kilns; all off gases (condensable and non-condensable) are burned, what is left goes to atmosphere. Herreshoff furnace - closed cycle process; all off gases are used to preheat sawdust and chips entering furnace; no emissions to atmosphere. (See next page for more info) Has taken emissions data.
5) Economic Information: none
6) Past, Present, and Future: 10 yrs ago, 3 Kingsford Co. owned plants performed, approximately 5 yrs ago 2 of these were shut down and the Burnside Plant expanded to its present size; no future growth is expected.
7) Local Regulations: none
8) Other State Agencies in state familiar with the subject: none

Comments:

Cumberland Charcoal Company is a division of Kingsford Co. at Burnside, Kentucky.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 6/2/78 | Time |
| Person Calling Steve Killingsworth | Activity Radian |
| Person Called George Plakotos | Activity Air Quality Section, Bureau of Environ. Serv. (504) 568-5128 |
| General Subject Wood Charcoal Industry in Louisiana | |

TOPICS DISCUSSED AND ACTION TAKEN

Mr. Plakotos said their files are open to the public but that no information could be given out.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 5/24/78 | Time: |
| Person Calling: Steve Killingsworth | Activity: |
| Person Called: John Chandler | Activity: Dept. of Environmental Protection (207) 289-2437 |
| General Subject: Wood charcoal industry in Maine | |

TOPICS DISCUSSED AND ACTION TAKEN

John Chandler said his office originated in 1971 and since then there has been no charcoal industry; one person applied but dropped the idea.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 6/7/78 | Time 2:00 |
| Person Calling Steve Killingsworth | Activity Radian |
| Person Called D. Andrew | Activity Bureau of Air Quality, Dept. of Health & Mental Hygiene (301) 383-2739 |
| General Subject Wood Charcoal Industry in Maryland | |

TOPICS DISCUSSED AND ACTION TAKEN

1) Location and name: Kingsford Company, White Church, Maryland
2) Owner: Kingsford
3) Capacity and type: 5,000 ton/yr lump charcoal from 27,000 ton/yr wood; 10 kilns (probably Missouri-type from description given by D. Andrew); less than 10 employees
4) Existing Controls: 3 oil-fired afterburners operating at 1400°F with a residence time of 1 sec.; no emissions data.
5) Economic Information: none
6) Past, Present, Future: In the past, have had to shut down because of lack of wood; no expansion foreseen for this reason.
7) Local (non-state) Regulations: none
8) Other State Agencies: none

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 6/8/78 | Time: 2:15 p.m. |
| Person Calling: Steve Killingsworth | Activity: Radian |
| Person Called: A. Graichen | Activity: Western Office, Div. of Air & Hazardous Materials Management Control, Dept. of Environmental Quality Engineering (617) 727-5194 |
| General Subject: Wood Charcoal in Massachusetts | |

TOPICS DISCUSSED AND ACTION TAKEN

1) Location and name: Pioneer Valley Charcoal
   Old Coke Kiln Road
   North Leverett, Mass.
2) Manuel Witt (617) 877-2181
3) Capacity and Type: 100 tons/yr lump charcoal produced using 500 cords/yr slab hardwood. Two beehive type kilns. One part-time employee
4) Existing Controls: none
5) Economic Information: none
6) Past, Present, Future: Has always had just 2 kilns; will continue to operate as long as market is there.
7) Local Regulations: no information
8) Other Agencies: none

Robert Donovan (617) 727-2658

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 5/24/78 | Time 1:15 pm |
| Person Calling Steve Killingsworth | Activity Radian |
| Person Called Mr. Kollmeyer | Activity Dept. of Natural Resources, Forestry Div. (517) 373-1275 |
| General Subject Wood Charcoal Industry in Michigan | |

**TOPICS DISCUSSED AND ACTION TAKEN**

1) Location and name: Sugartown Charcoal Co., Second Route, Gladwin, Michigan 48624 (no phone listed)
2) Owner: R. J. Ladd (517) 835-2438 (no answer when I called at 2:00 p.m., 2:15 p.m., 4:15 p.m. 5/24/78), Midland, Michigan
3) Capacity:
   Type of Process: Horizontal Retort
4) Existing Controls;
5) Economics: Principle Product - lump charcoal; wood used - elm, hard and soft maple, red and white oak
6) Past, Present and Future: There were 3 plants in operation years ago, 15 years ago, one shut down, 12 years ago, another, and presently, just one is in operation.
7) Local (non-state) Regulations:
8) Other State Agencies familiar with the wood charcoal industry:

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 5/24/78 | Time |
| Person Calling Steve Killingsworth | Activity Radian |
| Person Called William Rottschaefer, Senior Engr. | Activity Engineering Section, Div. of Air Quality, Minnesota Pollution Control Agency (612) 296-7331 |
| General Subject Wood Charcoal Industry in Minnesota | |

TOPICS DISCUSSED AND ACTION TAKEN

1) Location: Isanti, Minnesota
2) Owner: Husky Industries Inc. , Plant Supt.: Donn Becklin (612) 742-5573
   Box 267
   Isanti, Minnesota 55040
3) Capacity and Type: 6 Missouri type kilns, most recently producing 3600 ton/yr lump charcoal but did produce as much as 10,000 ton/yr in the past. 30-34 employees at this plant.
4) Existing Controls: 3 gas-fired afterburners (off gases [condensable and non-condensable] from 2 kilns piped to one after burner) what is left goes to atmosphere.
   Emissions data: no stack testa taken, only visual inspection of afterburner exhaust.
5) Economic Information: none
6) Past, Present, and Future: Has been only this one plant in state; this plant in the past had produced 10,000 ton/yr lump charcoal but presently is producing 3600 ton/yr. No future growth is foreseen.
7) Local Regulations: none
8) Other State Agencies familiar with the wood charcoal industry: none

Comments:

This plant does have a briquette facility adjacent to it; has baghouse dust collectors for briquetting.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 5/12/78 | Time 3:00 p.m. |
| Person Calling C. S. Collins | Activity |
| Person Called Steve West | Activity MS Air Pollution Control Association (601) 354-7011 |
| General Subject Wood charcoal plants in Mississippi | |

TOPICS DISCUSSED AND ACTION TAKEN

I asked for information on wood charcoal plants in the state. He told me:

- There is one plant in the state - Masonite Corporation in Pachuta.
- No others planned, no expansion planned.
- The Pachuta plant has a predryer which uses the hot gases from the carbonizer, high efficiency cyclones on the carbonizer and predryer, and a pneumatic conveyer from predryer to carbonizer.
- State opacity regulations are 40% by EPA Method 9. Particulate Regulations:

  allowable lb/hr = 4.1 (process wt in tons/hr)$^{0.67}$

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 5/12/78 | Time 3:15 p.m. |
| Person Calling C. S. Collins | Activity |
| Person Called Lee Frost | Activity Masonite Corp., Pachuta, MS (601) 776-2171 |
| General Subject Wood charcoal | |

TOPICS DISCUSSED AND ACTION TAKEN

I asked for information on his plant. He told me:

- They use a gas operated Herreshoff.
- They produce 48,000 tons/yr, 80% of it in Pachuta, MS; 20% in Winnfield, LA.
- They have ∿300 employees.
- They normally expand about 8% a year, plan ∿15% expansion in the next two years with existing facilities.
- Gave me the name Arthur Seeds with Charcoal Briquette Institute who can give more information on other plants.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 6/2/78 | Time: 1:15 p.m. |
| Person Calling: C. S. Collins | Activity: |
| Person Called: Lee Frost | Activity: Masonite Corp., Pachuta, MS (601) 776-2171 |
| General Subject: Wood Charcoal | |

TOPICS DISCUSSED AND ACTION TAKEN

- Both the Pachuta and Winnfield installations are Herreshoff no controls other than regular maintenance.
- Production data is for finished briquettes.
- For emission data contact by letter with background information:

  Ken Paterson or Bob Rasmus, 621-0652, Chicago

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 6/7/78 | Time 11:00 a.m. |
| Person Calling Peter Hulman | Activity |
| Person Called Ken Paterson | Activity Masonite Corp., - Chicago |
| General Subject | (312) 372-5642 |

TOPICS DISCUSSED AND ACTION TAKEN

3) Pachuta - 50,000 tons of char/year
Winnfield - 15,000 tons of char/year

4) Pachuta - off-gas used to dry briquettes and for predrying of sawdust. (Not sure if all of off-gas is used.)

Winnfield - vented to atmosphere (uncontrolled).

Mr. Paterson says that Masonite is in the process of selling their charcoal plants and does not recommend that we visit. He is afraid that the plant will belong to somebody else by the time we visit.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 5/31 | Time 11:00 |
| Person Calling Peter Hulman | Activity Radian |
| Person Called John Haasis | Activity Mo. Dept. of Natural Resources (314) 751-3241 Jefferson City |
| General Subject | |

TOPICS DISCUSSED AND ACTION TAKEN

EPA has a couple of reports on the Missouri kiln. Midwest Research Institute (MRI) performed emissions tests. Mr. Haasis warns that the test data may not be valid. PEDCo prepared a report for EPA region VIII or IX (Texas and Oklahoma) on the costs of controlling a charcoal kiln. The controls (afterburner) are not directly applicable to a Missouri kiln. The problem is caused by venting the 8 stacks of a kiln into 1 stack. This affects the quality of the charcoal, so that the kiln can no longer produce industrial grade (high carbon) charcoal. A portion of the charcoal is currently sold to industry to be used for adsorption.

Mr. Haasis will send us a 1973 list of charcoal producers. The list includes location and capacity. None of the kilns are currently controlled. The main raw material is cord wood. In 1973 there were 55 plants with 544 kilns. Several plants have requested permits for expansion. About 40 new kilns had been planned over the last two years. All permits have been denied, because of the lack of controls for new kilns. None of the requestors decided to reapply with controls.

Gerald Ross at the Missouri Forest Products Association can provide more information. It was suggested that I call him after we receive the packet of information from Haasis.

In general, Mr. Haasis believes that controls should be based on plant size. Large plants may be able to afford controls. Mom and Pop would go bankrupt trying to purchase an $18,000 afterburner for a $7000/year industry.

MISSOURI DEPARTMENT OF NATURAL RESOURCES
P.O. Box 1368 2010 Missouri Blvd. Jefferson City, Missouri 65101 (314) 751-3241

June 1, 1978

Mr. Peter Hulman
Radian Corporation
P. O. Box 9948
Austin, Texas 78766

Dear Pete:

Enclosed is the information you requested. Additional information concerning the charcoal industry can be obtained from Mr. Gerald Ross of the Missouri Forest Products Association, 400 E. High, Jefferson City, Missouri 65101, (314) 634-3252.

Due to its length, I could not include a copy of a report entitled "Stationary Source Testing of a Missouri Type Charcoal Kiln". This can be obtained from the Midwest Research Institute, 425 Volker Boulevard, Kansas City, Missouri 64110, (816) 651-0202 under EPA Contract #68-02-1403 and MRI project #3927-C(14).

If you have any questions, please give me a call.

Very truly yours,

AIR POLLUTION CONTROL PROGRAM

John W. Haasis
Environmental Engineer
Planning Section

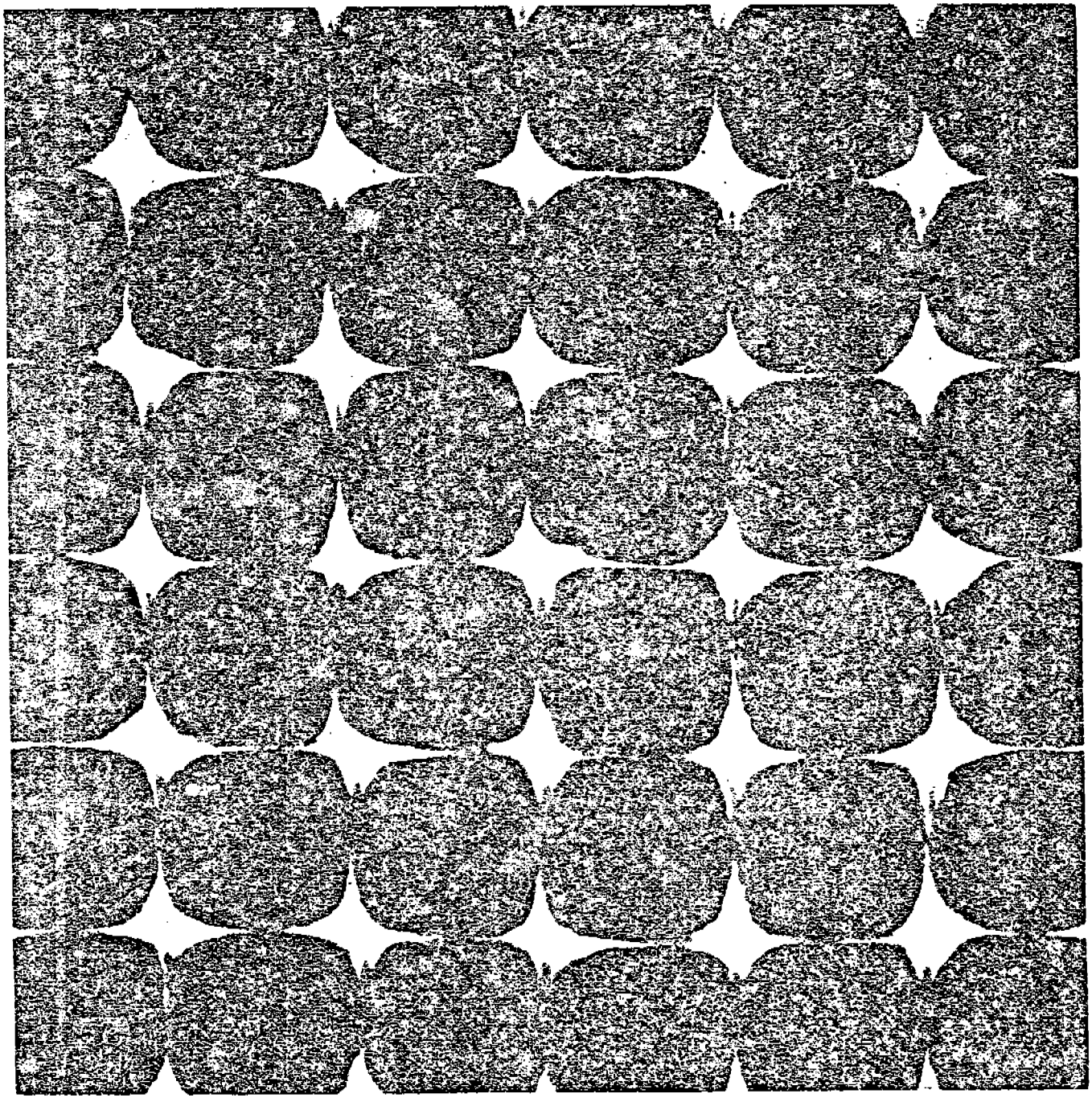
JWH:js

Enclosures (3)

Division of Environmental Quality
James P. Odendahl Director

**Joseph P. Teasdale** Governor
**Carolyn Ashford** Director

# MISSOURI CHARCOAL DIRECTORY



MISSOURI DEPARTMENT OF CONSERVATION

JEFFERSON CITY, MISSOURI

B-79

April 1973

PREFACE:

This is the second Directory of the wood charcoal industry published by the Forestry Division, Missouri Department of Conservation. The earlier edition, printed in 1963 and revised in 1964, was quite popular and requests for copies have come from all over the United States.

