WASTE REDUCTION ASSESSMENT

AMERICAN CAST IRON PIPE COMPANY
1920 North 16th Street
P. O. Box 2727
Birmingham, Alabama 35202-2727

Company Assessment Team

Joe Pegues, Works Manager
E. E. Langner, Vice President, Manufacturing
Harold E. Hartline, Corporate Environmental Manager
Ben Thomas, Corporate Environmental Chemist

Waste Reduction Assessment Team

Doug Myers, Team Leader
Team Members - See Page "i"

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WASTE REDUCTION TEAMS

Department	WRATT Team		ACIPCO Representative
Steel Foundry	Ed Nemeth Maury Neptune	Report Writer Team Member	Mike Davidson Brooks Johnston
Iron Melting Facility	John Lewis Maury Neptune	Report Writer Team Member	Charles Tuggle Mike Farabee
Monocasting	Glenn Brittain Ed Nemeth	Report Writer Team Member	Paul Crocker
Fittings Foundry	Don Troiano Bud Etherington	Report Writer Team Member	Charles Carden Jim McHan Frank Bergstrom
Machine Shop	John Lewis Don Troiano	Report Writer Team Member	Ed Whitley Herman Brasher
General Yards	Bud Etherington Maury Neptune John Lewis	Report Writer Team Member Team Member	Gordon Simpson
Maintenance Mech.	Glenn Brittain Bud Etherington Don Troiano	Report Writer Team Member Team Member	Howard McCormick, Russell Oliver, Elec. Dan Youngblood, Cons.
Medical Services	Doug Myers	Report Writer	Roland Bradford

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EXECUTIVE SUMMARY

American Cast Iron Pipe Company (ACIPCO) already has an excellent Enviromental Engineering Department but no published corporate policy regarding waste minimization (reduction). At the corporate level, it is recommended that a waste minimization team be appointed.

The technology appears to be available for ACIPCO to reduce the present Large Quantity Generator (LQG) status to Small Quantity Generator (SQG). Reduction to SQG status should be a corporate goal.

It is evident that much time and money has already been spent in reducing environmental waste. However, there are a few areas which are worthy of further study. In some cases, substantial cost reduction for waste disposal may result. Opportunities for waste reduction and cost savings are listed by department.

Steel Foundry

- Suggest substituting refractory piers for cast iron plates as heat treating supports to reduce use of gas and to reduce time in furnace.
- Suggest closer monitoring of atmospheric control in heat treating to reduce oxidation and scaling. Also suggest operating with positive pressure in furnace to reduce air infiltration.
- Suggest considering one new, modern, 5-ton electric arc furnace for the three smaller furnaces currently used; this should reduce power consumption and crew size. Also, there should be a reduction in melt times, better temperature control, better alloy recovery, reduced electrode inventory, reduced breakage of electrodes, and reduced space requirements for the operation.
- Suggest equipping the 15-ton furnace with water-cooled panels (already on site) and a water-cooled roof. This would reduce maintenance costs, refractory material and labor costs, and electrode consumption.
- Recommend that a study be made of reducing the number of coatings to a standard 20 to 25 different coatings.

Iron Melting Facility

- Evaluate economics of selling cupola slag for cement blocks or rock wool instead of landfilling.
- There is much wasted heat. A good general rule is that air exhausted to the atmosphere above 300°F. has valuable recoverable heat.

Monocasting

- Volatile Organic Compounds (VOC) from Painting - Change to a water-based paint emulsion. Obtain approval of American Water Works Association (AWWA).
- Reduce the number of colors of paint used.
- Heat Recovery - Pre-heat air for annealing operation.
- Core Sand and Sand - Continue to evaluate cost effectiveness of cleaning and recycling vs. landfilling.

  Better segregation of solid wastes.

Fittings Foundry

The Fittings Foundry is an operation where good process skills and controls have resulted in the production of quality castings. A few opportunities for waste reduction are as follows:

- Reclaim sand.
- Reduce asphalt paint drainage.
- Check for gas leaks.
- Substitute steel hoppers for cardboard boxes for delivery of sand.
- Better segregation of solid wastes.

Machine Shop

- A program for coolant conservation and recovery.
- Reduce the amount of metal machined by making castings closer to the correct dimensions.
- Meter compressed air used by the machine shop to detect excessive use.

General Yards

- Modernize handling of cupola sludge involving large settling tank (clarifier) and state-of-art filtering equipment such as a filter press.
- Better segregation of wastes is needed. Examples: burnable, non-burnable, scrap steel, metal cans, cardboard for baling, etc.
- Better Solvent Recovery (MEK) - Drums arrive at the solvent recovery unit without bungs. Water contaminates the solvent which must then be sold to Allworth. This results in the purchase of virgin solvent.

- Steel drums which are returnable and/or saleable should be segregated and disposed of at a profit, instead of being melted.

Maintenance Department

- Find probable water leaks.
- Used Hydraulic Oils - Consider reclaiming instead of selling.
- Industrial Engineering - A better layout of craftsman and management areas would improve operations.
- Used tires - Can be sold. See listing of potential buyers in this report.
- Improve identification of waste collection points.

Medical Services

The Medical Services Clinic was exceptionally aware of waste minimization and will be a model operation for other large companies.

INTRODUCTION AND BACKGROUND

During the period of February 26 through March 1, 1991, a seven-man assessment team visited the American Cast Iron Pipe Company in Birmingham, Alabama. This facility totals 550 acres with 50 acres under roof. The company was started about 85 years ago and currently has approximately 2,600 employees.

The company manufactures rolled and welded steel pipe, centrifugally cast ductile iron pipe, statically cast valves, fittings and hydrants in gray or ductile iron, centrifugally cast steel tubes, and statically cast steel job-shop castings. They also operate complete facilities for testing, coating, and machining their products.

