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COKE OVEN CHARGING EMISSION CONTROL TEST PROGRAM - SUPPLEMENTAL OBSERVATIONS

by

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ABSTRACT

The larry car, developed jointly by the American Iron and Steel Institute and the Environmental Protection Agency, was tested at the Jones and Laughlin Pittsburgh Works by The MITRE Corporation during the Spring and Summer of 1973. The purpose of these tests was to demonstrate the improvement in atmospheric conditions that can be obtained while charging a slot type coke oven. New larry cars having both similar and contrasting features are currently in operation on other slot type coke ovens, and their effectiveness should logically be assessed as an adjunct to the J & L car evaluation process. This report describes the procedures used to gather comparative operational information at the Weirton Steel Corporation, Division of National Steel Corporation, Brown's Island Coking Plant, where two charging cars, similar in several ways to the J & L car, are in production operation.

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The authors would like to express their appreciation for the splendid cooperation and support of Weirton Steel personnel, particularly Mr. Houston Woods, Director of Environmental Control; Mr. Gene Current, Assistant Director of Environmental Control; Mr. Thomas Emmerth, Assistant Superintendent of Brown's Island Coke Plant; and their respective staff members. The task of gathering the required information was aided immeasurably by the help of these gentlemen.

The design of the particulate sampling equipment represents the adaptation of an earlier MITRE design to the unique problems encountered in the proposed observations. Mr. Andrew Wallo III, played a major role in the adaptation and fabrication of the particulate sampling equipment used and described in this report.

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1.0 CONCLUSIONS

Information was gathered on the design and operation of the new charging cars operating on the Brown's Island battery of the Weirton Steel Division, National Steel Corporation. A comparative analysis with the AISI/EPA charging car demonstration of the ability to reduce emissions due to charging was then performed. A direct comparison was made in areas where the similarities between the Weirton cars and AISI/EPA car designs are strong. In areas where contrasting features or procedures were observed, assessment of their success relative to design intent and EPA objectives is reported.

The strong similarities between the two designs are: basic automation of the coke oven top side activities, specifically control of the damper, steam and ascension pipe caps, ascension pipe cleaning, and lid removal-replacement; improved operator environment; improved coal handling systems to control coal flow and contain emissions. An integral part of the improvements in emissions containment is the improved drop sleeve-to-oven port seals and aspiration of the ovens to the collection main during charging. These features are considered part of the charging system.

Both systems appear to have had reasonably good success in automation of the oven controls. Although the Weirton car has a somewhat more complex set of functions (dual collection mains), both cars performed required functions with only an occasional malfunction, usually caused by misalignment of the actuating or control arms. Both cars had lid lifting mechanisms which adequately performed the required

functions. Both cars experienced similar problems with the lid lifting electromagnets and their associated wiring. The re-lidding cycle for the Weirton car was a few seconds slower than the AISI/EPA car, but this appears to be a function of the control system adjustment rather than a basic difference in the design capability. The ascension pipe cleaning device on the Weirton car appears to work quite well. There is still, however, an occasional need to manually clean the ascension pipe goosenecks. The original design of the cleaner for the AISI/EPA car was unsuccessful, reportedly because of alignment problems. We have not observed the operation of the replacement unit so we cannot comment on its operation. We understand, however, that its design is similar to the Weirton unit. If so, similar results should be expected.

Both cars have had reasonable success in the improvement of operator environment. This comment is not based on quantitative data, but rather on conversations with several operators and "in the cab" observations. There were, however, some comments at both locations to the effect that the cab placement and configuration makes direct observation of the car operation and oven conditions difficult, if not impossible. Such restrictions of view may represent a safety as well as an operational problem.

The two cars employ contrasting approaches to coal flow control. The Weirton car uses a screw feed transfer conveyor, while the AISI/EPA car depends on gravity to feed the coal directly from the

hopper down through the drop sleeve into the oven. The screw feed arrangement controls coal flow by stopping or starting the screw transfer unit. The gravity feed is controlled by a butterfly valve in the drop sleeve assembly. We understand that screw or turntable feed is generally recognized as providing better coal flow control, but that coal hopper clearance restriction on some batteries may prevent the consideration of these designs for retrofit or replacement cars. This was a major consideration in the choice of the gravity feed system for the AISI/EPA demonstration car. A detailed analysis of system performance is somewhat beyond the scope of this paper, but observations to date would tend to substantiate the superiority of the screw and possibly the turntable feeds over gravity feed. It does appear that correction of certain proven design problems, such as drop sleeve packing and side wall angle may substantially improve the performance of the AISI/EPA gravity feed car.