This publication is written as a service to Missouri timberland owners and the charcoal industry. All known markets for charcoal wood are listed. Foresters, too, will benefit from the knowledge of the present operating charcoal plants which help to provide an incentive for better timber management.

The Directory will also be helpful to the charcoal briquet plants in Missouri to pinpoint the sources from which they can draw their raw material.

In addition, it should also prove helpful to those persons considering entering the charcoal business by giving them knowledge of the location of the present industry, allowing them to make direct contact with those persons presently in the business.

Any corrections, additions, or comments made to the author will be appreciated.

Eldon L. Heflin
Robert Massengale

Forestry Division
MISSOURI DEPARTMENT OF CONSERVATION

# MISSOURI CHARCOAL INDUSTRY

The wood charcoal industry was a pioneer industry in the state with the early production taking place in 1815 or 1816 near Ironton. Charcoal production was closely tied to the early production of iron. The Maramec Iron Works began operation near St. James in 1826. They hired sixteen men to cut one and a half cords a day to fill their needs. In 1857 a new and larger furnace was installed, and charcoal consumption then reached a peak of 1,000 bushels per day.

Charcoal was used in the pig iron industry up until the 1890's. About that time charcoal became a by-product of wood carbonization. The main products were then the chemicals produced during carbonization such as methanol, methyl acetone, wood tar and acetic acid. During the period 1930 to 1950 synthetic chemical products replaced wood chemicals and the demand for charcoal also dropped. This was the low point in the history of the charcoal industry and many plants went out of business.

Starting in the early 1950's use of charcoal started making a comeback. With outdoor cooking becoming so popular the demand for briquettes has been increasing at an annual rate of 13.8%.

Charcoal making technology is undergoing a gradual change. The traditional method of producing charcoal is in kilns. Raw materials used are largely hardwoods cut from the forest and stacked in the kilns by hand labor. These kilns are scattered over the southern half of the state (see map). Most charcoal is still produced in kilns today, however, limited use is being made of retorts. The advantages are that they require less time and produce lump charcoal of more consistent quality than kilns. In recent years labor has been in short supply and the costs have been soaring.

In 1964 a survey of the charcoal industry in Missouri was published. During the last nine years there have been some substantial changes in the industry.

The number of primary plants in the state has dropped from 84 to 55 since the last survey. There are 8 secondary plants in the state. These are either briquetting plants, lump bagging plants or industrial coal plants. Some of these plants are also primary producers of charcoal.

The number of kilns in the state has dropped from 562 to the present 544. This has not been just the closing of 18 kilns, but some major shifts in the industry. Many operations with only a small number of kilns have ceased operating. This may amount to as many as fifty kilns being taken out of production. To compensate for this loss a few companies have added new, larger kilns. There are fewer companies, slightly fewer kilns, but production

is at about the same level as nine years ago. The estimated total annual production at the present rate is 137,836 tons of coal. Sold at briquetting and industrial coal plants this would have a value of over $5,500,000.

The source of wood for charcoal has changed drastically in the past ten years. At the time of the last survey almost 100% of the production came from roundwood. Now at least 50% of the wood comes from sawmill slabs and industrial waste. There are various reasons for this trend. Cutters to produce roundwood are getting harder to find in many parts of the state. Sawmills are looking for a way to dispose of their waste slabs. Burning of mill residues is rapidly being eliminated and for those plants that haven't or can't install a chipper, disposal as charcoal wood is a logical choice. Other industrial plants have waste disposal problems that can be a source of supply for a charcoal plant. Every indication is that this trend away from roundwood as a source of charcoal will accelerate over the next few years.

The charcoal industry uses over 310,000 cords of wood each year. This returns to the landowner or sawmill owner over $2,480,000 per year.

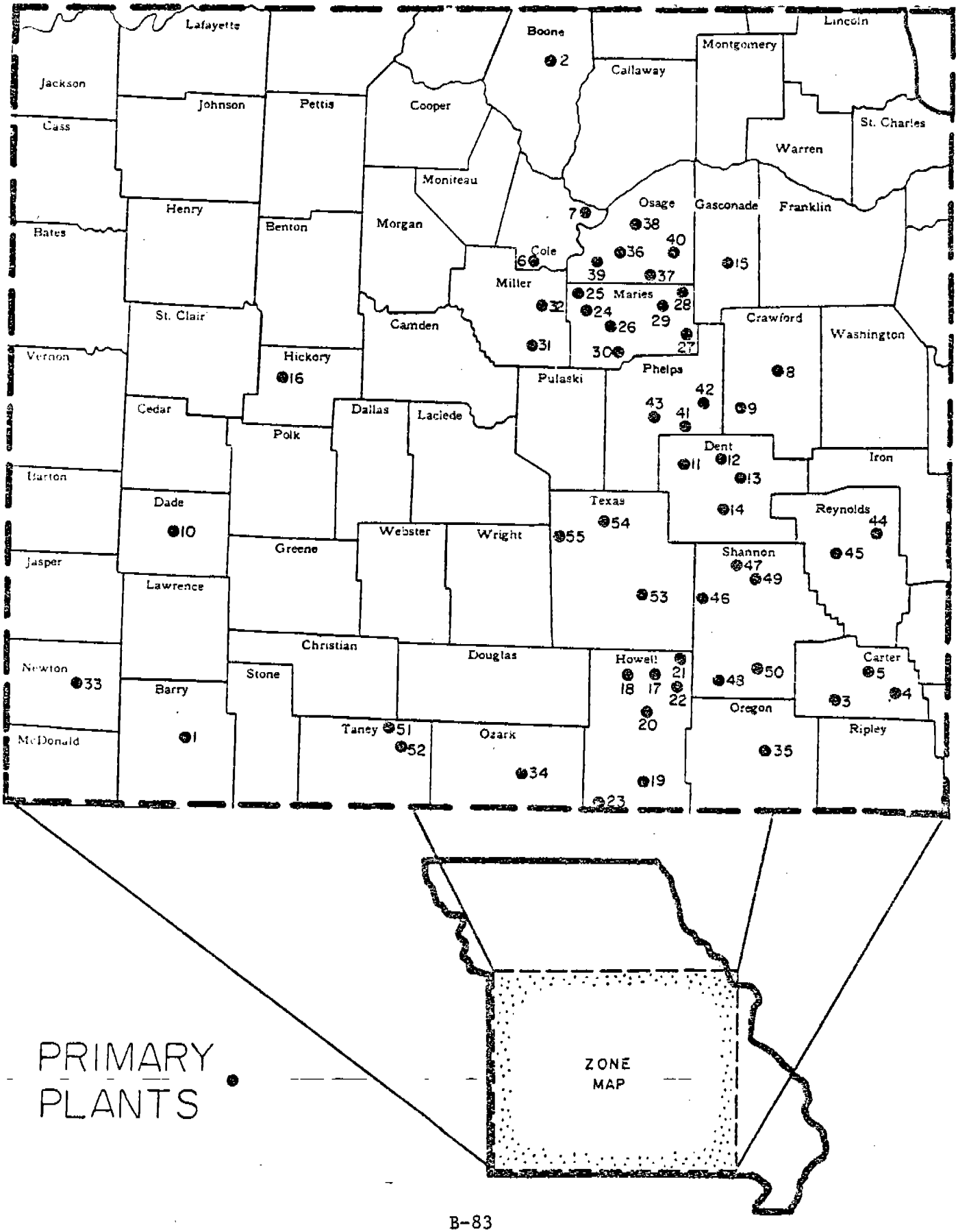
The primary plants employ 209 people and the secondary plants have 341 employees. The total employment figure then is 550 directly employed by the industry. No figures on the number of wood suppliers and cutters are available, but at least as many are employed in the woods as in the plants.

Air pollution is the concern of all of the plant operators. Many want to expand their operation, but are hesitating because of the uncertainty of future regulations. Different methods of smoke control are being tested in the hopes of finding a solution. Continuous retorts have been used, but they still produce smoke. Afterburners for burning smoke are being tested but they are expensive. This is one of the problems of the industry that will have to be overcome in the next few years.

The following list of plants has been compiled with the aid of the Farm Foresters of the Missouri Department of Conservation. Each plant listed produced charcoal during 1972, and only plants that have operational kilns have been listed. The plant capacity is based on 12 burns per kiln per year as indicated by the following:

| | |
|---|---|
| Over 5,000 tons annual capacity | A |
| 1,000 tons to 4,999 tons annual capacity | B |
| 500 tons to 999 tons annual capacity | C |
| Less than 500 tons annual capacity | D |