The assessment team was concerned with only eight of the many departments including: Monocast, Fittings and Foundry, Steel Castings Foundry, Melting, General Yards, Machine Shop, Maintenance, and Medical.

The department assessments are presented below.

A. STEEL DEPARTMENT

I. DESCRIPTION OF FACILITIES AND OPERATIONS

The steel foundry is primarily a job-shop operation which produces cast cylinders to order in quantities of one or a few at most. The castings are custom-produced to meet wall thickness, diameter, length, steel chemistry, heat treatment, and physical test requirements of the customer. The molds are lined internally with a cement/silica sand mixture to achieve the outside diameter of the casting and to protect the steel mold from damage by the hot metal poured into the mold. The lining also serves as a separating compound when stripping the casting from the mold after a cooling cycle has taken place.

The steel foundry has some machining capabilities for cutoff and rough outside diameter turning. The shop can increase the length of a cylinder and add a flange, bell-end or other end connections through their submerged arc welding facilities. Heat treating is accomplished in any of four small horizontal car-bottom furnaces or in four modern, round, vertical furnaces with tight atmospheric and temperature controls.

Alloy steels are melted in any of seven different melting furnaces. Three are small coreless induction furnaces, and four are electric arc furnaces (EAF).

Capacities of the melting furnaces are:

Induction Melters:	1 of approximately 700 pounds 2 of approximately 400 pounds each
Arc Furnaces (EAF):	2 of 2 tons each 1 of 4 tons 1 of 15 tons.

The EAF shop is capable of making many grades of carbon and alloy steels. In conjunction with the new AOD vessel, the shop can make very "clean steel," free of non-metallic inclusions and undesirable dissolved gases, essential for sound casting going into extremely high pressure applications. The induction furnaces are less versatile in that refining for close chemistry control is generally limited to controlling the known alloy content in the grades of scrap charged.

II. WASTE GENERATION, HANDLING, AND DISPOSAL

A. Four Horizontal Car-bottom Heat-treating Furnaces

Raised some inches from the refractory top of the car, supported by brick piers, are heavy (4 to 5 inch thick) cast iron plates with a series of approximately 4 inch square holes over the entire plates. The plates cover the whole surface of the cars. The tubing being heat-treated lies on top of these plates while in the furnace. Although these plates serve as a support for the tubing, they are extremely counter-productive to the cost and time required for each cycle. Each time a new batch of product is placed in the furnaces for heat-treating, these base plates must also be raised to the same target temperature for the designated heat-treating cycle of the tubing. A tremendous amount of natural gas energy is used each time these heavy plates are reheated. In addition to the wasted energy, time is also wasted in bringing these plates up to the target temperature.

B. Atmospheric Control in Heat-Treating

The atmosphere appears to be oxygen rich as indicated by heavy scale on the tubing after heat-treating. The two main sources of excess oxygen are through actual burner settings and air infiltration from leaks through openings not properly sealed. In addition to heavy scaling, a deeper decarbonized zone than desired requires excess metal removal by machining. Backtracking from here, more metal probably is planned in the as-cast wall thickness to provide for this metal removal.

C. Boring Machine

Two holes are bored at the drag end of a tube on the boring machine in order to insert a pin to support the tube vertically in the vertical heat-treating furnaces.

D. Melting Furnaces

There are three coreless induction melting furnaces and four electric arc furnaces (EAF). None of the seven melting furnaces were operating during the two visits made to the steel foundry. Either the business level was low or there are too many furnaces. The three induction furnaces do not take up much room, but the four EAF's take up the rest of the melt shop. While inspecting the three small furnaces, it was noted that the entire control system for power, arc, and electrode is old and of a type no longer used in modern EAF shops. Transformer size for the three furnaces is unknown, but they are most likely underpowered by today's standards; consequently tap-to-tap heat times are longer than they should be.

E. Pipe Coating and Painting

A general comment made during a visit to the pipe coating and painting line was that there are over 100 different paints and coatings used at ACIPCO, creating much waste in solvents and left-over small quantities of seldom used coatings.

F. Housekeeping

Behind the welding machine stations is a case of unknown items stored in a disorganized array. Throughout the shop, many hoses, extension cords, and wires are randomly scattered in work areas and walkways. In addition to being a definite safety hazard, it lends itself to less than the best of work habits.

III. OPPORTUNITIES FOR WASTE REDUCTION

A. Car-Bottom Heat Treating Furnaces

A simple but proven method used in most car-bottom furnaces is to support the furnace load on refractory piers, eliminating the heavy base plates. These piers can be precast off-site and placed on the cars. Three piers per car, evenly spaced, should be able to support both short and long tubes in the furnace and allow free circulation of the hot gases around the product. Actual furnace time, and more importantly, significant gas usage, should considerably reduce each cycle.

The refractory piers can be cast or rammed into a steel form tapered from about 10 inches at the bottom to about 8 inches at the top and about 12 inches high. The length would be equal to the width of the car. Before weight is placed on them the first time, they should be brought up to a temperature of ceramic bonding. An inquiry to refractory suppliers for precast piers supplied by their firms could be made.

B. Atmospheric Control

It appears that a savings can be made at each level of the operation by closely monitoring atmospheric control at the heat-treating furnaces. An additional control to minimize air infiltration is through positive furnace pressure control during firing.

C. Boring Machine

Machine time and handling time could be eliminated by hand welding a pin or a strap over the top of the tube to support it during heat-treating in the vertical furnace. Since this end of the tube is cut off during finishing operations, it does not matter whether two holes are bored through it or if a strap or pin is welded on it for support.