Both the AISI/EPA and Weirton cars represent substantial improvements in emission control compared to older cars observed. While the AISI/EPA car seems more capable of sealing the emissions during the charge, it is less consistent in overall emission control than the Weirton car. The relief (coking) stacks on the Weirton car appear to be the source of 50% of more of its emissions, especially near the end of the charge. The AISI/EPA car, on the other hand, seems more able to reduce emissions during this period, assuming that the drop sleeves have properly seated in the ports. The Weirton car drop

sleeve seal usually exhibits some leakage, but the rate (i.e., the seal) is fairly consistent. The AISI/EPA car seal exhibits a more "very good" or "very bad" tendency, perhaps because of its weight and resistance to movement sometimes necessary to seal alignment. It was concluded, however, that both the AISI/EPA and Weirton charging car drop sleeve-to-oven port seals represent considerable improvement over older types of drop sleeves in the areas of both coal spillage reductions and emission containment.

Containment of the emissions during the charging process at both J & L and Weirton is heavily dependent upon the reduction of oven pressure through steam aspiration. The original concept for improvement of aspiration at J & L involved the replacement of steam ejectors and the raising of steam pressure supplied to the ejectors to 175 pounds. Marginal improvements were obtained using the higher pressure and the potential problem of increased coal carry over was recognized. Experimentation showed that a reasonable compromise could be achieved by running approximately 120 pounds pressure to the new ejectors. It has been reported that further improvements have been accomplished through the installation of jumper pipes between existing "smoke holes." This has the effect of connecting two oven aspirating systems in parallel and supplying an off take passage at both ends of the oven as in a dual collection main system. Substantial improvements in oven aspiration have been reported.

The double collection main system at Weirton has performed well under most charging conditions. Improvement has been attempted by raising steam pressure to the ejectors, but coal carry over problems were experienced causing some pressure reduction. The system is now operating at an acceptable level and generally holds the oven close to neutral during charging. A major portion of emissions for both cars occurs after the drop sleeves have been raised for re-lidding and are thus beyond the control of the car itself. The elimination of these emissions will depend primarily on oven aspiration, leveling procedures, and to a much lesser extent, the details of how the coal was placed in the oven.

We recognize the impossibility of generalization as to production rates for all battery conditions, much less production rates for other batteries, but investigation and observations indicate that a rate of 40 to 45 ovens per 8 hour shift from a single set of functional machines would represent a reasonable production goal. On batteries where operating units must be shared, this rate may be substantially altered. Such sharing is praticed at J & L, but is not currently practiced at Weirton. Observations and associated discussions of the Weirton and AISI/EPA car indicate that the Weirton car has never been and is not expected to be pacing unit of the battery under present operating practices. This conclusion is consistent with the average observed charging time of five minutes for the Weirton car. The AISI/EPA car has displayed a tendency to be the pacing factor,

particularly when operations are running behind the normal production schedule. This statement is consistent with observed charging times ranging from 7 to 10 minutes. The situation might be affected substantially, however, by changes in operating practice, such as the adoption of stage charging (i.e., the cars might be more closely matched).

Both cars provide flexibility in their opreation through the use of independent/step controls for each function. This flexibility allows the adoption of modified procedures, such as stage charging or the circumvention of problem areas when mechanical or electrical problems occur. Judging from discussions with maintenance and operating personnel, the Weirton car has undergone more extensive additions and modifications to the control system than the AISI/EPA car. The changes, most of which have been initiated by the local supervisory and maintenance personnel, have for the most part proved to be useful in both maintenance and operation under conditions of malfunction.

The training of operators to run the Weirton car has not presented a problem in terms of production rates or lost production. The new operators go through a break-in period during which time they work in parallel with an experienced operator. The operators we spoke to did not express any problems in learning the operation of the new cars.

Based on discussions and observations, the Weirton car has few problems in the area of operability/dependability. With the exception of the two instances reported here, involving some damage by fire, no lost oven production was attributable to the Weirton charging cars. During the observations, one car operated 24 hours a day for five straight days without any malfunctions which caused production delays or loss of production. We feel that much of this record can be attributed to the mechanical arrangement of the Weirton car. Elements of the hydraulic and electrical system are positioned away from the drop sleeve, open charging port and potential flame and heat. We also feel that the relatively light weight of the drop sleeve assembly contributes to the lack of mechanical/hydraulic problems. An additional factor which we feel has a significant impact is a thorough understanding of car operation and control by individual operators. This certainly reduces the incidence of equipment damage caused by improper or negligent operation.