# CHARCOAL INDUSTRY IN MISSOURI



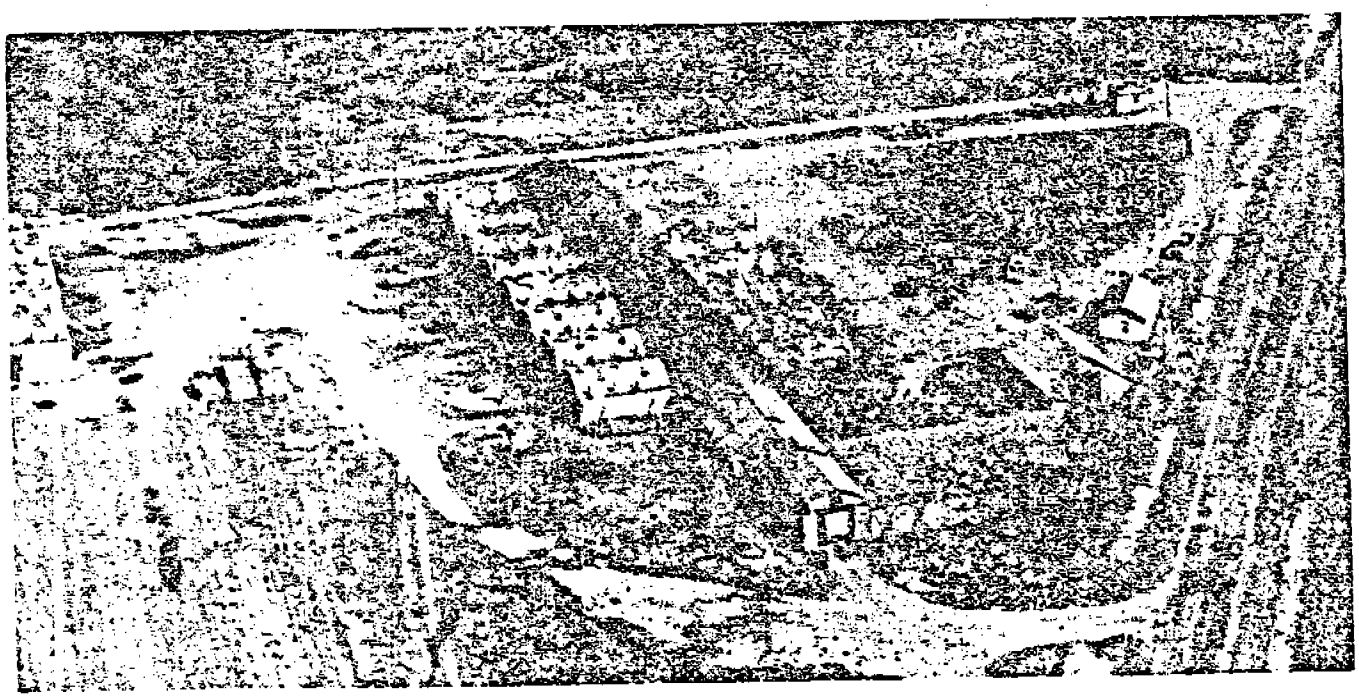
PRIMARY PLANTS

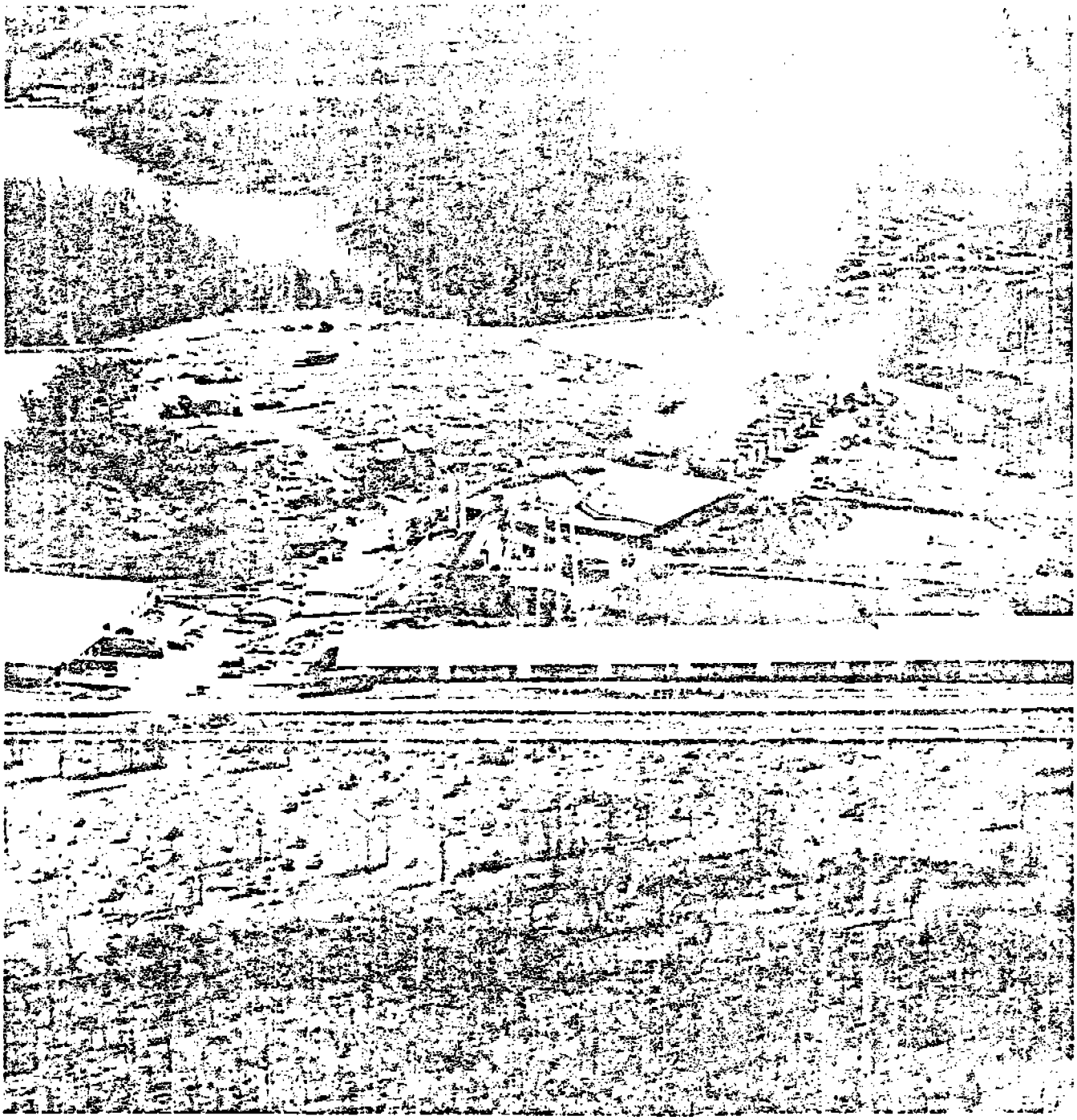
| County | Map No. | Name & Address | Telephone | Size of Plant |
|---|---|---|---|---|
| Barry | 1 | Heaser Charcoal Co.<br>Route #1<br>Purdy, Mo. 65734 | 417/442-3951 | B |
| Boone | 2 | L&A Dailing Charcoal Co.<br>Route #4<br>Centralia, Mo. 65240 | 314/362-2021 | B |
| Carter | 3 | Kerr Charcoal Company<br>Van Buren, Mo. 63965 | N/A | B |
| | 4 | Leach Bros. Charcoal Co.<br>Ellsinore, Mo. 63937 | 314/322-5455 | B |
| | 5 | Rozark, Inc.<br>Ellsinore, Mo. 63937 | 314/322-5270 | B |
| Cole | 6 | Louis Stegeman Charcoal Co.<br>Henley, Mo. 65040 | 314/793-6352 | B |
| | 7 | Rich Stegeman Charcoal Co.<br>Route #3<br>Jefferson City, Mo. 65101 | 314/395-4514 | B |
| Crawford | 8 | Hardwood Charcoal Company<br>Steelville, Mo. 65565 | 314/775-2711 | B |
| | 9 | Fordell Development Corp.<br>Wesco, Mo. 65586 | 314/743-2807 | B |
| Dade | 10 | Pringle Charcoal Company<br>Route #1<br>Greenfield, Mo. 65661 | 417/637-2157 | B |
| Dent | 11 | Hobson Charcoal Company<br>Route #2<br>Salem, Mo. 65560 | 314/729-3789 | D |
| | 12 | Carty Charcoal<br>Route #2<br>Salem, Mo. 65560 | 314/729-4792 | B |
| | 13 | Floyd Charcoal Company<br>Box 549<br>Salem, Mo. 65560 | 314/729-4133 | A |
| | 14 | Wieberg Charcoal Company<br>Salem, Mo. 65560 | 314/729-4491 | B |

| County | Map No. | Name & Address | Telephone | Size of Plant |
|---|---|---|---|---|
| Gasconade | 15 | Gene's Charcoal<br>Route #2<br>Owensville, Mo. 65066 | 314/437-2878 | B |
| Hickory | 16 | J & E Charcoal Company<br>Wheatland, Mo. 65779 | 417/282-6387 | B |
| Howell | 17 | Old Hickory Charcoal Co.<br>Mt. View, Mo. 65543<br>(Smith Flooring Co.) | 417/934-2291 | C |
| | 18 | Carr Forest Products<br>Route #1<br>Mt. View, Mo. 65543 | N/A | B |
| | 19 | Nubbin Ridge Charcoal Co.<br>West Plains, Mo. 65775 | 417/256-7300 | B |
| | 20 | Peace Valley Charcoal Co.<br>Route #1<br>Peace Valley, Mo. 65551 | 417/277-3547 | B |
| | 21 | Craig Charcoal Company<br>Box 148<br>Mt. View, Mo. 65543 | 417/934-2400 | B |
| | 22 | Robert Bay Charcoal Co.<br>Mt. View, Mo. 65543 | 417/934-6115 | C |
| | 23 | Bakersfield Charcoal Co.<br>Hocomo, Mo. 65482 | 417/284-3501 | B |
| Maries | 24 | Barnhart Charcoal Co.<br>Meta, Mo. 65058 | 314/229-4881 | B |
| | 25 | Ripka Charcoal & Lumber<br>Meta, Mo. 65058 | 314/229-4434 | B |
| | 26 | Wulff Charcoal Company<br>Vienna, Mo. 65582 | 314/422-3477 | B |
| | 27 | Kingsford Charcoal Co.<br>High Gate, Mo. 65481 | 314/699-4355 | B |
| | 28 | W. B. Stockton<br>Star Route<br>Belle, Mo. 65013 | 314/859-3886 | B |
| | 29 | H & D Charcoal<br>Belle, Mo. 65013 | 314/859-3412 | C |

| County | Map No. | Name & Address | Telephone | Size of Plant |
|---|---|---|---|---|
| Maries | 30 | Curtis & Hayes Charcoal<br>Route E<br>Hayden, Mo. 65480 | N/A | C |
| Miller | 31 | Louis Stegeman Charcoal Co.<br>Iberia, Mo. 65486 | 314/793-6352 | B |
| | 32 | Kirkweg Charcoal Co.<br>St. Elizabeth, Mo. 65075 | 314/493-2359 | D |
| Newton | 33 | Neosho Charcoal Products<br>Route #5<br>Neosho, Mo. 64850 | 417/451-5083 | B |
| Ozark | 34 | Ozark Forest Charcoal Co.<br>Gainesville, Mo. 65655 | 417/679-4477 | B |
| Oregon | 35 | Greer Springs Company<br>20 Brentmoor<br>St. Louis, Mo. 63105 | 314/778-7354 | B |
| Osage | 36 | Ben Berhorst<br>Freeburg, Mo. 65035 | 314/744-5209 | B |
| | 37 | Sylvester Wieberg Charcoal<br>Freeburg, Mo. 65035 | 314/744-5273 | B |
| | 38 | Al Luecke Charcoal Co.<br>Freeburg, Mo. 65035 | 314/455-2979 | B |
| | 39 | Charkol, Inc.<br>Meta, Mo. 65058 | 314/229-4203 | B |
| | 40 | Gene Noblett Charcoal Co.<br>Belle, Mo. 65013 | 314/859-3494 | C |
| Phelps | 41 | Lenox Charcoal<br>Lake Spring, Mo. 65532 | 314/364-1845 | B |
| | 42 | Parry Charcoal Company<br>St. James, Mo. 65559 | 314/265-3506 | D |
| | 43 | Tackett Charcoal Co.<br>Vienna, Mo. 65582 | 314/364-1404 | B |
| Reynolds | 44 | Black River Charcoal Co.<br>Lesterville, Mo. 63654 | 314/637-2321 | B |
| | 45 | Copeland Charcoal Company<br>Reynolds, Mo. 63666 | 314/689-2408 | B |

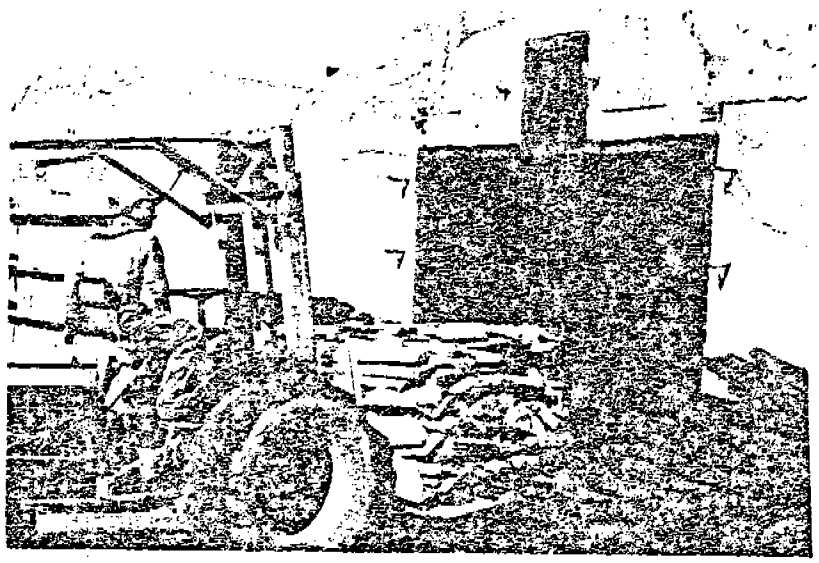
| County | Map No. | Name & Address | Telephone | Size of Plant |
|---|---|---|---|---|
| Shannon | 46 | Craig Charcoal Company<br>Summersville, Mo. 65571 | 417/932-4320 | A |
| | 47 | Robert Hamilton<br>Round Springs, Mo. 65467 | 314/858-3202 | B |
| | 48 | Kerr Charcoal<br>Route #2<br>Birch Tree, Mo. 65438 | 314/292-3319 | B |
| | 49 | Round Springs Charcoal<br>Round Springs, Mo. 65467 | N/A | B |
| | 50 | Dailey Charcoal<br>Winona, Mo. 65588 | N/A | D |
| Taney | 51 | Horner Charcoal Co.<br>Bradleyville, Mo. 65614 | 417/796-2363 | B |
| | 52 | S & S Charcoal Company<br>Box 116<br>Branson, Mo. 65616 | 417/796-2492 | B |
| Texas | 53 | Thomason Charcoal Company<br>Raymondville, Mo. 65555 | 417/457-6282 | B |
| | 54 | Wulff Charcoal Company<br>Licking, Mo. 65542 | 314/674-2441 | B |
| | 55 | H. O. Charcoal Company<br>Plato, Mo. 65552 | N/A | B |

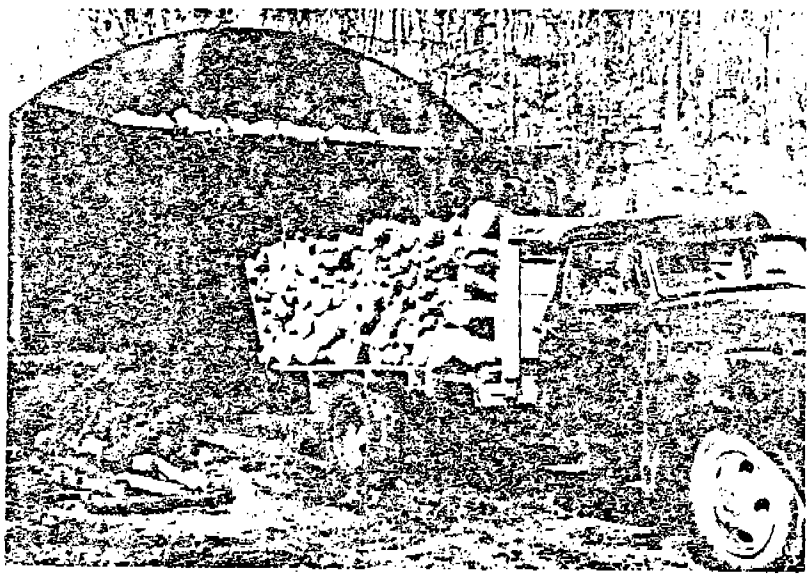




Aerial view of one of the largest charcoal briquet manufacturing plants in the United States located approximately five miles north of Salem in Dent County. This is a completely integrated operation from cutting cordwood to making briquets. Where a large dependable supply of charcoal is needed to keep such a plant in operation this is the trend. Enormous ground space is needed since the warehouses, for briquet storage, covers over eight acres. The two water reservoirs are maintained as an emergency water supply in case of fire. Missouri charcoal plants out number all others in the U. S.

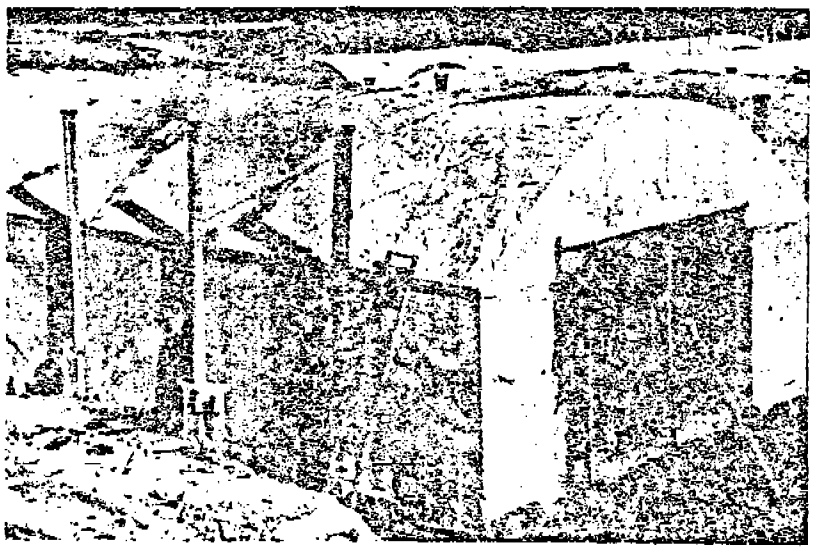
Sources of wood for charcoal has traditionally been roundwood but this is changing. Approximately 50% of the charcoal produced comes from sawmill slabs. This varies over different parts of the state with 100% roundwood still used in some areas. This is a fine example of an integrated operation with sawmill waste becoming a charcoal plants raw material.





Roundwood must be unloaded by hand, where bundled slabs can be handled by forklift trucks. Doors in both ends of the steel kilns facilitate loading and unloading. Repairs to steel kilns can be made by welding sheet steel over the damaged area.

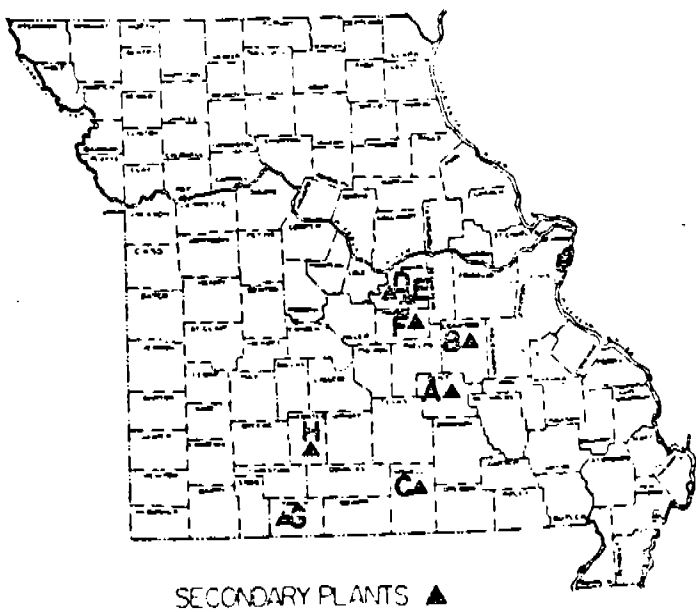
Common "Missouri-Type" kilns. Many operators prefer the kilns of poured concrete. The ladder is used by the operator so that he may open or close the lids on the roof during the burning.