D. Melting Furnaces

It is strongly recommended that the Engineering Department investigate one new high-powered 5-ton EAF, with modern controls and hydraulic electrode controls to replace the three smaller furnaces. A modern 5-ton EAF will out-perform the three smaller furnaces combined. The new furnace should also be equipped with water-cooled side wall panels and a water-cooled roof. Sizable savings would result from crew size reductions, less power consumption per ton melted, greatly reduced tap-to-tap melt times, better temperature control, better alloy recovery, less electrode consumption per ton melted, and reduce electrode inventory by eliminating two small-size electrodes which are difficult to find and expensive because of the small diameters. Another important savings in both money and time will be a reduction in broken electrodes during melting. A considerable amount of space would be freed up in the shop for more efficient feeding of the furnace.

The one 15-ton EAF should be equipped with the water-cooled panels which are already on site but not in service yet. Also, a water-cooled roof for this furnace should be considered immediately; it will pay for itself in less than six months by reducing maintenance cost, refractory material costs, and refractory labor costs. A water-cooled roof is much lighter in weight, reducing the loads on the furnace mast and thrust bearing. A side benefit to water-cooled panels and roof is a reduction in electrode consumption due to cooler electrodes at the roof openings, reducing high temperature oxidation.

E. Pipe Coating and Painting

It is recommended that management have production planning initiate a study of the last five years covering the number of coatings and quantity of pipe and tubing used. After the report is completed, the seldom-used coatings should be arbitrarily removed from offered coatings. Next, where an alternative coating serves the same protection as one not often used, this group of little-used coatings should be removed. This process of elimination should continue until a relatively small number of paints and coatings remain as ACIPCO's standard offering. It may be possible to get this group down to 20 to 25 standard coatings. A new corporate policy of standard coatings should then be established and announced to all customers. The policy should also state that any special coatings will be provided at an extra charge, and the customer will take or pay for any leftover non-standard paint or coating at ACIPCO's cost. The rationale for this policy can simply be stated as a cost and environmental necessity to eliminate hazardous wastes at the plant site.

F. Housekeeping

Cleaning the area and discarding unwanted items would create space to store the large number of boxes of welding wire and rods now stored in the aisles and crane bay where damage and waste can occur. Also, a more organized storage method could be evolved for the collection and temporary storage of the welding slag to be sent out for recovery processing.

In most of the areas where hoses and wires were observed on the floor, they could easily be suspended from supports off the building columns at these work stations.

B. IRON MELTING DEPARTMENT

I. DESCRIPTION OF FACILITIES AND OPERATIONS

ACIPCO operates a 150-inch cupola pouring up to 100-tons of iron per hour. Steel and plant scrap, coke, and limestone, at rate of about 10 TPH, feed into the cupola as raw materials. The cupola was designed by ACIPCO and is unique because of its large size. Other equipment appeared to be of standard manufacture. Molten metal, desulfurized with calcium carbide, is held in a 1,300-ton furnace and then fed into one of five induction-heated holding furnaces prior to pipe manufacture.

III. WASTE GENERATION, HANDLING, AND DISPOSAL

- About 150 tons per day of cupola slag is fed into water where it breaks down into a slurry. The solids are allowed to settle and are then hauled to the ACIPCO landfill.
- Ladle skimmings contain 30 to 40 percent iron
- Heat from the holding furnaces is wasted.

IV. OPPORTUNITIES FOR WASTE REDUCTION

- Cupola slag now hauled to the landfill could possibly be sold to a cement block manufacturer or a manufacturer of rock wool. Serious efforts should be made to explore these and other markets instead of landfilling.

- Consider recovering iron from the ladle.

- Many items used in melting are received in paper bags or pallets. We suggest that contact suppliers be requested to ship these items in returnable tote bags or tote bins. This would eliminate bags and pallets.

- Holding furnaces should be better insulated to conserve heat, thus reducing electric power consumption used in induction heating.

C. MONOCAST DEPARTMENT

I. BACKGROUND

American Cast Iron Pipe Company produces centrifugally cast ductile iron pipe in sizes 4 inches through 64 inches and 100 millimeters through 1,600 millimeters in diameter. The centrifuge process consists of spinning hot fluid iron in a metal mold about a horizontal axis while a weighed amount of molten iron is introduced into the mold. The centrifugal force of the rotating mold distributes the metal evenly, forming all parts of the pipe. This eliminates the use of a center core. All pipe is produced in 20-foot lengths. There are six centrifugal casting machines. Production rate ranges from 18,000 to 36,000 tons per month. There are 429 employees.

II. DESCRIPTION OF FACILITIES AND OPERATIONS

Figure 1 is a simplified flow diagram of the monocast process.

- Process and equipment used: Centrifugal casting done on deLavaud machines.

- Raw materials used: See Figure 1.