Equipment malfunctions will inevitably occur, but their impact can be magnified by delays in remedial actions. An important factor which tends to reduce the time required for resolution of maintenance problems is the centralization of responsibility for initiation and control of necessary work. At Weirton, the electrical department is totally responsible for all equipment maintenance work except for the heaviest mechanical work that may require special assistance. All necessary trades are included in the make up of electrical department

personnel. When outside help is required, they operate under the centralized direction of the electrical department. These factors improve coordination, reduce worker availability delays and generally expedite required repairs.

One final point should be made to help place the comparison of the two cars in perspective. That is, that the AISI/EPA car represents the retrofit of a new car to an older oven (P4 battery is nearing 20 years of age), while the Weirton car is a new car designed for and placed on an entirely new battery. Many of the problems experienced by the AISI/EPA car can be traced to battery equipment wear and misalignment problems. The difficulty experienced in predicting relative position changes caused by oven expansion, wear, and modifications, tend to indicate that equipment intended for retrofit should be designed to provide the maximum tolerance to "misalignment" practical, and consistent with emission control, and that new equipment should be given similar consideration in order to minimize maintenance and operating problems as it ages.

2.0 INTRODUCTION

The larry car, developed jointly by the American Iron and Steel Institute and the Environmental Protection Agency, was tested at the Jones and Laughlin Pittsburgh Works by The MITRE Corporation during the Spring and Summer of 1973. The purpose of this testing was to demonstrate the improvement in atmospheric conditions that can be obtained while charging a slot type coke oven. New larry cars having both similar and contrasting features are currently in operation on other slot type coke ovens, and their effectiveness should logically be assessed as an adjunct to the J & L (AISI/EPA) car evaluation process. This report describes the procedures used to gather comparative operational information at the Weirton Steel Corporation, Division of National Steel Corporation, Brown's Island Coking Plant, where two charging cars, similar to the AISI/EPA car, are in production operation.

MITRE observed these two charging cars in production operation in March and April of 1974 using observers familiar with the coke oven environment and the operation of the AISI/EPA car during the original test period. This report presents three general subject areas for which information was obtained. The first area concerns a description of the Weirton coking system, including oven configuration, larry car operation, and the coke oven charging procedures in general. The second area involves the actual observation of the two Brown's Island larry cars during the coal charging operation, which involved recording of emission characteristics and electro-mechanical

performance. The last area discussed is a brief work history of the two larry cars obtained through interviews with coke plant personnel responsible for the operation of the larry cars.

3.0 SYSTEM DESCRIPTION

3.1 Historical Background

One of the newest slot type coking facilities in the United States is located at the Weirton Steel Division of National Steel Corporation in Weirton, West Virginia. The battery, comprised of 87 ovens, is located on Brown's Island in the Ohio River adjacent to the main plant facility. At this time, the ovens and their associated by-product recovery facility are the primary activities on the island.

Work on the construction of the Brown's Island facility was started in August 1970. The oven was brought to a point where construction of the charging cars could commence in August of 1972. The oven first produced coke on May 31 of 1973 having experienced some delay caused by a gas explosion during initial firing of the facility. The ovens were considered to be in regular production operation at that time and have been operating continually since that time.

The break-in period of the facility is defined as the time from the first production of coke until the establishment of routine operational and maintenance procedures with the associated substantial reduction of production delays caused by nonfamiliarity with the new equipment and procedures. Based on discussions with supervisory operating personnel, reasonably smooth operation of the charging car was achieved in December of 1973. Although occasional problems arise which cannot be immediately resolved, supervisory maintenance

personnel say they now feel confident in their ability to understand the machine operation, and to solve problems in a timely manner as they occur.

3.2 Oven Description

The Brown's Island facility employs some of the most recent coke oven technology, including an enclosed pushing and quenching capability. The pushed coke is received by a closed refractory-lined hopper car which is connected via ducts to a car mounted scrubber. The hopper car is unloaded through bottom gates into stationary refractory lined hoppers beneath the track. These hoppers in turn feed the hot coke to the enclosed quench units. The resulting gases are cleaned prior to release to the atmosphere.