## SECONDARY PLANTS

| County | Letter | Name & Address | Telephone |
|---|---|---|---|
| Dent | A | Floyd Charcoal Company<br>Box 549<br>Salem, Mo. 65560 | 314/729-4133 |
| Crawford | B | Hardwood Charcoal Co.<br>Steelville, Mo. 65560 | 314/775-2711 |
| Howell | C | Old Hickory Charcoal Co.<br>Mt. View, Mo. 65543 | 417/934-2291 |
| Maries | D | Standard Milling Co., Inc.<br>Meta, Mo. 65058 | 314/229-4210 |
| Maries | E | Standard Milling Co., Inc.<br>Meta, Mo. 65058 | 314/229-4242 |
| Maries | F | Kingsford Company, Inc.<br>Belle, Mo. 65013 | 314/859-3321 |
| Taney | G | Keeter Charcoal Company<br>Box 277<br>Branson, Mo. 65616 | 417/334-4195 |
| Webster | H | Oak-Lite Corporation<br>Box 473<br>Seymour, Mo. 65746 | 417/935-4277 |

## SECONDARY PLANT LOCATIONS




SECONDARY PLANTS ▲

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 6/22/78 | Time |
| Person Calling Peter Hulman | Activity Radian |
| Person Called Gerald Ross | Activity Mo. Forest Products Assoc., Jefferson City,Mo. (314) 634-3252 |
| General Subject | |

TOPICS DISCUSSED AND ACTION TAKEN

Industry has been stable for about the last five years. Production rates have varied, however, depending on the market demand and the supply of raw materials. For example, labor to go out in the woods to collect cord wood has been getting more difficult to find. Sometimes the industry uses slab (outer cuts) from the lumber industry, which has been slow for the last two years. No more than maybe one or two plants have shut down since the '73 report. (Industry dependent on large pieces of wood)

Average plant has 15 kilns. Lifetime of a Missouri kiln varies. Some plants burn slower at lower temperature to get industrial grade charcoal, and some plants do a better job at maintenance. Both factors lead to a longer lifetime. Average lifetime is about 15 years.

Alternatives to BACT

(1) 2-4 new kilns might be able to slide under the 100 ton limit
(2) Maybe a plant should be allowed to replace 50% of its investment
(3) Law should be based on zoning - e.g. a plant should be allowed if it is placed where there is no dwelling within 300-400 acres (e.g. a plant near a town could be allowed to relocate)
(4) Laws could be flexible depending on the existing air quality

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 7/12/78 | Time 11:00 |
| Person Calling Peter Hulman | Activity Radian |
| Person Called John Haasis | Activity Mo. Dept. of Nat. Resources, Env. Qual. Div. (314) 751-3241 |
| General Subject | |

TOPICS DISCUSSED AND ACTION TAKEN

The process weight regulation for particulate mass has not been applied to the charcoal industry. This is because emissions from a charcoal kiln are difficult to quantify. EPA though that the regulation should be enforced. As a result, MRI tried to test the Missouri-type kilns, but their results are questionable. The state may rewrite the particulate mass regulation to exempt charcoal kilns. Charcoal kilns are already exempted from the visible emission (opacity) regulations. The state is currently trying to verify that the charcoal kilns do not cause degradation of the state's ambient air quality.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 6/7/78 | Time |
| Person Calling Steve Killingsworth | Activity |
| Person Called J. Bolstad | Activity Air Quality Bureau, Div. of Environ. Sciences; Dept. of Health and Environ. Sciences (406) 449-3454 |
| General Subject Wood charcoal industry in Montana | |

TOPICS DISCUSSED AND ACTION TAKEN

No wood charcoal industry in Montana as per J. Bolstad.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

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|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 6/9/78 | Time |
| Person Calling Steve Killingsworth | Activity |
| Person Called Dennis Burling | Activity Air Pollution Control Division, Nebraska (402) 471-2186 |
| General Subject Wood charcoal industry in Nebraska | |

TOPICS DISCUSSED AND ACTION TAKEN

No wood charcoal industry in Nebraska according to Dennis Burling.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

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|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 6/9/78 | Time |
| Person Calling Steve Killingsworth | Activity |
| Person Called Windal McCurry | Activity Bureau of Environmental Health, Nevada (702) 885-4670 |
| General Subject Wood charcoal industry in Nevada | |

TOPICS DISCUSSED AND ACTION TAKEN

No wood charcoal industry in Nevada as per Windal McCurry.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

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|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 6/7/78 | Time: |
| Person Calling: Steve Killingsworth | Activity: |
| Person Called: Forest Bumford | Activity: Air Pollution Control Agency, NH (603) 271-2281 |
| General Subject: Wood charcoal industry in New Hampshire | |

TOPICS DISCUSSED AND ACTION TAKEN

No wood charcoal industry in New Hampshire according to Forest Bumford.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

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|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 6/13/78 | Time: |
| Person Calling: Steve Killingsworth | Activity: |
| Person Called: John Skoviak | Activity: Bureau of Air Pollution Control, Department of Environmental Protection (609) 984-3019 |
| General Subject: Wood charcoal industry in New Jersey | |

TOPICS DISCUSSED AND ACTION TAKEN

No wood charcoal industry in New Jersey as per John Skoviak.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

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|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date | Time |
| Person Calling Peter Hulman | Activity |
| Person Called David Duran | Activity Air Quality-Environmental Improvement Agency (505) 827-2813 |
| General Subject Wood charcoal in New Mexico | |

TOPICS DISCUSSED AND ACTION TAKEN

1) No industry.

6) One company has recently tried to operate a retort, but has been unsuccessful. The potential exists for the use of retorts by the sawmill industry over the next five years. There seems to presently be little demand for charcoal, however.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

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|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 6/7/78 | Time: |
| Person Calling: Steve Killingsworth | Activity: |
| Person Called: Mr. Preston | Activity: Dept. of Environmental Conservation (518) 457-7431 |
| General Subject: Wood charcoal industry in New York | |

TOPICS DISCUSSED AND ACTION TAKEN

No wood charcoal industry in New York as per Mr. Preston.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 5/24/78 | Time |
| Person Calling Steve Killingsworth | Activity |
| Person Called Larry Magee | Activity Division of Environmental Management, North Carolina (919) 733-3781 |
| General Subject Wood charcoal industry in North Carolina | |

**TOPICS DISCUSSED AND ACTION TAKEN**

No wood charcoal industry in North Carolina today as per Larry Magee; there were 2 process plants which went out of business 15 to 20 years ago; currently sawdust and bark are being sent to South Carolina.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

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|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 5/24/78 | Time: |
| Person Calling: Steve Killingsworth | Activity: |
| Person Called: Mr. Mount | Activity: Air Pollution Control Commission, ND (701) 224-2374 |
| General Subject: Wood charcoal industry in North Dakota | |

TOPICS DISCUSSED AND ACTION TAKEN

No wood charcoal industry in North Dakota as per Mr. Mount; the Husky Industries plant uses only lignite coal.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

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|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 6/8/78 | Time 8:30 a.m. |
| Person Calling Steve Killingsworth | Activity Radian |
| Person Called Fred Klingelhafer | Activity Southeast District, Air Pollution Control EPA (614) 385-8501 |
| General Subject Wood Charcoal Industry in Ohio | |

TOPICS DISCUSSED AND ACTION TAKEN

1) Location: Roseville Charcoal, McArthur, Ohio
2) Owner: President - Ray Longstreth
3) Capacity and Type: 19 beehive-type kilns; the output of the plant is considered confidential.
4) Existing Controls: 4 portable oil-fired afterburners; the burns are staggered so that about 2 or 3 kilns are in the stage that require afterburners. No stack test taken; visual inspection - no emissions when afterburners are in use.
5) Economic Information: Cost of the use of the afterburners $25/ton lump charcoal; selling price of lump charcoal - $160-170/ton.
6) Past, Present, Future: Four years ago there were 3 plants operating--2 Roseville plants and one Victory Charcoal plant. One Roseville plant shut down; no expansion or reduction expected at the remaining Roseville plant.
7) Local Regulations: none (court injunction)
8) Other State Agencies: none

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 5/30/78 | Time: |
| Person Calling: Steve Killingsworth | Activity: Radian |
| Person Called: Mr. McWhirter | Activity: Dept. of Health, Oklahoma, Environm Health Serv., Air Pollution Control Div. (405) 271-5220 |
| General Subject: Wood Charcoal Industry in Oklahoma | |

TOPICS DISCUSSED AND ACTION TAKEN

4 plants in Oklahoma. Information will be given separately.

First Plant:

1) Location and name: K-V Charcoal, Idadel, Oklahoma
2) Owner: Mr. Richardson
3) Capacity: 2 60 cord rectangular metal kilns (approximately 10 ft. wide, 8' tall, 40-60 ft. long), only one kiln is used.
4) Existing Controls: The one kiln operated has a gas-fired afterburner; no emissions data. The other kiln does not have an afterburner.
5) Economic Information: none
6) Past, Present, Future: 10 years ago the second kiln was built but this kiln was never fitted with an afterburner and was never used, today this second kiln is still not used and in the future will probably not be used due to the strictness of the air pollution standards in Oklahoma.
7) Local Regulations: none
8) Other State agencies that may be helpful: Oklahoma Agricultural Dept., Forestry Division.

Second Plant:

1) Location and name: Forest Products Charcoal Company, Clayton, Oklahoma.
2) Owner: Andrew Sigel, home office: Memphis, Tennessee
3) Capacity: 2 40 cord metal Missouri-type kilns
4) Existing Controls: propane gas-fired afterburner (not clear whether an afterburner attached to each kiln or what), no emissions data.
5) Economic Information: none
6) Past, Present, Future: 10 years ago this plant didn't exist; the future is dependent upon what the EPA decides on the pollution standards.
7) Local Regulations: none
8) Other Stage Agencies: Oklahoma Agricultural Dept., Forestry Division

Third Plant:

1) Location and name: Forest Products Charcoal Company, Talihinia, Oklahoma
2) Owner: Andrew Sigel, home office: Memphis, Tennessee
3) Capacity: 3 80 cord Missouri-type kilns (concrete with metal roofs)
4) Existing Controls: none (operation is not in compliance with Oklahoma air pollution standards)

(continued)

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐Incoming Call
☐Outgoing Call

| Project No. | | Distribution |
|---|---|---|
| Project Name | | |
| Date | Time | |
| Person Calling | Activity | |
| Person Called | Activity | |
| General Subject | | |

TOPICS DISCUSSED AND ACTION TAKEN

5) Economic Information: none
6) Past, Present, Future: 10 years ago, there were about 18 40 cord kilns on site; future operation of this plant very dependent upon EPA's ruling.
7) Local Regulations: none
8) Other State Agencies: Oklahoma Dept. of Agriculture, Forestry Division

Fourth Plant:

1) Location and name: Forest Products Charcoal Company, Heavener, Oklahoma
2) Owner: Andrew Sigel, home office: Memphis, Tennessee
3) Capacity: 4 40 cord metal Missouri-type kilns presently shut down due to a notice from the EPA
4) Existing Controls: Apparently no controls, since EPA shut them down
5) Economic Information: none
6) Past, Present, Future: About 10 years ago there were 12-14 40 cord kilns on site; the future is dependent upon actions taken by EPA.
7) Local Regulations: none
8) Other Agencies familiar with wood charcoal in Oklahoma: Oklahoma Agricultural Department, Forestry Division.

Comments:

The Heavener plant is 2 miles from the Oklahoma-Arkansas state line; the Talihinia plant about 13 miles from this line. Air standards are much more lax in Arkansas than in Oklahoma. These plants could relocate to Arkansas and operate within the law. This type of discrepancy is the basis for Oklahoma requesting the EPA to look into the problem.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 5/22/78 | Time 3:00 p.m. |
| Person Calling R. D. Delleney | Activity Radian |
| Person Called Paul Boys | Activity EPA Reg. 10 |
| General Subject Data on Wood Charcoal Industry in Oregon | |

TOPICS DISCUSSED AND ACTION TAKEN

Paul referred me to: Pete Bosserman
Dept. of Environmental Quality
State of Oregon
Portland, Ore. (503) 229-6271

Open flames in Herreshoff furnaces at Georgia-Pacific (Medford) and Kingsford (Springfield) prevent direct measurement of off-gas. Grab sample and assumptions result in 400-2000 t/yr estimate of emissions. Use waste bark rather than send to Wigwam waste burner at Georgia-Pacific. Pete referred me to (1) Paul Wilhite - Lane Regional APCD (503) 686-7601, (2) Kingsford Plant (Springfield) Ron Guard (503) 746-9601, (3) Georgia Pacific (Portland) Al Mick (Eng) (503) 222-5561, and (4) Georgia Pacific Plant (Medford) Bob Carsten (503) 826-2756.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

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|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 7/1/78 | Time: 4:00 p.m. |
| Person Calling: Peter Hulman | Activity: Radian |
| Person Called: Pete Bosserman | Activity: Dept. of Environ. Quality, Portland (503) 229-6278 |
| General Subject: Wood charcoal industry in Oregon | |

TOPICS DISCUSSED AND ACTION TAKEN

1) a. Georgia Pacific
   White City, OR
   b. Kingsford
   Springfield, OR

2) see 1)

3) a. Herreshoff - 20,000 T briquette/yr
   16,000 lbs char/hr } both use bark
   b. Herreshoff - 52,000 T briquette/yr

4) a. A bark dryer was installed last year. Part of the furnace off-gas is recirculated to the dryer; the rest is flared to the atmosphere. Most of the gas going to the dryer passes first through a gas afterburner. After the dryer, some of the gas is vented through exit cyclones; some is recycled to the furnace.
   b. Kingsford has several bark dryers. Much of the off-gas recirculates through a gas chamber to the dryers. The rest is flared. Flames are visible out the top - generally invisible during day.

Emissions - no direct measurements. Both plants have a slight black visible plume 10-15% average opacity. Kingsford is better controlled because they recirculate more gas.