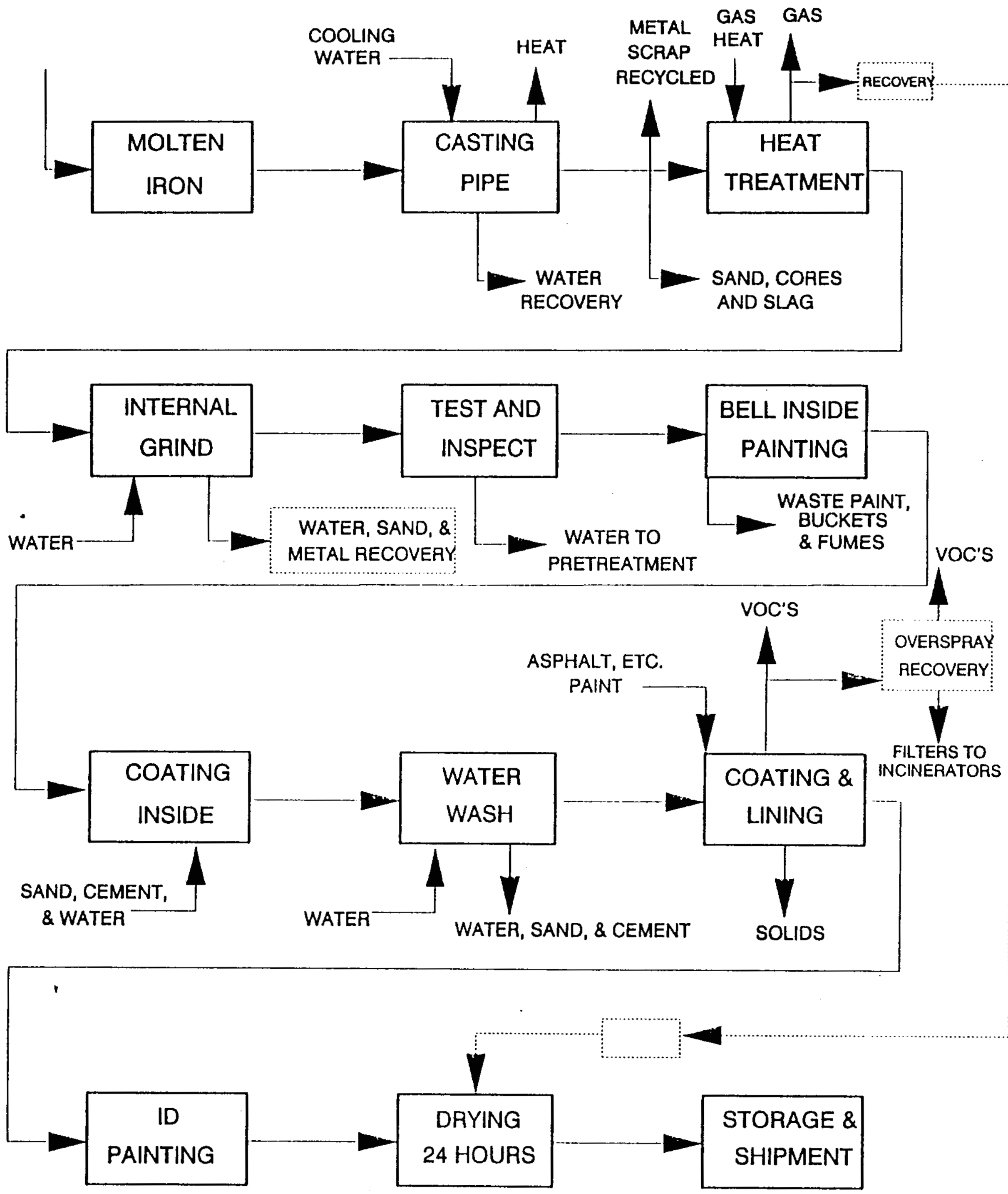

FIGURE 1. ACIPCO MONOCAST

III. WASTE GENERATION, HANDLING, AND DISPOSAL

The following are the major waste items from the Monocast Operations:

- Slag from surface of molten metal - Collected and landfilled.
- Sand from molds - Collected and landfilled.
- Core sand mixed with paper - Collected and landfilled.
- Metal tailings from fill trough - Collected and recycled to furnace.
- Splash metal - Not all recovered; some landfilled with core sand.
- Cement left over from lining - Sluiced to trough and catch basin; water sent to treatment.
- Paper from bags and incoming materials - Segregated, placed in trash bins and sent to incinerator.
- Grind metal and sand from internal grinding - Sluiced to water drain.
- Unused paint - Multiple color changes.
- Volatile organic compounds - Largely naptha containing xylene; 23,300 pounds of xylene per year; vaporized to atmosphere.
- Heat - Recoverable heat vented to atmosphere.
- Cardboard - Some boxes reused for storing cores; some landfilled or burned.

III. OPPORTUNITIES FOR WASTE REDUCTION

American Cast Iron Pipe Company is already studying many of the items listed below for waste reduction; for example, the cost of landfilling sand and core material vs. reclaiming and recycling. Cost effectiveness is periodically reviewed. However, the following are opportunities for waste reduction.

- VOC's - Naphtha and xylene in the naphtha from painting pipe:
  - (a) Change to water-based paint with approval of the American Waterworks Association.
  - (b) Do not paint inside of pipe to be coated with cement.

- Excess Paint: Reduce colors from the approximately 100 now being used to less than 20 colors. This would save on spray equipment wash-out and on wasted paint. The sales force that specifies colors could be instructed to reduce the number of colors for waste reduction purposes.

- Heat Recovery:

  (a) Utilize the exhaust heat from the large pipe annealing heater by installing pre-heaters for intake air supply. See dotted line on Figure 1.

  (b) Replace open drum personnel gas heaters with infra-red; also a more efficient means for providing heat in open areas.

- Core Sand: Could be reclaimed by treating to remove binder. Study cost effectiveness.

- Sand: Could be cleaned and reused. Study cost effectiveness of cleaning vs. landfilling.

- Better Segregation of Solid Wastes (Cores, Paper, etc.): Provide additional trash bins and mark each container for the type of waste.

- Lining and Coating: Experiment with Teflon or peel release materials on metal surfaces to reduce labor requirements for the conveyor, handling equipment, and cleaning area.

- Splash Metal: Additional use of magnet separators to remove metal from core sand going to landfill.

- Cooling Water:

  (a) Better separation of sand and solids from cooling water, such as centrifuging.

  (b) Increase heat transfer; evaluate effect of etched or roughened outside of surface molds, leaving the areas for roller support as a smooth area.