The ovens are of the tall (20 feet) configuration and utilize a double collection main by-product recovery system. Each oven charge contains approximately 70,000 pounds of coal. The oven is charged through four ports spaced unequally across the width of the oven.

The port design features a tapered oven top seat contoured to accept and seal the lower portion of the larry car drop sleeve (boot) and a matching lid which uses a "sharp edge" seal especially suited for "setting" by rotation by the car mounted automatic lid lifter mechanism. The cast iron lid has a sealing edge diameter of ~19-3/4 inches and the oven port has a minimum diameter of ~17-3/4 inches. This diameter extends downward through the brickwork for a distance of approximately 1 to 1-1/2 feet where the passage fans out laterally to a width of 3 to 5 feet at the oven inner roof.

During the oven charging cycle, aspiration of the ovens is accomplished using steam ejectors. The ejectors located in the collection main side of the ascension pipe bend are of standard configuration. They are currently operated at 100 pounds pressure and approximately 400°F+ steam.

During recent periods of operation at higher pressures, problems were encountered in the by-product primary cooler spiral heat exchangers. The excessive coal carry over caused fouling of the liquor side of the spiral heat exchanger. In addition, this problem was aggravated by the cooling unit water having a high iron content which in turn caused excessive scale to be deposited on the water side of the spiral heat exchangers. The two problems combined to produce high by-product input temperatures that came very close to causing facility shutdown. The improvement of cooling water quality and the reduction of aspirator steam pressure are credited with the current solution to this problem.

During discussions of the carry over problem with Weirton personnel, they voted some continuation of excessive coal carry over build ups in the liquor traps and on damper valves. As a result, they found it necessary to initiate more frequent trap clean outs. Although J & L operating personnel reported no problems with by product cooling units, they also reported a requirement to clean the traps at more frequent intervals as compared to operation with lower ejector steam pressures. A possible explanation for the differences in operating experiences

between the two sites is that the Weirton coal preparation process produces a higher proporation of fines than the J & L process. This could allow a higher preparation of cool dust to pass the trap and potentially foul the cooler units. This situation is being investigated and appropriate action will be taken.

The seal of the ascension pipe caps is an area in which problems are frequently encountered. The design of the cap is similar to the charging port design in that a sharp edge seal is employed. The cap is allowed to "float" with respect to the hinge mechanism to provide a self-centering seating action. Considerable leakage around caps was observed immediately after a charge, with many continuing to leak for several hours into the coking cycle.

It appears that the relatively short "leak path" around the "sharp edge" seal is not readily plugged by the self-sealing action of condensing and hardening tars and carbon build-up. An investigation of the problem is currently under way by Koppers and two new cap configurations are undergoing tests on operating ovens. A solution to the problem is important, since observation indicates that the cap leaks account for a substantial portion of the ambient background emissions (conditions between charging operations). Also, cap leaks occurring during charging and aspiration diminish the vacuum capacity available at the charging ports. Although probably not sufficient to make the difference between a negative and positive port condition, the lost capacity would allow emissions to the atmosphere which would otherwise be contained by the recovery system.

3.3 Charging Car Description

The two charging cars operating on the Brown's Island Battery utilize some of the most significant improvements in modern coke oven technology. The cars are of the basic screw feed design, but several features have been added to improve car operation and the conditions in which the machine operators work. These features are discussed in the following section.

The charging car coal handling system (Figure 1) for each of the four charging sleeves is comprised of a car mounted hopper, a screw type conveyor fed by gravity from the hopper, a "slide plate" valve, a "drop-boot", and a device for mechanically removing and replacing the charging port lids. The significant difference between this coal handling system and the system used on the AISI/EPA car (Figure 2) is the use of the screw conveyor to control the coal flow as opposed to an oscillating "butterfly" valve in the lower portion of the "drop sleeve" on the AISI/EPA car.