6) GP's bark dryer increased their production capacity. There is no other indication of growth in the industry.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 5/26/78 | Time: |
| Person Calling: Steve Killingsworth | Activity: Radian |
| Person Called: John Clark | Activity: Bureau of Air Quality, Penn. (717) 787-4324 |
| General Subject: Wood Charcoal Industry in Pennsylvania | |

TOPICS DISCUSSED AND ACTION TAKEN

1) Location and name: Humphrey Charcoal Corporation
P. O. Box 440
Brookville, Penn. 15825
(Jefferson County, Pine Creek Township)
2) Owner: President - J. L. Humphrey
3) Capacity and Type: 18 on-site beehive-type kilns, only 15 of these are used. Five of the 15 are cycled in and out of production, 10 are active most of the time. These kilns were originally (120 years ago) used as brick-tile kilns but were converted to charcoal production. Each kiln has a capacity of 50 cords of wood (slab wood, mostly red oak and hickory depending on what's available). A typical kiln is 24 ft. in diameter, 8 ft. high with a 4 ft. domed roof (total height 12 ft) with a 16 inch diameter 4 ft. long stack located on the center top of the dome (gas-fired afterburners are located on each stack). Each kiln is operated on a 14 day cycle (7 days to burn; 7 days to cool); during the first 36 hours of this 14 day cycle water is driven out of the wood and no afterburners are activated; after this 36 hr period destructive distillation of the wood begins and afterburners are activated for the duration of the 7 day burn period. The kilns are gas-fired using natural gas. This plant also has briquetting facilities on site and produces approximately 6000 ton/yr of briquettes. (All lump charcoal used to make briquettes) Approximately 30 employees.
4) Existing Controls: Gas-fired afterburners located on each kiln
Emissions data: No stack tests have been made. They estimate afterburner efficiency at 80%. Based on this efficiency they guess the following:
Particulate emissions: 153 ton/yr/kiln
Hydrocarbon emissions: 24.5 ton/yr/kiln
5) Economic Information:
Raw wood cost: $20/ton (approximate)
Bagged briquettes cost: $80/ton (approximate)
6) Past, Present, Future:
About 18 years ago there were about 4 plants in operation; approximately 7-8 years ago one of these stopped production and about 2 years ago, 2 others stopped production. There three plants which stopped production were small operations. No expansion at the Humphrey plant is foreseen. The industry appears to be declining in Pennsylvania.
7) Local Regulations: none
8) Other State Agencies familiar with the industry: none

Comments:

Information was taken from a file started in 1955.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No.<br>200-187-32 | Distribution |
| Project Name<br>Wood Charcoal | |
| Date<br>6/7/78 | Time |
| Person Calling<br>Steve Killingsworth | Activity |
| Person Called<br>Doug McVay | Activity<br>Division of Air Resources, RI<br>(401) 277-2808 |
| General Subject<br>Wood charcoal industry in Rhode Island | |

**TOPICS DISCUSSED AND ACTION TAKEN**

No wood charcoal industry in Rhode Island as per Doug McVay.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 5/25/78 | Time |
| Person Calling Steve Killingsworth | Activity |
| Person Called J. Anderson | Activity Senior Industrial Agent, State Development Board, South Carolina (803) 758-3351 |
| General Subject Wood charcoal industry in South Carolina | |

TOPICS DISCUSSED AND ACTION TAKEN

Mr. Anderson recommended that I call T. S. Ragsdale in Lake City, South Carolina.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

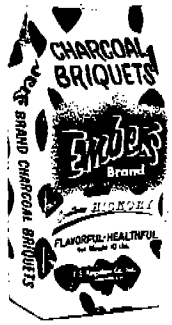
☐ Incoming Call
☒ Outgoing Call

| Project No. | | Distribution |
|---|---|---|
| 200-187-32 | | |
| Project Name | | |
| Wood Charcoal | | |
| Date | Time | |
| 5/25/78 | | |
| Person Calling | Activity | |
| Steve Killingsworth | | |
| Person Called | Activity | |
| Tom Ragsdale | T. S. Ragsdale, Inc. (803) 394-8567 | |
| General Subject | | |
| Wood charcoal production in South Carolina | | |

**TOPICS DISCUSSED AND ACTION TAKEN**

Tom Ragsdale said there is a Herreshoff furnace operating in Lake City, South Carolina. He would not answer my questions over the phone, but if a letter is sent, he would cooperate.

A letter was written to Mr. Ragsdale. His return letter is attached.





# T. S. Ragsdale Company, Incorporated

POST OFFICE DRAWER 937

Lake City, South Carolina
29560

TEL. (803) 394-8567


June 27, 1978

Radian Corporation
P. O. Box 9448
Austin, Texas 78766

Attention: Mr. Steve Killingsworth

Dear Mr. Killingsworth:

In reply to your letter of May 30, I wish to give you the following answers to specific questions:

1. We do not make any lump charcoal.

2. We use two four hearth Herschoff continous furances.

3. Our controls are Honeywell constant recording Thermo couple type reading. We have been given a five year permit for continous operation by the S. C. Pollution & Air Control Authority.

4. The area is not saturated.

5. We anticipate no growth. The size of our operation 10 years ago is about the same size as today. Five years from now we expect to be the same size as we are today.

6. None others operating in the state of South Carolina.

7. We are paying $2.50 per ton for sawdust and bark. As stated above, we do not produce any lump charcoal, only granular charcoal.

Trust the above information is clear in its answers. If you have any further questions, the writer will be delighted to try to answer them.

Yours very truly,

T. S. RAGSDALE COMPANY, INCORPORATED

Thomas S. Ragsdale, Jr.
President

TSRjr/msa

B-111

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 6/8/78 | Time: |
| Person Calling: Steve Killingsworth | Activity: |
| Person Called: David Eaton | Activity: Air Quality Program, South Dakota (605) 773-3329 |
| General Subject: Wood Charcoal industry in South Dakota | |

TOPICS DISCUSSED AND ACTION TAKEN

No wood charcoal industry in South Dakota as per David Eaton.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 5/30/78 | Time: |
| Person Calling: Steve Killingsworth | Activity: Radian |
| Person Called: John Patton | Activity: Air Pollution Control Div., Dept. of Public Health |
| General Subject: Wood Charcoal Industry in Tennessee | Bureau of Env. Health Serv., Air Pol. Contr. Div. (615) 741-3931 |

TOPICS DISCUSSED AND ACTION TAKEN

Two plants in Tennessee. Information will be given separately.
First Plant:

1) Location and name: Jamestown Charcoal, Jamestown, Tennessee
2) Owner: Royal Oak Charcoal
P. O. Box 865
Cookeville, Tennessee 38501
Phone: (615) 526-9761
3) Capacity: 7500-8000 ton lump charcoal/yr (last year's production figure)
Eight rectangular block kilns with flat roofs and 2 rectangular metal roofs with curved roofs. Approximately 2 days to load, 2 days to unload, 5 days to burn and cool for a total of a 9 day cycle. Four or five employees.
4) Existing Controls: Oil-fired afterburners; the two metal kilns connected to one afterburner, 4 block kilns connected to another afterburner and the other 4 block kilns connected to a third afterburner. These afterburners were recently installed and will be tested sometime next month. No emissions data.
5) Economic Information: none
6) Past, Present, Future: This plant began operation last July, no future growth is expected.
7) Local Regulations: none
8) Other State Agencies familiar with the industry: none

Second Plant:

1) Location and name: Kingsford Company, Red Boiling Springs, Tenn. (60 miles west of Jamestown)
2) Owner: Kingsford Company
Person to Contact: James G. Greanias
P. O. Box 1033
Louisville, Kentucky 40201
Phone: (520) 589-5350
All information pertaining to this plant was confidential; however, Mr. Jett would answer some general questions.
3) Capacity and Type: Larger output of lump charcoal than Jamestown plant (7500-8000 ton/yr); about 12 rectangular kilns; 4-5 people employed.
4) Existing Controls: Oil-fired afterburners; 4 kilns going to one afterburner; 8 kilns going to another afterburner. No smoke going to atmosphere upon visual inspection.
5) No economic information.
6) No growth information
7&8) None

Comments:

There was a third plant located at Memphis, Tenn.; however, it has shut down. Herreshoff furnace.
Gary Jett (615) 528-5535 was very helpful, Cookeville, Tennessee.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 6/1/78 | Time 1:30 |
| Person Calling Peter Hulman | Activity Radian |
| Person Called Ben White | Activity Shelby County (Memphis) Local Program of Tenn. Air Pollution Control (901) 528-3828 |
| General Subject Charcoal Plant in Memphis | |

TOPICS DISCUSSED AND ACTION TAKEN

The plant closed down on Nov. 1, 1976. They used to be called Royal Oak and changed their name to Husky Corp. They were located on property owned by E. L. Bruce, a furniture company which supplied the charcoal plant with sawdust.

Reasons for closing:

1) E. L. Bruce moved, therefore cutting off Husky Corp.'s supply of raw material.
2) Compliance problems - very secondary.

Suggested talking to Jim Hanes at (615) 741-3931 for information on the rest of the state.

RADIAN CORPORATION

Visit

☐ Incoming Call
☒ Outgoing Call

| Project No. | | Distribution |
|---|---|---|
| 200-187-32 | | |
| Project Name | | |
| Wood Charcoal | | |
| Date | Time | |
| 5/26/78 | | |
| Person Calling | Activity | |
| Peter Hulman | | |
| Person Called | Activity | |
| Texas Air Control Board | Compliance Department | |
| General Subject | | |
| Wood Charcoal Industry in Texas | | |

**TOPICS DISCUSSED AND ACTION TAKEN**

Gary Naler - see supplementary information on page 3

1) (a) B&B Charcoal Co.
Box 314
Flatonia, Texas 78941

(b) National Charcoal Co.
Box 7123
San Antonio, Texas 78207

2) (a) Frank Kainer, owner
(b) Mr. Fr. Fred A. Harkreaden, president; C. M. Gill, manager

3) Small operations
(a) Garage-looking kiln, fan pulls draft through top → pipes on bottom
(b) Natural draft kiln - draft from bottom to top (natural convection) exhaust through top.

4) Homemade wet scrubbers - water recirculates to settling pond
(a) Two kilns/scrubber - gas collected through pipes at bottom of kilns - pipes run around sides to scrubber.
(b) Hooded exhaust - pulled by negative pressure into scrubber; 70-80% opacity before scrubbers; 25-28% opacity afterwards (within compliance). Would not be acceptable in a populated area. However, would require butane for incinerators - cannot get gas into plant site (would be too costly)

5) Small operations that only employ people in the local area.

6) No growth projected.

7) No local regulations - all are state regulations.

Colby Jordan

1) (a) Pine - O. Pine Co.
Char-Time Charcoal Division
Box 1167
Jacksonville, Texas 75766

(continued)

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☐ Outgoing Call

| Project No. | | Distribution |
|---|---|---|
| Project Name | | |
| Date | Time | |
| Person Calling | Activity | |
| Person Called | Activity | |
| General Subject | | |

TOPICS DISCUSSED AND ACTION TAKEN

(b) Campfire Co., Inc. (Division of Arkansas Charcoal Company, Inc.)
P.O. Box 1389
Jacksonville

2) (a) Clyde Leatherwood - general manager
523 W. 22nd St.
P.O. Box 7977
Houston, TX 77008
(b) Marion Lewis, general manager

3) (a) Have 5 ovens (kilns); capacity 240,000 lbs waste wood. Since September 1976 only operate 2 kilns, 4 days for kiln cycle.
(b) Prior to October 15, 1976 - 13 kilns each 24' x 60' x 10'; only briquetting now. Charcoal from AK and OK.

4) (a) Afterburner fired with NG (both kilns to afterburner).
(b) Manifold exhaust to gas afterburner;

1975 Emission Inventory

| afterburner Eff | Date Installed | Cost | Energy Consumed |
|---|---|---|---|
| 100% | 1971 | 4000. | 5 MM Btu |
| 100 | 1968 | 1600. | 2 |
| 95 | 5-1969 | 1956. | 1 |

stacks 20' high, 30" diameter; 1000+°F exhaust; 150 tons particulates/yr/kiln

5) None

6) (a) September 1976 reduced from 40-6 employees and 2 kilns; January 1978 - 10 employees and 2 kilns; no plans to increase employees or capacity
(b) 1969 - 58,000T wood/yr → 12,000 T charcoal/yr (used 144,000 mcf NG in total plant)
1975 - 20,000T wood/yr → 4,006 T charcoal/yr; 50% capacity, 24 hr/day, 7days/week, 30 weeks/yr.

Note: Campfire has just recently been bought by Kingsford. They are putting in lots of bucks to fix up kilns and afterburner. Should be operating at full capacity soon.

(continued)

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☐ Outgoing Call

| | | |
|---|---|---|
| Project No. | | Distribution |
| Project Name | | |
| Date | Time | |
| Person Calling | Activity | |
| Person Called | Activity | |
| General Subject | | |

TOPICS DISCUSSED AND ACTION TAKEN

October 15, 1976 - no charcoal
August 10, 1977 - rumours of closing down - 50 employees; cost of gas and legal pressure caused closing down; many residents in area complain of being covered in dust.

Supplementary Information from David Henricks

1) (a) B&B charcoal
   (b) National

3) (a) 2 30 cord kiln - metal
   8 12 cord kiln (only 4 operating)
   Modified Missouri-type kilns
   (b) 1973 - 653 tons charcoal - 4 employees
   12 kilns (10 currently operating)

4) (a) Venturi tower containing 12 water spray nozzles fed by 1/3 HP pump (later replaced with larger pump); kiln can only operate when scrubber in operation; 2 scrubbers. 1 for big kiln above. Burn 2 little kilns at a time. (11/9/76 CO reading 20' downward ∿200 ppm)
   (b) 2 scrubbers
   South - 8' long, 3 power $H_2O$ sprayers, 1 HP water pump, 5 kilns
   North - 6-7' long, 2 power $H_2O$ sprayers, two 3/4 HP water pumps, 6 kilns
   Estimated cost of one scrubber - $1,500 using scrap materials. Corrosion eats through scrubber walls about once/year, much maintenance.

5) Hurt by cheap Mexican charcoal and import from less regulated states.

6) Production stable -
   (a) Strong market in Houston
   slight decline due to scrubber

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 6/9/78 | Time: |
| Person Calling: Steve Killingsworth | Activity: |
| Person Called: Ron Phillips | Activity: Bureau of Air Quality (801) 533-6108 |
| General Subject: Wood charcoal industry in Utah | |

TOPICS DISCUSSED AND ACTION TAKEN

No wood charcoal industry in Utah according to Ron Phillips.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 6/9/78 | Time: |
| Person Calling: Steve Killingsworth | Activity: |
| Person Called: Mr. Garabedian | Activity: Environmental Engineering Division (802) 828-3309 |
| General Subject: Wood charcoal industry in Vermont | |

TOPICS DISCUSSED AND ACTION TAKEN

No wood charcoal industry in Vermont according to Mr. Garabediar.

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 6/8/78 | Time |
| Person Calling Steve Killingsworth | Activity Radian |
| Person Called Nick Buchholz | Activity Air Pollution Control Board, Virginia (804) 786-8569 |
| General Subject Wood Charcoal Industry in Virginia | |

TOPICS DISCUSSED AND ACTION TAKEN

1) Location and name: Imperial Briquet, Cambridge, Virginia
2) Owner: no information
3) Capacity and type: 8 Missouri-type kilns; at most 50 employees
4) Existing Controls: none
5) Economic Information: none
6) Past, Present, Future: Has always been just one plant in the state; this plant used to have 20 kilns; does not foresee any change in the size in the future.
7) Local Regulations: none
8) Other State Agencies: none

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date | Time |
| Person Calling Peter Hulman | Activity |
| Person Called | Activity Department of Ecology, Office of Air Programs (206) 753-2813 |
| General Subject Wood charcoal industry in Washington | |

TOPICS DISCUSSED AND ACTION TAKEN

No industry

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 5/24/78 | Time |
| Person Calling Steve Killingsworth | Activity |
| Person Called Dale Farley | Activity Engineering Division, Air Pollution Control Commission (304) 348-3286 |
| General Subject Wood charcoal industry in West Virginia | |

TOPICS DISCUSSED AND ACTION TAKEN

Mr. Farley requested that a letter be sent. His return letter is attached.