D. FITTINGS FOUNDRY

I. BACKGROUND

The Fittings Foundry produces cast iron and ductile iron fittings for the water and sewage industry and special castings for other industries, such as aluminum foil manufacturers. The fittings operations include cleaning room, pattern shop, and pattern storage areas. The foundry pours approximately 65 to 75 tons of ductile and gray iron daily, operating one shift per day, five days per week.

II. DESCRIPTION OF FACILITIES AND OPERATIONS

The two general molding processes used in the Fitting Foundry are: green sand process and air-set process. The process flow for the green sand units are straight line flow from sand preparation, molding, core set, pour-off, and shake-out. The air-set units include mulling and mixing sand, fill mold and shake-out. The green sand lines employ sand slingers and jolt squeeze molding techniques. The iron melting or holding process is centralized at the end of the molding lines. The pour-off ladles are transported to the molds via overhead cranes. An exception is at the green sand cope and drag unit where molds are transported on a car conveyor to pour-off area. Molds continue through cooling to shake-out.

Core making consists of air-set and shell-molding processes. Various core binders are used in the air-set process, depending on curing time desired.

At the shake-out operation, green sand is separated from core butts and returned to the sand mulling system. Core butts and air-set molds are sent to shake-out pit area. Approximately 300 pounds of green sand is added for every ton of metal poured.

The casings are sent to the cleaning room where steel shot wheelabrators remove sand and scale from castings. Sprues and risors are removed with an acetylene torch. Castings are ground using sling-grinders and other special grinders. Pipe is transported from grinding area to the asphaltic dip tank by chain conveyor or to the concrete lining area by belt conveyor.

Raw Materials Used:

Ductile and gray irons
ACIPCO 33 sand
Hertzboro 48 sand
Clay binder for green sand system
Pep Set - phenolic urethane (fast reaction for smaller cores)
Isocure - Alkyd oil (slow reaction for large cores)
Alpha Set - (core)
Chromite sand - (pin cores)
Magnesium Innoculant (ductile iron)
Thermoloy (ductile iron)
Cutting and scarfing powder.

III. WASTE GENERATION, HANDLING, AND DISPOSAL

The following items were noted as wastes generated.

- Air set mold and core butts which do not break down after pour-off are transported to the yard. The metal is removed for recycling and the remaining core material is sent to the landfill.

- Sand - About 300 pounds of new sand is required per ton of product. Virgin sand costs $30 per ton. Wasted sand is landfilled.

- Asphalt paint drainage from dipped fittings is wasted. Castings are transported to the paint dip tank on hooks attached to a chain conveyor. The hooks and castings are immersed in the paint and then hoisted out. Paint is dragged out of the pit and drains for several yards. Only about 5 percent of the hooks were loaded with fittings but all hooks had been immersed and were dragging out paint.

- Cardboard is placed in marked containers for incineration. Shell cores are delivered in cardboard boxes.

- Plastics and other combustibles such as wood and paper are placed in the container for incineration.

- Natural gas leaks were detected in several areas such as air-set molding and ladle heaters.

- Grinding wheels were worn down, reducing the rate of grinding and increasing labor costs.

IV. OPPORTUNITIES FOR WASTE REDUCTION

The following suggestions are made to reduce the cost of generating and handling waste.

- Sand Recovery - A cost study of reclaiming.

  (a) Install a crusher and screen system to recover air-set sand. An estimated 4 to 5 tons of sand per day could be recovered.

  (b) A phenolic urethane binder for the sand would make reclamation of sand easier.

  Weigh costs of reclaiming vs. virgin sand and landfilling.

- Reduce Paint Drag Out

  (a) Remove hooks that are not in use; need detachable hooks.

(b) Reduce chain speed and increase drag-out time to allow more time for drainage.

(c) Lengthen drip pan to drain paint back to pit.

(d) Chain appears much too long for area served. Shortening chain would reduce maintenance and power costs.

- Cardboard

  Shell core-sand may be delivered in returnable steel hoppers instead of cardboard. Request vendor to change to steel hoppers.

- Gas Leaks

  Check all service lines for gas leaks. The same maintenance group that checks for air leaks could also check for natural gas leaks.

- Grinding Wheels

  Do not grind with wheels less than an optimal diameter for wheel life and grinding performance.

- Solid Wastes - General

  Better segregation of waste is needed--metal rods, paper, wood, etc. The bins are available but the employees need encouragement to place wastes into the proper bin.

E. MACHINE SHOP

I. BACKGROUND

The Machine Shop has 400 employees and provides machinery for facing, drilling, threading, boring, and similar operations for pipe products, cores, and cylinders. A secondary function is to provide machine shop support for all manufacturing operations.

The American Cast Iron Pipe Company shop may be the largest machine shop in the Southeast.

II. DESCRIPTION OF FACILITIES AND OPERATIONS

Individual machines used are lathes, boring mills, inside diameter honing, welding, etc. Work assigned to a particular machine is carried to completion without relocating as much as possible. Only limited assembly, such as threaded flanges, is performed.

III. WASTE GENERATION, HANDLING, AND DISPOSAL

The following is a list of waste generated and the method of handling:

- Metal chips from cutting - Machining can remove up to 45 percent of initial casting weight and which amounts to 6 to 7 tons per day. Chips are collected and recycled to the cupola.

- Synthetic coolant - New make-up solvent averages about 1,200 gallons per month at a cost of about $88,000 per year.

- Compressed air - Compressed air service lines were observed in all areas of the plant, including manufacturing areas. Noisy air leaks were found in many areas.

- Industrial Engineering:

  (a) The tool room was being upgraded and re-organized to better serve the Machine Shop.

  (b) Boring of winder cores - Poor utilization of machine operator's time.

  (c) Excess production of metal chips.

- Nylon rope and slings - On the floor and subject to damage from vehicles.