The coal is gravity fed from the main hopper to the screw conveyor which can be stopped or started using separate controls in the control cab. The slide valve at the drop sleeve end of the screw conveyor is not used to control the primary coal flow. Its primary function is to seal the drop sleeve after the charge and also to prevent coal tailings from the conveyor tube from falling on the oven surface or the lid lifting mechanism. This arrangement provides a positive coal feed through the screw to a point above the slide plates. From this point, the coal drops loosely through the open slide plate, through the drop sleeve assembly and into the open charging port. In

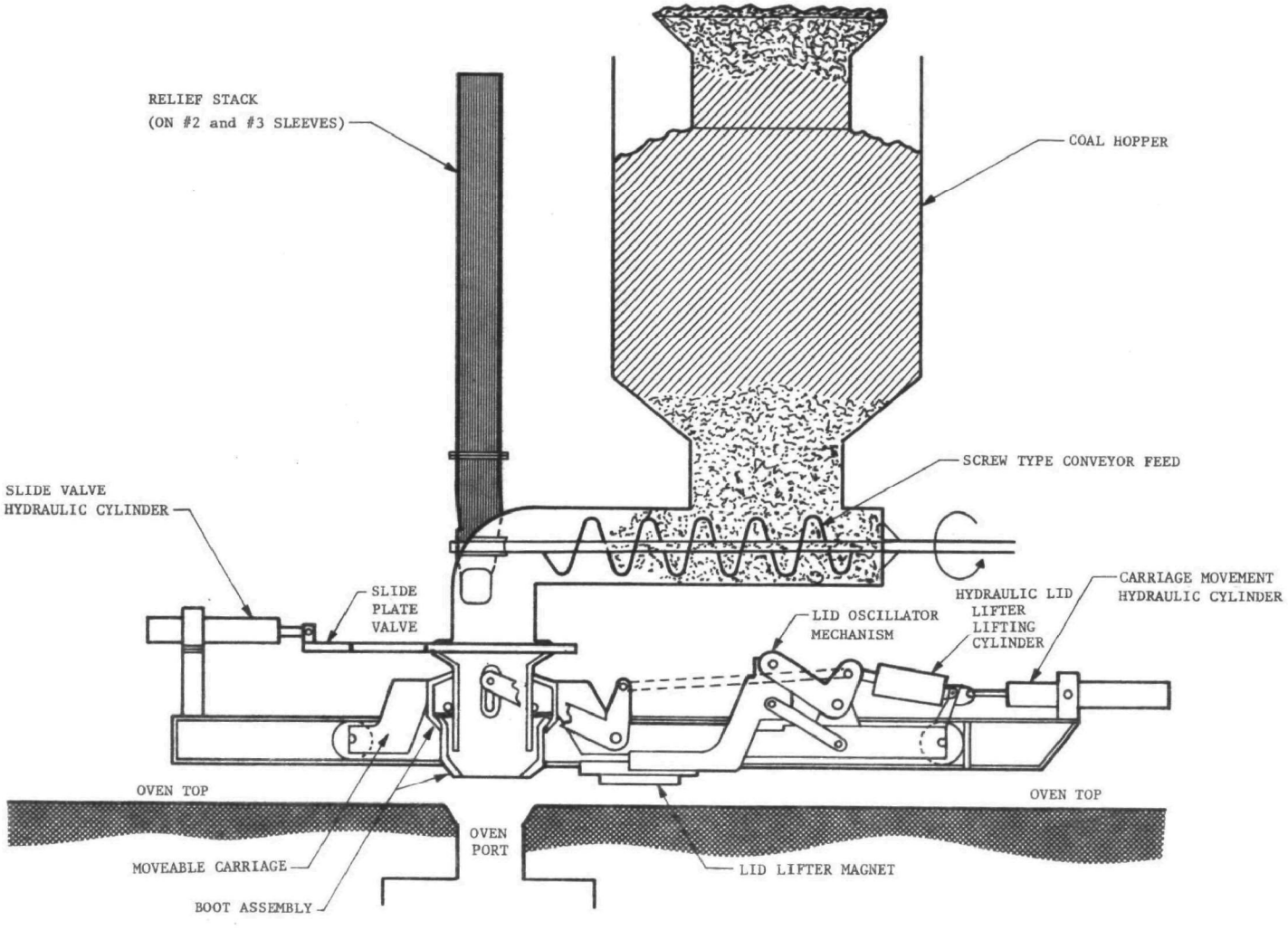

FIGURE 1
WEIRTON CAR ARRANGEMENT

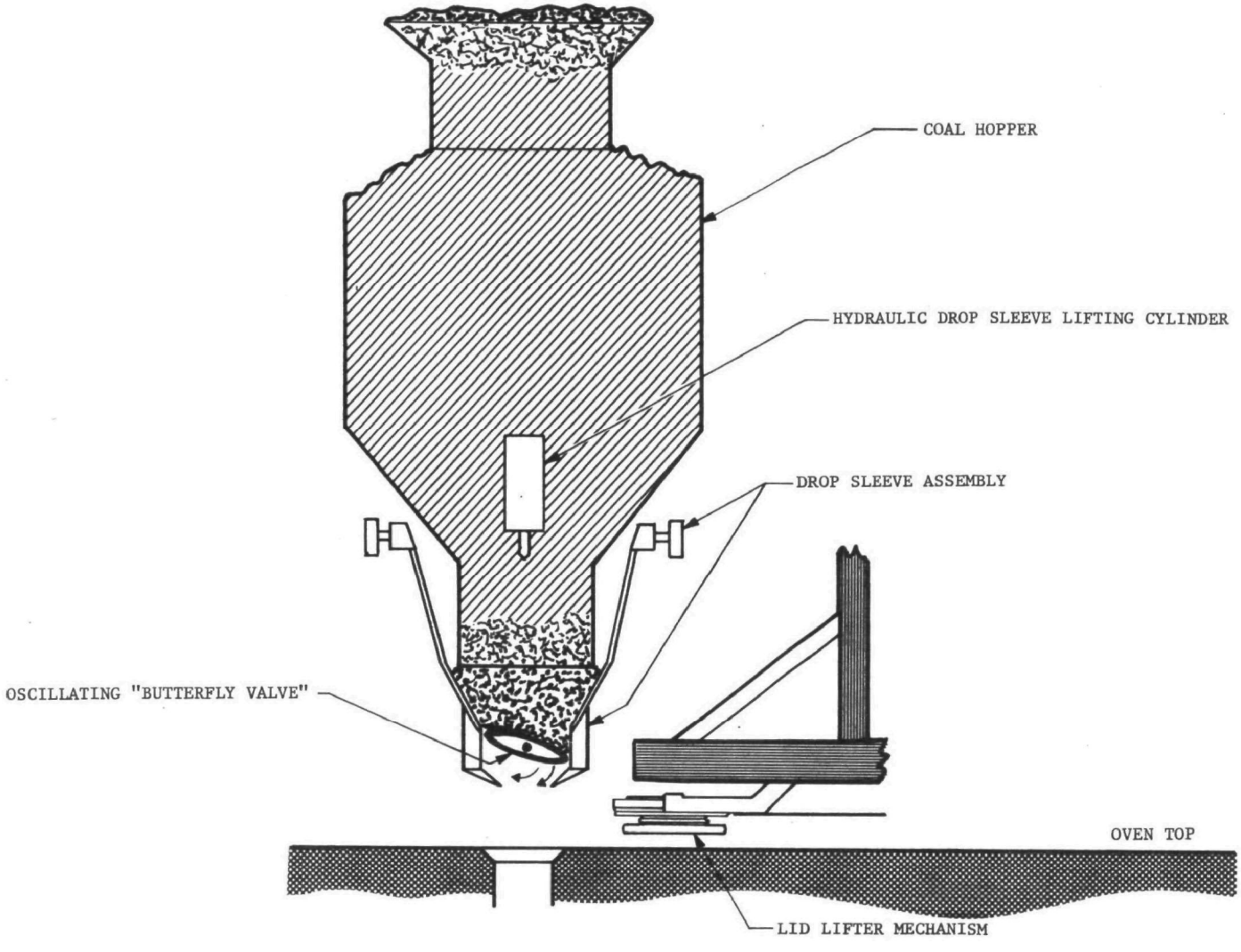

FIGURE 2
J & L CAR ARRANGEMENT

contrast, the coal in the AISI/EPA car is fed by gravity to the drop sleeve assembly. The flow of coal is controlled by the butterfly valve in the lower portion of the sleeve which oscillates back and forth to allow the coal to feed past it into the open charging port. The AISI/EPA car is designed to maintain some coal on top of the butterfly valve to improve the sealing function of the drop sleeve after the charge. The intent of both systems is to seal the lower portion of each drop sleeve after the hopper has emptied until the re-lidding sequence can be initiated.

The Number 2 and Number 3 sleeves on the Weirton car are equipped with relief stacks connected to the system at the drop sleeve end of the screw conveyor above the slide plate valve. The other two sleeves (Number 1 and 4) also have attachment points for similar stacks but these are blocked off by cover plates installed at the time of car fabrication. During the latter portion of the charge when Number 3 and Number 2 hoppers have emptied, the stacks vent emissions caused by oven back pressure until slide plate valve closure is initiated. If emissions caused by oven back pressure are present on sleeves 1 or 4, and the slide valve is not closed, the emissions are vented through the screw conveyor and up through the empty hopper. Closure of the slide plate valves effectively stops emission venting through both the stacks and the empty hoppers.