WEST VIRGINIA
AIR POLLUTION CONTROL COMMISSION
1558 Washington Street, East
CHARLESTON, WEST VIRGINIA 25311
TELEPHONE: 348-2275 OR 348-3286

June 1, 1978

Mr. Steve Killingsworth
Radian Corporation
P. O. Box 9948
Austin, Texas 78766

Dear Mr. Killingsworth:

This letter and the attached information is being sent as per your request on May 17, 1978, concerning charcoal producing facilities located in West Virginia. Most of the questions asked you will find answered on the data sheet attached.

With regards to the costs associated with the production of charcoal, as you know this varies greatly with the size of operation, methods used, etc., and could be best answered by the companies themselves. As a rule, this agency does not normally require information regarding economics of air pollution sources in our state.

Although the growth potential in West Virginia for this type of industry appears to be great because of the large amount of hardwood cut within the state for the furniture and other industries, the high transportation costs associated with our mountainous terrains up until now have not led to an increased growth rate in terms of the number of plants for this industry in our state. Attached you will find a copy of this agency's Regulation VII which is a state-wide regulation dealing with sources of this type. Should you have any further questions regarding this matter, please feel free to contact me at (304) 348-4022.

Sincerely yours,

Robert L. Weser

Robert L. Weser, P. E.
Chief, Compliance Division

RLW/nah

Enclosures

DATA SHEET

| Name of Owner<br>Location | Roseville Charcoal (Bentree)<br>Dixie, West Virginia | Roseville Charcoal<br>Swiss, West Virginia | Kingsford Charcoal<br>Bellington, West Virginia | Kingsford Charcoal<br>Parsons, West Virginia | Kingsford Charcoal<br>Beryl, West Virginia | Kingsford<br>Maysville |
|---|---|---|---|---|---|---|
| Capacity | Input<br>30 - 50 cords/kiln<br>3 - 4 kilns | Shutdown 1977 | Greatly variable | Output<br>Process weight 23,600 ton/yr. | Not Available | Shutdown 1972 |
| Number of People Employed | Not Available | -- | 12 | 166 | 20 | -- |
| Type of Kiln | Beehive | -- | Batch type concrete kilns | Retort furnace | 2 Retort furnaces | -- |
| Emission Controls | None | -- | (F.O.) Afterburner | Afterburner | Duplex Cyclones<br>Afterburner - 1900° F<br>Water Sprays | -- |

**RADIAN CORPORATION**

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name: Wood Charcoal | |
| Date: 5/12/78 | Time: 9:30 a.m. |
| Person Calling: Peter Hulman | Activity |
| Person Called: Andrew Baker | Activity: Forest Products Lab., Madison, WI (608) 257-2211 x. 480 |
| General Subject: Wood Charcoal Industry in Wisconsin | |

TOPICS DISCUSSED AND ACTION TAKEN

1) Husky Industries, Hixton, WI (near Black River Falls)

2) James Hayer, Foreman

3) 12 40-50 cord Missouri-type kilns operated at "pretty much full capacity"

4) Built with control in mind: close together and on level ground; oil-fired afterburner; fuel cost ∿20% cost of charcoal.

5) None

6) Another operation is set up, but is having operation problems: The Rusch Bros., Antigo, Wisconsin; president is Jack Rusch. They use a non-Herreshoff type retort. No other growth projected.

RADIAN CORPORATION

TELEPHONE CALL RECORD

☐ Incoming Call
☒ Outgoing Call

| | |
|---|---|
| Project No. 200-187-32 | Distribution |
| Project Name Wood Charcoal | |
| Date 6/8/78 | Time |
| Person Calling Steve Killingsworth | Activity |
| Person Called Bob Sundin | Activity Director of Department of Environmental Quality (307) 777-7391 |
| General Subject Wood charcoal industry in Wyoming | |

TOPICS DISCUSSED AND ACTION TAKEN

No wood charcoal industry in Wyoming as per Bob Sundin.

# APPENDIX C

# STATE REGULATIONS

## Table C-1. STATE EMISSION REGULATIONS APPLICABLE TO THE WOOD CHARCOAL INDUSTRY

| State | Particulates[a] | Visibility[b] |
|---|---|---|
| **Alabama** | | |
| All Counties | | No. 1 or 20% opacity (except No. 3 or 60% opacity for 3 min/hr) |
| Class 1 Counties | | |
| $P \leq 30$ tons/hr | $E = 3.59P^{0.62}$ | |
| $P > 30$ tons/hr | $E = 17.31P^{0.16}$ | |
| Class 2 Counties | | |
| $P \leq 30$ tons/hr | $E = 4.10P^{0.67}$ | |
| $P > 30$ tons/hr | $E = 55.0P^{0.11}-40$ | |
| **Alaska** | | |
| All Sources | | 20% opacity (except for 3 min/hr) |
| New Sources | 0.05 grains/scf of gas | |
| Existing Sources | 0.1 grains/scf of gas | |
| **Arizona**[c] | | |
| All Regions | | No. 2 |
| Phoenix-Tucson AQCR | | |
| $P \leq 30$ tons/hr | $E = 3.59P^{0.62}$ | |
| $P > 30$ tons/hr | $E = 17.31P^{0.16}$ | |
| Remaining AQCR | | |
| $P \leq 30$ tons/hr | $E = 4.10P^{0.67}$ | |
| $P > 30$ tons/hr | $E = 55.0P^{0.11}-40$ | |
| **Arkansas** | | |
| Principal Regulation | | |
| All Sources | Suspended particulates from plant are not to exceed ambient background by more than 75 $\mu g/M^3$ for any 24 hr. average or 150 $\mu g/M^3$ for any 30 min. average. | |
| New Sources | | No. 1 or equivalent opacity (except for 5 min/hr, 3 times/day) |
| Existing Sources | | No. 2 or equivalent opacity (except for 5 min/hr, 3 times/day) |
| Alternative Regulation | | |
| All Sources | | No. 1 or equivalent opacity |
| $P \leq 30$ tons/hr | $E = 3.59P^{0.62}$ | |
| $P > 30$ tons/hr | $E = 17.31P^{0.16}$ | |

Table C-1 (continued). STATE EMISSION REGULATIONS APPLICABLE TO THE WOOD CHARCOAL INDUSTRY

| State | Particulates[a] | Visibility[b] |
|---|---|---|
| California | Regional regulations to maintain ambient air standards in each of 47 regions. | No. 2 or equivalent opacity (except for 3 min/hr)<br>Regional regulation may be stricter. |
| Colorado | | |
| All Sources | | 20% opacity |
| P ≤ 30 tons/yr | $E = 3.59P^{0.62}$ | |
| P > 30 tons/hr | $E = 17.31P^{0.16}$ | |
| Connecticut | | |
| All Sources | | No. 1 or 20% opacity (except No. 2 or 40% opacity for 5 min/hr) |
| P ≤ 30 tons/hr | $E = 3.59P^{0.62}$ | |
| P > 30 tons/hr | $E = 17.31P^{0.16}$ | |
| Delaware | | |
| All sources contributing, if uncontrolled more than 50 tons/yr of particulates | 0.2 grains/scf of dry gas | No. 1 (except for 3 min/hr, 15 min/day) |
| Florida | | |
| All Sources | | No. 1 or 20% opacity |
| P ≤ 30 tons/hr | $E = 3.59P^{0.62}$ | |
| P > 30 tons/hr | $E = 17.31P^{0.16}$ | |
| Georgia | | |
| All Sources | | No. 2 or equivalent opacity (except No. 3 or equivalent opacity for 3 min/30 min) |
| New Sources | | |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0P^{0.11}-40$ | |
| Existing Sources | $E = 4.10P^{0.67}$ | |
| Hawaii | | |
| All Sources | | |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | E = 40 lb/hr | |
| New Sources | | No. 1 or 20% opacity (except No. 3 or 60% opacity for 3 min/hr) |
| Existing Sources | | No. 2 or 40% opacity (except No. 3 or 60% opacity for 3 min/hr) |

Table C-1 (continued). STATE EMISSION REGULATIONS APPLICABLE TO THE WOOD CHARCOAL INDUSTRY

| State | Particulates[a] | Visibility[b] |
|---|---|---|
| Idaho | | |
| All Sources | | |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0P^{0.11}-40$ | |
| New Sources | | No. 1 or equivalent opacity (except for 3 min/hr) |
| Existing | | No. 2 or equivalent opacity (except for 3 min/hr) |
| Illinois | | |
| All Sources | | No. 1½ or 30% opacity (except No. 3 or 60% opacity for 8 min/hr, 3 times/day) |
| New Sources | | |
| P ≤ 450 tons/hr | $E = 2.54P^{0.534}$ | |
| P > 450 tons/hr | $E = 24.8P^{0.16}$ | |
| Existing Sources | | |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11}-40$ | |
| Indiana | | |
| All Sources | | No. 2 or 40% opacity (except for 15 min/day) |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11}-40$ | |
| Iowa | | |
| All Sources | | No. 2 or 40% opacity |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11}-40$ | |
| Kansas | | |
| All Sources | | |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11}-40$ | |
| New Sources | | 20% opacity |
| Existing Sources | | 40% opacity |

Table C-1 (continued). STATE EMISSION REGULATIONS APPLICABLE TO THE WOOD CHARCOAL INDUSTRY

| State | Particulates[a] | Visibility[b] |
|---|---|---|
| Kentucky[d] | | |
| New Sources | | 20% opacity |
| P ≤ 30 tons/hr | $E = 3.59P^{0.62}$ | |
| P > 30 tons/hr | $E = 17.31P^{0.16}$ | |
| Existing Sources | | 40% Opacity |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11}-40$ | |
| Louisiana | | |
| All Sources | | 20% opacity (except for 4 min/hr) |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11}-40$ | |
| Maine | | |
| All Sources | | No. 2 or 40% opacity (except for 5 min/hr, 15 min/3 hrs) |
| P ≤ 30 tons/hr | $E = 3.59P^{0.62}$ | |
| P > 30 tons/hr | $E = 17.31P^{0.16}$ | |
| Maryland | Area regulations to maintain ambient air standards in each of 6 areas. | |
| Massachusetts | | |
| All Sources | | No. 1 (except No. 2 for 6 min/hr) |
| | | 20% opacity (except 40% opacity for 2 min/hr) |
| New Sources and Sources in Critical Areas | | |
| P ≤ 30 tons/hr | ½ of emissions from Table C-2 | |
| P > 30 tons/hr | $E = \frac{1}{2}(55P^{0.11}-40)$ | |
| Existing Sources | | |
| P ≤ 30 tons/hr | Table C-2 | |
| P > 30 tons/hr | $E = 55.0P^{0.11}-40$ | |

Table C-1 (continued). STATE EMISSION REGULATIONS APPLICABLE TO THE WOOD CHARCOAL INDUSTRY

| State | Particulates[a] | Visibility[b] |
|---|---|---|
| **Michigan** | | |
| All Sources | 0.20 lbs/1000 lbs of gas | No. 1 or 20% opacity (except No. 2 or 40% opacity for 3 min/hr, 3 times/day) |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11}-40$ | |
| **Minnesota**[e] | | |
| All Sources | 0.3 grains/scf of exhaust gas | 20% opacity (except 60% opacity for 4 min/hr and 40% opacity for 4 more min/hr for pre-1969 sources only) |
| P ≤ 30 tons/hr | $E = 3.59P^{0.62}$ | |
| P > 30 tons/hr | $E = 17.31P^{0.16}$ | |
| **Mississippi** | | |
| All sources | $E = 4.10P^{0.67}$ | No. 2 or 40% opacity (except 15 min/hr, 3 times/day) |
| **Missouri**[f] | | |
| All Sources | 0.3 grains/scf of exhaust gas | Exempt |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0P^{0.11}-40$ | |
| **Montana** | | |
| All Sources | | No. 2 or equivalent opacity from any installation (except No. 3 or equivalent opacity for 4 min/hr) |
| | | No. 1 or equivalent opacity from any single source (except No. 3 or equivalent opacity for 4 min/hr) |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11}-40$ | |
| **Nebraska** | | |
| All Sources | | No. 1 or 20% opacity |
| New Sources | To maintain ambient air standards | |
| Existing Sources | | |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11}-40$ | |

Table C-1 (continued). STATE EMISSION REGULATIONS APPLICABLE TO THE WOOD CHARCOAL INDUSTRY

| State | Particulates[a] | Visibility[b] |
|---|---|---|
| Nevada | | |
| All Sources | | |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | 20% opacity |
| P > 30 tons/hr | $E = 55.0\ P^{0.11} - 40$ | |
| New Hampshire | | |
| New Sources | | |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0P^{0.11} - 40$ | |
| Existing Sources | | |
| P ≤ 30 tons/hr | $E = 5.05P^{0.67}$ | |
| P > 30 tons/hr | $E = 66.0\ P^{0.11} - 48$ | |
| New Jersey | | |
| All Sources | 99% efficient control or 0.02 grains/scf of undiluted exhaust gas, and a maximum of 10 lbs/hr. | 20% opacity |
| New Mexico | | |
| All Sources | To maintain ambient air standards | No. 1 (except for 1 min/30 min) |
| New York[6] | | |
| All Sources | | 20% opacity |
| P ≤ 50 tons/hr | $E = 3.76P^{0.665}$ | |
| New Sources | | |
| P > 50 tons/hr | 0.03 grains/scf of undiluted dry gas | |
| Existing Sources | | |
| P > 50 tons/hr | $E = 72.7P^{0.082} - 50$ | |
| North Carolina | | |
| All Sources | | |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11} - 40$ | |