- Housekeeping - Very good.

IV. OPPORTUNITIES FOR WASTE REDUCTION

Since much has already been done to reduce waste, the following opportunities for further waste reduction are offered in a positive manner.

- Synthetic coolant losses may be reduced by:

  (a) Better drainage from chips. Set up experimental draining hopper with screen and coolant sump to measure optimum drain time.

  (b) Centralized preparation and control of coolants.

  (c) Purchasing coolants in bulk rather than in 55-gallon drums; to be dispensed by tool crib attendant.

  (d) Periodically testing coolants for proper water content; add water as needed.

- Excess metal in molded item was observed for a winding core for aluminum foil. Clean casting weight was 2,600 pounds and finished machine weight was 1,200 pounds or a 54 percent loss during machining. A casting mold closer to the final dimensions may save on machining, coolant, and recycling of metal chips.

- Compressed air: There is the potential for substantial cost reduction for compressed air by placing in-line gas meters to each department, and targeting and repairing air leaks. It may be profitable to designate one or two machinists to search for air leaks on a regular schedule.

- Industrial engineering: The boring machine operator could probably operate two machines simultaneously if the machines were adjacent to each other, as are the N.C. lathes.

F. GENERAL YARDS DEPARTMENT

I. BACKGROUND

The General Yards Department is divided into three sections: Yard and Track, Switching, and Material Handling. Total area of the plant is about 2,000 acres. The WRATT team was concerned only with the Material Handling Section as it related to the processing and handling of the plant refuse.

II. DESCRIPTION OF FACILITIES AND OPERATIONS

Some parts of the yard acreage are devoted to the Melting Department for the processing of melting stock. Other large areas are used for the storage of incoming materials and products awaiting shipment or further processing. A large rail switching yard handles the many carloads of material needed in the plant each day. The largest area, recently acquired, is vacant but had been strip-mined for coal. This area has recently been opened as the company landfill. APIPCO is building a railroad near the new scrap shredder installation and hopes to have this railroad in operation by late summer. A large area is used for ponds and settling basins to handle the large volume of water-borne sludge and water.

In addition to handling and hauling plant and waste materials, Material Handling is also responsible for the operation of the incinerator, the solvent recovery system, the decanting ponds, and the landfill.

III. WASTE GENERATION, HANDLING, AND DISPOSAL

One of the General Yards Department's major concerns is the operation of the various settling ponds and other facilities to handle the sludges and other water-borne wastes. Effluent from the Fittings Foundry and the Monocast Department enter a settling pond adjacent to the switching yard. Nearby are two smaller ponds and two small decanting ponds which are used only when the primary settling pond is being cleaned. Water from the settling pond is pumped to the first of several additional ponds on the top of a hill. Water carrying the sludge from the cupola is pumped into one of two concrete settling bins and then flows into this same pond. The flow rate from the cupola is 4,000 gallons per minute. Flow to the concrete settling bins is changed from one bin to the other each week, allowing an opportunity for the one not in use to be cleaned out. The water flows over weirs to two additional settling ponds and then into a large polishing pond. At this point, nearly all of the particulate matter has settled out. Water from the polishing pond flows back down the hill to a 7-1/4 acre reservoir. From this reservoir, the water is pumped to an elevated storage tank for re-use. Also from this reservoir, there is a permitted water discharge to the storm water system (Village Creek) which is normally about 350 gallons per minute. See Figure II, Plant Layout.

Cleaning of the three settling ponds on the hill where the bulk of the cupola sludge is caught is nearly a constant process. A small dredge, called the "Mud-Cat," can clean the ponds to a depth of about 15 feet. This dredged material is pumped to a dewatering pond where the solids are allowed to drain. As the settled material is pumped from the dredge to the dewatering pond, fringe specification cement is added to the stream. The cement serves to make the small amounts of lead and zinc non-leachable and the refuse is thus rendered nonhazardous. The dewatering pond is cleaned about twice a year and this nonhazardous material is hauled to the ACIPCO landfill.

An area referred to as the regular dump is a collecting point for solid refuse which is not otherwise treated. All of this material eventually goes to the ACIPCO landfill. Since material is usually hauled to the landfill only once a week, this collection area is a necessity.

Another responsibility of the General Yards Department is the operation of the incinerator. Throughout the plant, refuse is supposed to be sorted into burnable and non-burnable categories. Bins of the burnable materials are sent to the incinerator. Cardboard is supposedly sorted out and baled while the rest of the burnable refuse is fed into the incinerator and burned. It is estimated that about 20 tons of material per day goes through the incinerator. Natural gas is used for light-up and to maintain the stack temperature, if necessary, in the 1400 to 1600 degree Fahrenheit range. About one cubic yard of ash is generated in the incinerator each day. This goes directly to the dump and then the landfill. A liquid incineration unit is also available but its operation is no longer permitted.

A solvent reclamation system is used to recover dirty (but water free) solvents. MEK is the primary material recovered.

Cupola slag is trucked from the collector and goes to the landfill. Small quantities are used on some of the roads around the property.

Foundry sand, ladle skimmings, and lining refuse are accumulated and reworked for metal content by an outside contractor, Watkins Metals Reclamation Company. After reworking, the refuse goes to the landfill while the recovered metal is returned to the cupola for remelting.

Steel drums are collected and go to the scrap metals processing area where they are crushed and sent to the cupola to be remelted. Unfortunately, a number of drums containing mixed materials are delivered to the yard area and this material must be separated before the drums can be processed.

Pallets are collected and separated. Some are returnable and others are sold. Broken or defective pallets are incinerated or otherwise burned. The 4 inch x 4 inch timbers, which are used for shipping pipe, are reprocessed, when possible, by another department. Scrap lumber is sent to a firewood area where it is available to the employees for firewood. A limited amount may be incinerated or burned by the General Yards Department.