The lid lifting mechanism on the Weirton car utilizes an electromagnet to secure the port lid to the lifting mechanism. The lifting

and lateral motion is supplied by a combination of hydraulic piston cylinders. When the lid is replaced after a charge, the lifter mechanism rotates the lid in its oven-top seat to improve the lid seal. This rotating action is supplied by a hydraulic rotary actuator.

The lid lifting mechanism is mounted on a wheeled carriage along with the drop sleeve assembly. The drop sleeve or "boot" is fairly light in weight. It is composed of two interlocking sections with a self-aligning inner seal ring. The horizontal movement of the carriage places either the drop sleeve or the lid lifter over the charging port on which the car is spotted. The complete carriage unit moves beneath and is independent of the slide plate valve. The action of each sleeve carriage can be controlled independently or they can be operated as part of the automatic master charge sequence.

The horizontal carriage motion is controlled by a cylinder located at the extreme end of the track assembly. The vertical lifting motion for both the drop sleeve and lid lifter are supplied by a cylinder located on the back end of the moveable carriage. Because the same lift cylinder is used for the lid lifter and the drop sleeve, they move up and down in unison regardless of which is in current functional use. The lid rotating motion is supplied by an actuator forming a part of the vertically moveable portion of the lid lifting unit. It is located behind the lid magnet and is connected to it by two operating rods. The arrangement described maintains maximum separation of system hydraulic components from the area directly above an open charging port.

The major difference between these functional systems on the Weirton car and the AISI/EPA car is the separation of the drop sleeve assembly from the moveable carriage. On the AISI/EPA car, the drop sleeve is raised to allow the lid lifter mechanism to move horizontally under it. The lifter mechanism is lowered to secure and lift the cap. It is then retracted to allow the drop sleeve to be lowered for the charge. No horizontal movement of the drop sleeve is necessary during the sequence. The drop sleeve is quite heavy on the AISI/EPA car. Added to this is the weight of the coal being gravity fed into the top of it. This weight is utilized to achieve seat alignment and seal integrity in the oven top port during the charging operation. The separate hydraulic cylinder used to raise the drop sleeve assembly is located on a heavy frame along the upper side of the sleeve assembly.

The Weirton car is designed to minimize the requirements for oven top workers. The lid lifting and re-lidding mechanism performs one of the functions normally handled by these personnel. A second function, the control of the collecting main damper and the steam ejectors, is accomplished through the use of operating arms attached to hydraulic rotary actuators mounted on the car. Eight such arms are used, four on either side of the car to operate the pusher and coke side ascension pipe controls. The arms operate in pairs, one to open the damper and one to close it; one to open the ascension pipe caps and one to close them and simultaneously turn on the ejector steam. The steam can also be turned off by the proper operation of

the arms. All arms operate on controls of the oven on which the car is spotted. All control functions can be performed on this oven without moving the car.

The chore of ascension pipe cleaning (normally handled by the car operator) is performed by two car mounted mechanical cleaning devices controlled from within the cab. The units rotate outward from the car to contact the edge of the open ascension pipe. An interlock prevents the completion of the operation unless the caps are open and the frame of the device is properly seated on the edge of the open pipe. When seated, the device extends a shaft into the open pipe. A serrated scraper known as a "cookie cutter" mounted on the end of the shaft cleans the sides of the ascension pipe bend. At the end of the outward stroke, the scraper is automatically retracted and raised back to the stored position on the car. The complete cleaning system is operated hydraulically.

The functions of ascension pipe control and cleaning are achieved in a similar manner on the AISI/EPA car. A few operational differences are, however, worthy of mention. The AISI/EPA car employs a single operating arm to control the functions on the oven to be charged. A second operating arm is positioned so as to control the lid and damper on an oven to be charged in the next sequence. The car mounted ascension pipe cleaner is positioned to operate on the same oven.

The ascension pipe cleaner on the AISI/EPA car was originally designed to employ a rotary flail-type cleaner, however, recent changes

in design have modified this concept. It is understood that a scraping action similar to the Weirton device will be utilized on the new system.