Table C-1 (continued). STATE EMISSION REGULATIONS APPLICABLE TO THE WOOD CHARCOAL INDUSTRY

| State | Particulates[a] | Visibility[b] |
|---|---|---|
| North Dakota | | |
| All Sources | | |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11} - 40$ | |
| New Sources | | No. 1 or equivalent opacity (except No. 3 or equivalent opacity for 4 min/hr) |
| Existing Sources | 99.7% control is sufficient | No. 2 or equivalent opacity (except No. 3 or equivalent opacity for 4 min/hr) |
| Ohio[h] | | |
| All Sources | | No. 1 or 20% opacity (except No. 3 or 60% opacity for 3 min/hr) |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11} - 40$ | |
| Oklahoma | | |
| All Sources | | No. 1 or 20% opacity (except No. 3 or 60% opacity for 5 min/hr, 20 min/day) |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11} - 40$ | |
| Oregon | | |
| All Sources | | |
| P ≤ 30 tons/hr | Table C-2 | |
| P > 30 tons/hr | $E = 55.0P^{0.11} - 40$ | |
| New Sources and Special Control Areas | 0.1 grains/scf of exhaust gas | No. 1 or 20% opacity (except for 3 min/hr) |
| Existing Sources | 0.2 grains/scf of exhaust gas | No. 2 or 40% opacity (except for 3 min/hr) |
| Pennsylvania | | |
| All Sources | Greater of 0.02 grains/scf of dry exhaust gas or $E = 9.41P^{0.42}$ | 20% opacity (except 60% opacity for 3 min/hr) |
| Rhode Island | | |
| All Sources | | 20% opacity (except for 3 min/60 min) |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11} - 40$ | |

Table C-1 (continued). STATE EMISSION REGULATIONS APPLICABLE TO THE WOOD CHARCOAL INDUSTRY

| State | Particulates[a] | Visibility[b] |
|---|---|---|
| South Carolina | | |
| All Sources | | |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11} - 40$ | |
| New Sources | | No. 1 or equivalent opacity (except No. 3 or equivalent opacity for 5 min/hr, 20 min/day) |
| Existing Sources | | No. 2 or equivalent opacity (except No. 3 or equivalent opacity for 5 min/hr, 20 min/day) |
| South Dakota | | |
| All Sources | | No. 1 or 20% opacity (except No. 3 or 60% opacity for 3 min/hr) |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11} - 40$ | |
| Tennessee[1] | | |
| All Sources | | No. 1 or 20% opacity (except for 5 min/hr, 20 min/day) |
| New Sources | | |
| P ≤ 30 tons/hr | $E = 3.59P^{0.62}$ | |
| P > 30 tons/hr | $E = 17.31P^{0.16}$ | |
| Existing Sources | | |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11} - 40$ | |
| Texas | | |
| All Sources | $E = 0.048\ q^{0.62}$<br>q = stack effluent in acfm | |
| New Sources | | 20% average opacity over a 5 min period (except for 5 min/hr, 6 hrs/10 days) |
| Existing Sources | | 30% average opacity over a 5 min period (except for 5 min/hr, 6 hrs/10 days) |
| Utah | | |
| All Sources | 85% particulate control if uncontrolled source would emit >100 tons particulates/yr | |
| New Sources | | No. 1 or 20% opacity |
| Existing Sources | | No. 2 or 40% opacity |

Table C-1 (continued). STATE EMISSION REGULATIONS APPLICABLE TO THE WOOD CHARCOAL INDUSTRY

| State | Particulates[b] | Visibility[b] |
|---|---|---|
| Vermont | | |
| All Sources | Table C-2 | |
| New Sources | | No. 1 or 20% opacity (except No. 3 or 60% opacity for 6 min/hr) |
| Existing Sources | | No. 2 or 40% opacity (except No. 3 or 60% opacity for 6 min/hr) |
| Virginia | | |
| All Sources | All kilns constructed so that all emissions, both gaseous and particulate are directed through an air pollution control device, providing complete combustion of all gases from the kiln. | No. 1 or 20% opacity (except for brief periods) |
| ACQR 1-6 | | |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11}-40$ | |
| ACQR 7 | Table C-2 | |
| Washington | | |
| All Sources | 0.10 grains/scf of dry exhaust gas | 20% opacity (except 3 min/hr, 15 min/8 hrs) |
| Washington D.C. | | |
| All Sources | Table C-2 | No visible emissions (except No. 1 or 20% opacity for 2 min/hr, 12 min/day) |
| New Sources | 0.03 grains/scf of exhaust gas | |
| West Virginia | | |
| All Sources | Table C-4 | No. 1 or equivalent opacity (except No. 2 or equivalent opacity for 5 min/hr) |
| Wisconsin[b] | | |
| All Sources | 0.4 lbs/1000 lbs of gas | No. 1 or 20% opacity (except No. 4 or 80% opacity for 5 min/hr, |
| New Sources | | No. 1 or 20% opacity (except No. 4 or 80% opacity for 5 min/hr, 3 times/day) |
| P < 30 tons/hr | $E = 1.59P^{0.62}$ | |
| P > 30 tons/hr | $E = 17.31P^{0.16}$ | |

Table C-1 (continued). STATE EMISSION REGULATIONS APPLICABLE TO THE WOOD CHARCOAL INDUSTRY

| State | Particulates[a] | Visibility[b] |
|---|---|---|
| Wyoming | | |
| New Sources | | 20% opacity (except 40% for 6 min/hr) |
| P ≤ 30 tons/hr | $E = 3.59P^{0.62}$ | |
| P > 30 tons/hr | $E = 17.31P^{0.16}$ | |
| Existing Sources | | 40% opacity |
| P ≤ 30 tons/hr | $E = 4.10P^{0.67}$ | |
| P > 30 tons/hr | $E = 55.0\ P^{0.11} - 40$ | |

[a] E = emissions in lbs/hr
P = process weight rate in tons/hr of raw material

[b] Emissions are not to exceed the shade or density designated by the specified number on the Ringelmann chart and for the specified % opacity. Most states allow deviations for periods of startup, cleaning, or malfunction. Limits of duration and/or visibility for these episodes have been included in parentheses for all states in which such limits have been specified.

[c] All CO emissions must be controlled by complete secondary combustion.

[d] Either the particulate or visibility standard may be satisfied (for compliance). The particulate standard for existing sources may also be satisfied if the gas is exhausted through 97% efficient particulate control equipment and does not exceed 0.02 grain/scf of dry gas.

[e] Either the particulate or the visibility standard may be satisfied for compliance. The standard may also be satisfied by exhausting all gases through control equipment that is 99.7% efficient for post-1969 sources, 99% efficient for pre-1969 sources, or 85% efficient for all sources in remote areas.

[f] The particulate standard may alternatively be designated as a gas concentration limit as specified in a gas volume rate table. Limits rauge from 0.1 to 0.02 grains/scf of gas.

[g] Gases and liquid particulates must also be limited by control devices with efficiencies of 70-99.9%, depending on the environmental rating and the emission rate potential of the source.

[h] CO emissions from all new sources and all existing sources in priority I areas must be controlled by the best available control technology.

[i] The particulate standard may alternatively be set by use of diffusion equations:

$E = 0.2\ h_s(V \times 0.02(T-60))^{0.25}$ for stacks less than 500 ft. in height

$E = 0.3\ h_s(V \times 0.02(T-60))^{0.25}$ for stacks greater than 500 ft. in height

$h_s$ = height of the stack
$V^s$ = flow rate of exhaust gas in $ft^3$/sec adjusted to 60°F
T = exhaust temperature of gas

[j] Emissions from all sources within sub-region 1 of the Lake Michigan AQCR and the Southeast Wisconsin Intrastate AQCR must satisfy the visibility requirements designated for new sources throughout the rest of the state. CO emissions must be controlled by incineration at 1100°F for at least 3 sec or an equivalent control.

Table C-2. PROCESS WEIGHT RATE TABLE FOR MA, VT, VA, AND DC

| Process weight per hour in pounds | Maximum weight of particulate discharge per hour in pounds | Process weight per hour in pounds | Maximum weight of particulate discharge per hour in pounds | Process weight per hour in pounds | Maximum weight of particulate discharge per hour in pounds | Process weight per hour in pounds | Maximum weight of particulate discharge per hour in pounds |
|---|---|---|---|---|---|---|---|
| 50 | .24 | 1200 | 3.12 | 3300 | 5.36 | 7000 | 8.05 |
| 100 | .46 | 1300 | 3.26 | 3400 | 5.44 | 7500 | 8.39 |
| 150 | .66 | 1400 | 3.40 | 3500 | 5.52 | 8000 | 8.71 |
| 200 | .85 | 1500 | 3.54 | 3600 | 5.61 | 8500 | 9.03 |
| 250 | 1.03 | 1600 | 3.66 | 3700 | 5.69 | 9000 | 9.36 |
| 300 | 1.20 | 1700 | 3.79 | 3800 | 5.77 | 9500 | 9.67 |
| 350 | 1.35 | 1800 | 3.91 | 3900 | 5.85 | 10000 | 10.00 |
| 400 | 1.50 | 1900 | 4.03 | 4000 | 5.93 | 11000 | 10.63 |
| 450 | 1.61 | 2000 | 4.14 | 4100 | 6.01 | 12000 | 11.28 |
| 500 | 1.77 | 2100 | 4.24 | 4200 | 6.08 | 13000 | 11.89 |
| 550 | 1.89 | 2200 | 4.34 | 4300 | 6.15 | 14000 | 12.50 |
| 600 | 2.01 | 2300 | 4.44 | 4400 | 6.22 | 15000 | 13.13 |
| 650 | 2.12 | 2400 | 4.55 | 4500 | 6.30 | 16000 | 13.74 |
| 700 | 2.24 | 2500 | 4.64 | 4600 | 6.37 | 17000 | 14.36 |
| 750 | 2.34 | 2600 | 4.76 | 4700 | 6.45 | 18000 | 14.97 |
| 800 | 2.43 | 2700 | 4.84 | 4800 | 6.52 | 19000 | 15.58 |
| 850 | 2.53 | 2800 | 4.92 | 4900 | 6.60 | 20000 | 16.19 |
| 900 | 2.62 | 2900 | 5.02 | 5000 | 6.67 | 30000 | 22.22 |
| 950 | 2.72 | 3000 | 5.10 | 5500 | 7.03 | 40000 | 28.3 |
| 1000 | 2.80 | 3100 | 5.18 | 6000 | 7.37 | 50000 | 34.3 |
| 1100 | 2.97 | 3200 | 5.27 | 6500 | 7.71 | 60000 or more | 40.0 |

Table C-3. PROCESS WEIGHT RATE TABLE FOR WV

| Process weight rate in pounds per hour | Maximum allowable total stack emission rate in pounds per hour |
|---|---|
| 0 | 0 |
| 2,500 | 0.2 |
| 5,000 | 0.8 |
| 10,000 | 1.8 |
| 20,000 | 4.0 |
| 30,000 | 6.2 |
| 40,000 | 8.3 |
| 50,000 | 10.5 |
| 100,000 | 21.2 |
| 200,000 | 21.2 |
| 300,000 | 21.2 |
| 400,000 | 21.2 |
| 500,000 | 21.2 |
| 600,000 | 21.2 |
| 700,000 | 21.2 |
| 800,000 | 21.2 |
| 900,000 | 21.2 |
| 1,800,000 and above | 21.2 |

For a process weight between any two consecutive process weights stated in this table the emission limitation shall be determined by linear interpolation.

# APPENDIX D

# TRIP REPORTS

RADIAN
CORPORATION

21 June 1978

TRIP REPORT

From: Peter Hulman

Subj: Visit with Andrew Baker at the Forest Products Lab, Madison, Wisconsin, 5/16/78

Dr. Baker explained that the main problem for expansion in the industry is the availability of raw materials. Charcoal is a scavenger industry. Before being used for charcoal, wood materials will first be used for:

(1) Pulp

(2) Particle board

(3) Energy (burned to produce steam)

Last winter quite a few industries in Wisconsin traveled up to 50 miles to find wood to use for energy. There is a growing trend in the wood industries to gain energy self sufficiency by combusting wood wastes.

Wood is more energy-efficient than charcoal. The energy efficiency of making charcoal from dry wood is about 30-40%. When the fuel needs are added for a briquetting plant, the net energy efficiency might be negative.

Different raw materials are used in different areas. In Missouri, they use roundwood. For Wisconsin, slabs are used. California uses bark and hogged wood, while Washington burns all wood wastes for fuel. A Herreshoff furnace can only be operated where there is a large excess of raw materials. 180-360 metric tons of dry material/day are needed to operate a Herreshoff furnace. In Wisconsin, for example, there is not enough raw material for a Herreshoff.

The only available emissions data is opacity information. Visual and odor problems are the only recorded complaints. Odors indicate that a kiln or retort is not burning well. The worst odors are probably not worse than the odors from a fireplace.

Emissions should be about the same for all types of wood. Southern soft woods may have more tar. Dr. Baker thinks that retort pine

tar may be collected by Louisiana Pine Products Company in Alexandria, LA. We need to verify this on our own. Nobody else uses wood chemicals except for the liquid smoke industry.

The industry varies from site to site depending on

(1) local terrain,

(2) geography, and

(3) species of wood charred.

The cost and feasibility of controls is site specific. Substituting a Herreshoff furnace for a kiln operation is not a viable control, since the Herreshoff requires a larger quantity of raw materials than a kiln.

Dr. Baker feels that the operation of a Missouri-type kiln is an art. The plant in Hixton, Wisconsin, is probably the most modern operation. Even though the side stacks have been eliminated, the burn can still be followed by looking into the intake vents. Pipes stick through the intake vents into the center of the kiln. They are pulled out as the charcoal front moves. Moving the pipes causes the charcoal front to move towards the air supply. When the front reaches the site of the kiln, the intake vent is plugged with sand.

The company in Hixton generated emissions estimates for the design of their smoke burner. The information is published in the Forest Products Journal from September of 1971 or 1972. The smoke burner uses large pipes to elminate problems with plugging. The char from Hixton is sent to the Husky briquetting plant in Waupaca, WI, along with char from Isanti, Minnesota, and lignite char from North Dakota.

Herreshoff furnaces, according to Dr. Baker, are run with less attention to details than are kilns. They also use a different raw material than kilns. As stated earlier, Herreshoff furnaces exist only where there is excess raw material.

Beehive kilns have been operated in Connecticut. The plant may have been required to apply controls. Dr. Baker knows only that the plant had been asked to supply emission information and that they had contacted an engineer.

Portable kilns are not used in the United States. A few may be found out on farms, but they would be for personal use only. They would not be a part of the industry.

"Retort" is an indefinite term. It has been used to describe any of a large variety of kilns or furnaces.

There are a few uses for charcoal in addition to recreational use. Some is used for metallurgical purposes, but this use is not described in the literature. What's more, data is unattainable: A metallurgical plant will not reveal information because they are afraid that it could be used to guess their capacity, and a charcoal plant will not reveal information because they are afraid that competition will steal their market. Other uses include charcoal for artists pencils and charcoal to filter vodka. It is also used by the chemical industry; but again, how much or where it is used is unattainable. In fact, the chemical industry may be using charcoal for metallurgical processes instead of for chemical processes. Charcoal used for metallurgical processes must conform to restrictions on volatile content, ash, and size.