About 100 tons of material per year is collected in the bag house serving the arc furnaces in the steel foundry. This material is significantly different from the cupola exhaust sludge and is considered to be a hazardous material. It is handled by Chemical Waste Management Company which treats it with cement and disposes of it in the hazardous waste landfill at Emelle, Alabama.

IV. OPPORTUNITIES FOR WASTE REDUCTION

While it appears that the General Yards Department is doing a commendable job of handling their waste streams, the following are suggestions where improvements could result in substantial cost savings.

Separation of waste is an area that could stand improvement. Burnable and non-burnable materials are supposedly separated in each generating area. However, the burnable refuse, as received at the incinerator, is apt to contain varying quantities of metal, glass, or other non-burnable items. Metal drink cans in particular should be sorted out and the aluminum ones resold separately. Much cardboard is incinerated which could be sorted out and baled. While it would be preferable to separate these materials prior to incineration, the ash should go to the reclamation area where the remaining metal could be sorted out and remelted.

In the immediate incinerator area there appears to be little need for any recovered heat. However, all heat going up the incinerator stack is wasted. This should be kept in mind for possible future utilization.

While there are approximately 100 kinds of paint used throughout the plant, the most common recoverable solvent is MEK. This is recovered in the in-plant solvent recovery system for about $.25 per gallon. However, if the feedstock to the recovery system is contaminated with water, the recovery becomes extremely difficult and more expensive. Unfortunately, most of the drums arrive at the solvent recovery unit open. Open drums which have been out in the rain pose a serious water contamination problem. A simple policing of these solvent drums could make the solvent recovery system far more effective by eliminating this contamination. By contrast to the $.25 per gallon in-house recovery cost, the material sent for processing by the outside vendor (Alworth) costs about $100 per drum or about $1.80 per gallon, plus the cost of replacement solvent.

The many steel drums generated in the plant operation are crushed and remelted. It is expected that a number of these drums are either returnable or saleable and an effort to separate these from the others should be worthwhile.

The 150 tons per day of cupola slag represent a possible income stream. In the past, some of this waste was sold to a cement block manufacturer. Although this facility is no longer in operation, there are a number of other local manufacturers who may be potential users of this material. The use of this cupola slag as a raw material for the manufacture of rock wool is also a possibility. A serious effort to explore these and other possible markets for this waste slag is certainly warranted.

Although the present system for handling the cupola sludge and other settlings is getting the job done, the material will have been pumped or otherwise handled several times before it reaches the landfill. In the future, as economic conditions dictate, this processing method might be replaced with a more direct separation method involving larger settling bins and state-of-the-art filtering equipment. Preliminary plans for such a system may already exist.

The materials found on the regular dump also need better separation. Loads containing recoverable metal should go to the metals reclaiming area rather than to the dump. Some materials, such as the submerged arc welding flux, should be reprocessed and recovered rather than thrown away. (Most of it probably is reused but a significant amount was seen on the dump.) There are local reprocessors.

The 100 tons per year of arc furnace bag house dust which goes to the landfill at Emelle may represent an attractive cost reduction opportunity. Chemical Waste Management charges $215 per ton to handle this material. By incorporating an on-site dry cement injection system, it is understood that this material could be reclassified as non-toxic and thus could go to the ACIPCO landfill. The on-site processing cost for this system is estimated at under $5 per ton for an annual savings of $21,000. Engineering drawings for the change in this processing are said to already exist.

Significant volumes of waste sand from the Fittings and Steel Foundries are generated each year. In the Fittings Foundry, 300 pounds of new sand per ton of metal poured are added in addition to the core sand that enters the system. A fairly simple pneumatic reclamation system would eliminate the bulk of the new sand addition to the green sand system. In the past, such installations have proven to be very attractive economically. With rising sand, transportation, and disposal costs, a careful evaluation of such a system would seem to be warranted. A more complex system would be necessary to recover the core sand, but installations now exist that are very satisfactory and capable of attractive savings in sand cost. An additional benefit of such systems is the reduction of material that is landfilled.

G. MAINTENANCE DEPARTMENT

I. BACKGROUND

The Maintenance Department provides services for all eight major departments at American Cast Iron Pipe Company. The services are subdivided into three groups:

(a) Mechanical - 135 employees

(b) Electrical - 93 employees

(c) Construction - 55 employees.

Each group serves all areas of this plant. The Maintenance Department already has in place an active waste minimization program. Solid wastes are transferred to the Yards Department for disposal.

The electrical shop covers about 40,000 square feet and the mechanical shops cover about 20,000 square feet. Storage facilities are provided off-site but adjacent to the plant.

Insert para. at A above

Jack, - Consider a paragraph on recycling [illegible] into the [illegible] to [illegible]. Fluid, [illegible] bleed off a stream for reclamation.

II. WASTE GENERATION, HANDLING, AND DISPOSAL

The following is a list of wastes and handling methods.

Potable Water

There are about 2,500 employees using about 11.5 million gallons of potable water per month for sanitary purposes. Industrial or process water use is about 17.5 million gallons per month. These figures imply considerable waste.

Oils

(a) Spent lube oil from all machinery in the plant is collected, stored in tanks, and sold to a scavenger at regular intervals.

(b) Hydraulic oil from all machinery in the plant is collected, stored in tanks, and sold to a scavenger at regular intervals.

(c) Mineral spirits from parts degreasing.

(d) Stay Dry with absorbed oil is ultimately sent to landfill.

Scrap Metal

(a) Copper is segregated and sold.

(b) Steel and iron are recycled to melting furnace.

Rags

Recyclable rags are sent to the laundry. Non-recyclable rags are placed in the hopper for incineration.