I asked Dr. Baker if he had any information on the California charcoal industry that was more current than the information sent to us by the California State Department of Forestry. He had no information, but suggested that we call

(1) Forest Products Lab in Richmond, California (just north of Berkeley)

(2) Forest Service Office in San Francisco
Al Groncki, leader
Dean Huber, forest products specialist
415/556-8875

PH/gj

RADIAN
CORPORATION

26 June 1978

TRIP REPORT

From: Peter Hulman

Subj: Plant Visit to Husky Industries, Inc. in Hixton, Wisconsin, on 6/15/78

Attending: John Copeland
Dean Delleney
Peter Hulman

Contact: Alvin Ploeger
John Hayes

## Summary

The plant consists of 12 Missouri-type kilns vented to 6 oil-fired afterburners: two kilns per afterburner. Stack emissions were essentially clear except during transitions in burner operation. The oil burners cycle on and off to maintain a temperature of 1200°F in the afterburners. A puff of black smoke appears when the burners cycle on, and a puff of white smoke appears when the burners cycle off. In either case, the smoke quickly dissipates.

Capital cost for the complete control system was estimated at 20 to 30 thousand dollars. Costs for duct work were minimized since the kilns are mounted close together on level land. Operating costs for fuel vary seasonally from a high of about $30/ton of char produced to a low of about $10/ton of char. The highest fuel consumption, up to 86 gallons of fuel oil/ton of char, occurs during the cold months of the winter.

## Plant Description

The Hixton plant employs a crew of seven men. It is located on flat, sandy terrain in west-central Wisconsin. A federal highway passes within about 500 yards of the plant site. One home is situated between the plant and the highway. No other homes appeared to be located near by.

Plant facilities consist of 12 Missouri-type kilns, 6 oil-fired afterburners, and a small building which serves as an office. Each arched-top kiln measures about 22 feet wide by 32 feet deep by 10 feet high. Large metal doors at the front of each kiln cover an entrance which measures about 10 feet by 10 feet. The 12 inch thick walls are made of reinforced concrete. Eight port holes run along

the bottom of each side, and three large ports with lids are located on each roof. Two 16 inch diameter exhaust pipes lead from the bottom back of each kiln to an afterburner. Two kilns are connected to each afterburner.

The plant was originally privately owned. It now belongs to Husky Briquetting, Inc. in Atlanta, Georgia. The first kilns used at the plant were portable. These were replaced with square concrete kilns, which were, in turn, replaced with Missouri-type kilns. The first Missouri-type kilns were constructed in 1968. They originally had two exhaust stacks per side. They were later modified to be exhausted through oil-fired afterburners. The first afterburner assembly was installed in 1970.

The kilns have a life expectancy of 15-20 years. Several of the roofs have begun to crack and spread out at the front and back. Braces on one of the kilns has retarded this deterioration and should prolong the life of the kiln. The life of kiln could conceivably be cut down to 10 years or less if it were mismanaged by being operated at an excessively high temperature.

Process Description

The raw material for the kilns is either slab or round wood. The operators use whatever is available. Raw materials are becoming more difficult to find. Saw dust, chips, and fines had been tried in the past, but they do not burn through properly in the Missouri-type kilns. Shavings do not work either.

45 cords of wood are loaded per charge. Incompletely charred wood from a previous burn is piled loosely at the bottom middle front of the kiln. The incompletely charred wood is sprayed with fuel oil and ignited to start the burn. The front doors are left open until the fire reaches the top of the kiln. The wood will not char properly unless the burn goes to the top of the kiln and then proceeds to the bottom. After the burn has been sufficiently established, the doors are closed, and the bottom edges are sealed with sand.

The 8 ports along the bottom of each side are opened and closed to control the air supply. Ports that are not being used are plugged with sand. The burn is started with only the front 2 ports on each side open.

ports on each side open. The burn is followed by looking through the ports about once every two hours. It progresses from the top to the bottom, from the middle to the sides, and from the front to the back. As it progresses to the back, the ports behind the flame front are progressively plugged and ports in front of the flame front opened. At least one port on each side is always open during the burn. At the end of the burn, all of the ports are plugged.

The char is allowed to cool before unloading. The cool down is often accelerated by pouring water through the openings on top of the kiln.

The kilns yield approximately 900-1000 lb of char per cord of wood charged. Cycle time varies depending on the moisture content of the wood, as shown in Table 1.

TABLE 1. CYCLE TIME FOR THE HIXTON KILNS (DAYS)

| Raw Material | Burn | Complete Cycle |
|---|---|---|
| Seasoned Wood | 4 | 7 |
| Green Wood | 7 | 10 |

Control System

The plant was required to install controls after construction of the nearby federal highway, because smoke from the kilns occasionally obstructed visibility on the highway. Emissions from the 12 kilns are controlled by combustion in 6 oil-fired afterburners. Gas-fired afterburners would have been used if the plant site had not been too remote to be economically connected to existing gas pipelines.

Two kilns are connected to each afterburner. A pair of 16 inch pipes equipped with butterfly valves run from the bottom of each kiln to the burner furnace. The burner furnaces are Houch furnaces measuring about 5 feet in diameter by 10 feet high. Each furnace is equipped with two oil burners. During operation, the burners cycle on and off automatically to maintain a furnace temperature of 1200°F. A forced draft fan runs continuously to supply combustion air. The combusted gases are vented through 21 foot stacks mounted on top of each furnace.

The afterburner is heated up to 1200°F before a kiln is fired. Firing of the kilns is staggered so that only one kiln per afterburner is operating in a period of heavy smoke emission. The oil burners operate throughout varying proportions of the burn, depending on the moisture content of the wood being charred. For example, with dry wood, the off gases (methane) sustain the burner temperature without additional oil after about 1/3 to 1/2 of the burn cycle is completed. With green wood, the oil burners operate throughout the entire burn cycle. In either case, the burners are shut down as soon as the burn is completed.

The afterburner system appears to work well. There was essentially no visible smoke from the stacks except during transitions in burner operation. A puff of black smoke from the fuel oil appears when the burners cycle on, and a puff of white smoke from the wood off-gases appears when the burner cycles off. Both visible emissions quickly dissipate. Odor from the plant was minimal and was, actually, rather pleasant.

Installation of the control system did not degrade the quality of charcoal produced. In fact, it made the kilns easier to operate. Before installation of the kilns, the burn was followed by watching the smoke coming from the stacks as well as by looking through the few original port holes. When the afterburners were installed, the stacks were removed and extra port holes were added. It is now easier to follow the burn by just looking into the port holes.

Estimated capital cost for the entire control system is $20,000-30,000. A furnace alone costs about $2,800. Cost for ducts was minimal since the kilns were constructed close together on level terrain. Capital costs will be significantly higher for plants with kilns mounted far apart or on hilly terrain.

Oil consumption varies seasonally. During the cold months of the winter, larger volumes of oil are needed to establish and maintain the 1200°F temperature in the burner. Charcoal production and oil consumption data for the Hixton plant is presented in Table 2. As can be seen, the cost for fuel averaged about $10/ton of char in the summer and about $20-30/ton of char in the winter. Because of the severity of winter 1978, fuel costs went up to as high as $39/ton of char. The energy ratio of the fuel consumed to the char produced varied in parallel to the variation in fuel costs: from about 0.1 in the summer to 0.2-0.3 in the winter, with a high of about 0.5 in winter 1978.

Suggestions for Improvement

If the plant were to be reconstructed, the kilns would be set in a circle with their backs facing the center. They would then all be connected to one large central afterburner. In this way, the afterburner would constantly be in use. Since it would always be maintained at operating temperature, fuel consumption would be reduced by eliminating the need to heat up the afterburner before firing a kiln. The kilns could probably be connected to the afterburner with one duct each instead of the two currently being used.

The few puffs of visible emissions could possibly be eliminated by designing the burners to be modulated instead of being cycled on and off. This mode of operation may also save fuel.

TABLE 2. PRODUCTION AND FUEL CONSUMPTION DATA FOR THE HIXTON PLANT

| Year | Month | Char Produced tons | Fuel Oil Consumption $10^3$ gal | Fuel Oil Consumption gal/ton of char | Fuel Cost[a] dollars/ton of char | Energy Ratio[b] Btu fuel oil/ Btu Char |
|---|---|---|---|---|---|---|
| 1977 | 1 | 471 | 14.9 | 31.6 | 14.2 | 0.18 |
| | 2 | 544 | 14.6 | 26.88 | 12.1 | 0.15 |
| | 3 | 650 | 23.4 | 36 | 16.2 | 0.20 |
| | 4 | 504 | 22.2 | 44 | 19.8 | 0.25 |
| | 5 | 562 | 15.7 | 28 | 12.6 | 0.16 |
| | 6 | 716 | 17.2 | 24 | 10.8 | 0.14 |
| | 7 | 660 | 14.5 | 22 | 9.9 | 0.12 |
| | 8 | 555 | 8.9 | 16 | 7.2 | 0.09 |
| | 9 | 600 | 18 | 30 | 13.5 | 0.17 |
| | 10 | 495 | 21.1 | 42.61 | 19.1 | 0.24 |
| | 11 | 420 | 13.8 | 32.9 | 14.8 | 0.19 |
| | 12 | 430 | 16.3 | 38 | 17.1 | 0.22 |
| 1978 | 1 | 377 | 21.5 | 57 | 25.6 | 0.32 |
| | 2 | 315 | 27.1 | 86 | 38.6 | 0.49 |
| | 3 | 408 | 24.9 | 61 | 27.4 | 0.35 |
| | 4 | 381 | 20.2 | 53 | 23.8 | 0.30 |
| | 5 | 418 | 14.2 | 34 | 15.3 | 0.19 |

[a] Based on 1978 cost of 44.9¢/gal for No. 2 fuel oil

[b] Based on average heat contents of No. 2 fuel oil = 141,850 Btu/gal and charcoal = 12,500 Btu/lb. From Perry, Chemical Engineer's Handbook, McGraw-Hill, Inc., 1963, p. 9-6.

RADIAN
CORPORATION

20 July 1978

TRIP REPORT

From: Peter Hulman

Subj: Plant Visit to Kingsford Company in Dothan, Alabama, on 7/6/78

Attending: John Copeland
Peter Hulman
Steve Killingsworth

Contact: Donald Demke, Plant Manager
James Greanias, Kingsford Vice President-engineering
C. E. Harden, Clorox Company Vice President-manufacturing, engineering and facilities

## Summary

The plant is based around a Herreshoff-type furnace. All off gases are vented through cyclones to a combustion chamber. Thirty percent of the combusted gases are directed to a wood predrying system, 20-25% to a briquette drier, and the remainder through a stack to the atmosphere. Emissions could not be observed since the plant was shut down during our visit. They claim that the control system is close to 100% efficient for the reduction of particulates.

Capital cost for the afterburner system is 25-30% of the cost of a retort system. The predrying system costs an additional 25%. A new retort system would cost about $2 million. No fuel is required for normal operation. If there were no predrying system, however, supplementary fuel would be required. Maintenance costs for the predrying system are high.

## Plant Description

The plant is located on the outskirts of a small city. It is about 1/4 mile from a major highway and numerous commercial buildings. The location of neighboring buildings was hard to verify because of the dense woods that surrounded the plant.

The Dothan plant was built in 1972 and went into operation in 1973. The center of the plant is a 5 hearth Herreshoff-type furnace. Kingsford bought a used shell, arm, and shaft, and installed their own refractory lining and exhaust gas combustion chamber. The used parts were originally used for ore beneficiation. The furnace measures 30-34 ft. high with a 21 ft. 6 in. O.D. and

a 20 ft. I.D. The combustion chamber measures 27 ft. high with a 14 ft. 6 in. I.D. and a 16 ft. O.D. A stack, with a 10 in. I.D. and an 11 in. O.D., is mounted on top of the combustion chamber. The overall height of the chamber and stack is about 50 to 55 ft.

The plant also includes a predrying system, a briquetting plant, an office, and a mountain of sawdust and wood chips.

Plant Operations

The plant normally operates 24 hrs/day, 7 days/week, 330 days/yr. It processes about 30 tons/hr of 50% moisture wood. It was not in operation on the day of our visit.

Raw materials include hard and soft wood sawdust, bark, or chips from the lumber industries. Raw materials are more available now than in the past, because pulp mills are having trouble controlling emissions when burning wood for fuel. The plant receives 40% of their materials from within a 20 mile radius. The remainder is received from up to 100 miles away.

When received, the materials are dumped onto a storage pile. A bulldozer blends the materials together to create a homogeneous mixture. From the pile, the materials are automatically conveyed to the predrying system and then to the furnace.

Retention time in the furnace is roughly 30 minutes. The furnace is fired up to 1200°F before adding wood. During operation, the temperature is controlled by regulating the air supply. Different temperatures are regulated for each hearth:

| | |
|---|---|
| Top | 900-1200°F |
| 2nd - 4th | 1200-1300°F |
| Bottom | 1200°F |

A combination of natural gas and fuel oil is only used for standby or upset. As the product leaves the furnace, it is hand sprayed with water for cooling and then enters a process storage tank.

Control System

Furnace exhaust gases pass through a duplex set of cyclones (2 in series). Particles removed in the cyclones are sent to the product stream. From the cyclones, the off gases pass through an

I.D. fan to primary and after combustion chambers, where the gases are completely combusted. Thirty percent of the combusted gas is used for wood drying and 20-25% for briquette drying. The remainder is exhausted through the stack.

The primary burner is run only when necessary, such as when the furnace firing is off or the temperature drops in the after combustion chamber. The off gas burns at about 1800-2000°F. At the top of the after combustion chamber it is cooled by blending with ambient air. A thermocouple located after the cooling air regulates the temperature.

There have been no problems with condensation because the off gases stay hot throughout the entire system. All ducts and equipment are refractory-lined. The only problem has been with the I.D. fan. It normally operates in 800-1000°F gas. Air leaks cause a surge in temperature that breaks the fan.

Capital cost for the control system (w/o a predrying system) was about 20-35% of the cost of a retort system. A new retort, installed with outside labor, costs about $2 million.

Effectiveness of the system could not be characterized, since the plant was shut down. It is claimed that the cyclones are 85-90% efficient and the afterburner is close to 100% efficient for particulate control. Kingsford filed a report of emission tests with the Alabama Air Pollution Control Commission to prove compliance with the state process weight rate regulations. The report is entitled Particulate Emission Rate and Size Study on the ACC Outlet Stack, the Aerodyne Cyclones Nos. 1 and 2 Outlet, and the Briquette Dryer Vent, Report Number 25577-09, and was written by Harmon Engineering in Auburn, Alabama, on June 28, 1977.

Wood Predrying System

The wood drying system capital cost was also about 25% of the retort system cost. The system consists of 2 rotary air dryers, primary cyclone separators (for product recovery), and secondary aerodyne collectors (for pollution control). Because of the abrasiveness of wood, maintenance costs for the aerodyne collectors are very high. However, without the predrying system, supplementary fuel would have to be used, and the furnace capacity would be dropped to 1/2 or 1/3. All of Kingsford's facilities have predrying systems. For other plants, the capital and maintenance costs might not be justifiable.

# APPENDIX E

# LIST OF CONTACTS

## APPENDIX E. LIST OF CONTACTS

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