Paper and Cardboard

There is only a small amount which is placed in the hopper designated for incineration.

Capacitors and Transformers with PCB's

Handled in accordance with regulations and when spent shipped to Emelle.

IV. OPPORTUNITIES FOR WASTE REDUCTION

Water use appears to be inordinately high. Suggest looking for open valves and underground leaks. Since this is an old facility, underground leaks are very likely. Suggest making an overall water balance and water balance by departments. The annual cost for potable water is $275,000 and for process water, $87,000. This appears to be a fruitful opportunity for waste and cost reduction.

The hydraulic oils are changed and recycled at regularly scheduled periods. Reclaiming and improved filtration will decrease the oil use and mechanical failures.

A layout study (craftsmen and management) for each area may be helpful to improve operational duties.

Improved identification of each type of waste storage and collection point.

If the incinerator is converted to collecting the heat generated, consideration could be given to burning waste oils as an energy source.

Waste tires can be sold.

H. MEDICAL SERVICES DEPARTMENT

I. BACKGROUND

ACIPCO operates a high quality health service clinic for the 2,600 employees, their families, and retirees. Medical service is provided by a staff of physicians, dentists, nurses, and health professionals. There is also a pharmacy to provide prescription needs. The health services are provided at no cost to the employees. There is a steady patient load, normally by appointment. In emergencies, such as an injury or a sudden severe illness, health care is also provided at the clinic.

The medical department conducts a random drug testing program extending to all employees. Employees are encouraged not to smoke to reduce cost of health care.

II. DESCRIPTIONS OF FACILITIES AND OPERATIONS

The health services building is strategically located just outside the plant area to serve both employees on shift and employee dependents. The building covers an area of about 15,000 square feet. There is an emergency room typical of most hospitals plus patient rooms and doctor and dental offices. There is also a pharmacy for dispensing prescription drugs. Except for surgery and specialized diagnostic equipment, the clinic provides most of the routine health services.

III. WASTE GENERATION, HANDLING, AND DISPOSAL

There are five categories of wastes generated at the ACIPCO clinic.

- Sharps (needles) and vials for collecting blood samples. These are placed in a red plastic container and sealed when the "fill line" on each container is reached.
- Bandages, such as band aids, are also placed in separate containers and sealed when full.
- Ordinary paper trash, such as kleenet and paper, is placed in a trash container with a red plastic bag.
- White paper from records keeping and other burnables are placed in a trash basket with a gray plastic liner.
- X-ray film - Outdated used film is recycled; the silver is recovered.

All waste from the clinic is hauled directly to the incinerator about twice per week for incineration at an average temperature of 1300°F for 12 minutes. Red containers containing sharps are never placed in other bags but are handled separately with a system of record keeping. Ashes from the incinerator are raked from the incinerator and transported to the landfill.

IV. OPPORTUNITIES FOR WASTE REDUCTION

ACIPCO Health Services would seem to be a model for other industries to follow. Opportunities for waste reduction were not found. Hazardous wastes are sealed and incinerated and reduced to a non-hazardous state. A record keeping system is in place to avoid any loss of waste before incineration.

OTHER SOURCES OF ASSISTANCE

For technical information on compliance questions, contact the following personnel at:

Alabama Department of Environmental Management
1751 Congressman W. L. Dickinson Drive, Montgomery, Alabama 36130
Telephone: (205) 271-7700

Solid Wastes -	Jack Honeycutt - Chief, Solid Wastes Branch Steve Jenkins - Chief, Hazardous Wastes Compliance Branch Telephone: (205) 271-7726
Air Discharges -	Ron Gore - Chief, Engineering Branch Telephone: (205) 271-7861
Water Discharges -	John Poole - Chief, Waste Water Division Telephone: (205) 271-7852

For technical information on exchange or disposal of wastes, the following are suggested:

Chemical Engineering Department and Alabama Waste Exchange
University of Alabama
P. O. Box 870203, Tuscaloosa, Alabama 35487-0203
Attention: Bill Herz - Telephone: (205) 348-1102

HAMMARR (Hazardous Material Management and Resource Recovery Program)
and project ROSE (Recycled Oil Saves Energy)
University of Alabama, College of Engineering
P. O. Drawer 6373, Tuscaloosa, Alabama 35487-6373
Attention: Dr. John Moeller - Telephone: (205) 348-8401
or 1-800-452-5901

National Fertilizer and Environmental Research Center (NFERC)
Tennessee Valley Authority (TVA)
P. O. Box 1010, Muscle Shoals, Alabama 35660-1010
Attention: Karen Brady - Telephone: (205) 386-2210

Southeast Waste Exchange
Urban Institute - University of North Carolina at Charlotte
Charlotte, North Carolina 29223
Attention: Maxie May - Telephone: (704) 547-2307

Waste Reduction Resource Center
P. O. Box 27687, Raleigh, North Carolina 27611-7687
Attention: Bob Carter/Vic Young - Telephone: 1-800-476-8686

CONCLUSION

The members of the WRATT team wish to thank the management and employees of American Cast Iron Pipe Company for their hospitality during the visits to make the waste reduction assessments. The cooperation of everyone in providing information is greatly appreciated.

ACIPCO is to be congratulated for the excellent operation and to be commended for its efforts to reduce waste. It is hoped the suggestions and recommendations in this report will be helpful.

Attachments

1. [illegible] minimization for the foundry industry, Daniel F Ocnan, JAPCA, July 1988 Volume 38 No 7 Pg 932
2. Foundry Sand Reclamation, CMP Report No. 90-6 July 1990 by John M. Svoboda.
3. Hot Tips From HHMMAK
4. Bulletin 872 – [illegible] Shredder for [illegible] and trash.