The original design of the Weirton cars did not call for vibrators on the hopper units to assist in coal flow. After experiencing some occasions where wet coal clung to the hopper side, the decision was made to install and test electro-mechanical hopper visbrators on the car. Two such units were attached to the sides of hoppers 2 and 3. A manual control switch for the two vibrators was installed on the control panel in the cab. The switch is connected in such a way as to allow vibrator operation only during a charging sequence.

During the normal operation of the car (as observed during the two week period), the vibrators were not used. On two occasions in which the car capabilities were being demonstrated to new operators, the vibrators were turned on for a short period. Operating personnel report that the vibrators are needed only during the most severe "wet coal" conditions and are generally capable of clearing the hoppers with only a short burst of operation. We were told that no plans had been made to install vibrators on all the hoppers at this time.

The occasional use of vibrators on the Weirton car is in contrast to the programmed use of vibrators on the AISI/EPA car. The vibrators are automatically controlled as part of the AISI/EPA car charging sequence and operate for a set period of time. Controls on the cab panel do, however, allow the operator to turn off the vibrators.

The control of the Weirton car during a charging operation is accomplished through the use of electro-mechanical timers and relay logic circuitry. Solid state circuitry is utilized only in the traction drive motor proportional control units. In addition to the normal relay logic circuitry, a number of circuits which bypass certain logic interlock strings have been added. These bypasses which have limited access and are not used in normal operation, provide an emergency capability to clear the car functions and allow it to move or be moved along the top of the battery. It is also possible using certain types of these bypasses to manually operate some of the car functions should a malfunction occur in the normal control logic. It was reported that this bypass capability has been responsible for maintaining production in several instances when malfunctions occurred and the spare car was not immediately available for relief operation. Operation of the car using these circuits generally requires a second operator in the car equipment room and close coordination between the cab operator and the bypass operator.

No method is provided on the Weirton car for the indication of coal level in the hoppers or coal flow in the system. The initiation of an automatic charge cycle starts timing devices which open the slide valves and sequentially start the conveyor screws. The screws continue in operation until the timed sequence runs out or the car operator judges that the hoppers are empty. The operator uses several observations to aid him in this decision. They include elapsed time from the start of the charge, observed activity around each drop

sleeve, the position of the leveler bar, flow of smoke from the 2 and 3 sleeve stacks, and the observed drop in screw motor current when the hoppers go empty. The operator can also leave the cab and visually check the coal level in the hoppers through ports cut in the side of each hopper. This, however, is seldom necessary.

The lack of level sensing devices is in contrast to the multi-point level sensing system used on the AISI/EPA car. The charging control system senses the "20% remaining" level signal and interrupts the coal flow at this time to start the leveling sequence. Coal flow is started again when the pusher operator confirms the start of leveling. The lower level sensor ("hopper empty") is responsible for stopping the coal flow to insure the presence of a coal plug above the butterfly valve.

The last feature of note is the improvement of the operating cab environment. The cab is closed and was observed to be generally free from charging emissions during relatively heavy smoke conditions. An air conditioning unit in the cab seems to be quite effective. In addition to this unit, a second unit has been added to the cars electrical equipment room to hold its temperature at a lower level. The operators seemed quite pleased with the conditions compared to those generally associated with the operation of a larry car.

4.0 CHARGING OPERATION

4.1 Coking Cycle

As in most plants, the coking time is a function of several variables including product demand, coal characteristics, manpower availability and raw material availability. During the two weeks of observation, the coking time had been raised to 23.5 hours because of shortages of delivered coal. The longer cycle decreased the plant production rate, and thus the number of charging operations performed in a shift.

The operating pace had been slowed to 30 ovens per 8 hour shift. We were told that a rule of thumb for a normal production rate change is to add or drop 1 over per 8 hour shift. Their normal production pace utilizes between a 17 and 18 hour coking cycle. To this date, the Brown's Island Battery has reached and maintained a maximum of 39 ovens per shift. It is expected to be able to maintain a maximum production schedule somewhat above this rate.

4.2 Charging Sequence

After the larry car fills its hoppers at the coal bin, it then proceeds to the oven that is scheduled to charge (A-1 in this example). A sequential numbering system is used in which the 87 oven batteries are divided into three equal sections; A, B and C. Figure 3 presents a small portion of Section A to clarify the discussion of the charging sequence, while Table 1 displays a portion of the Weirton charging and dampering sequence. The first operation the larry car operator performs is to spot the larry car over the oven to be charged. He accomplishes this by aligning pointers on the larry car with the

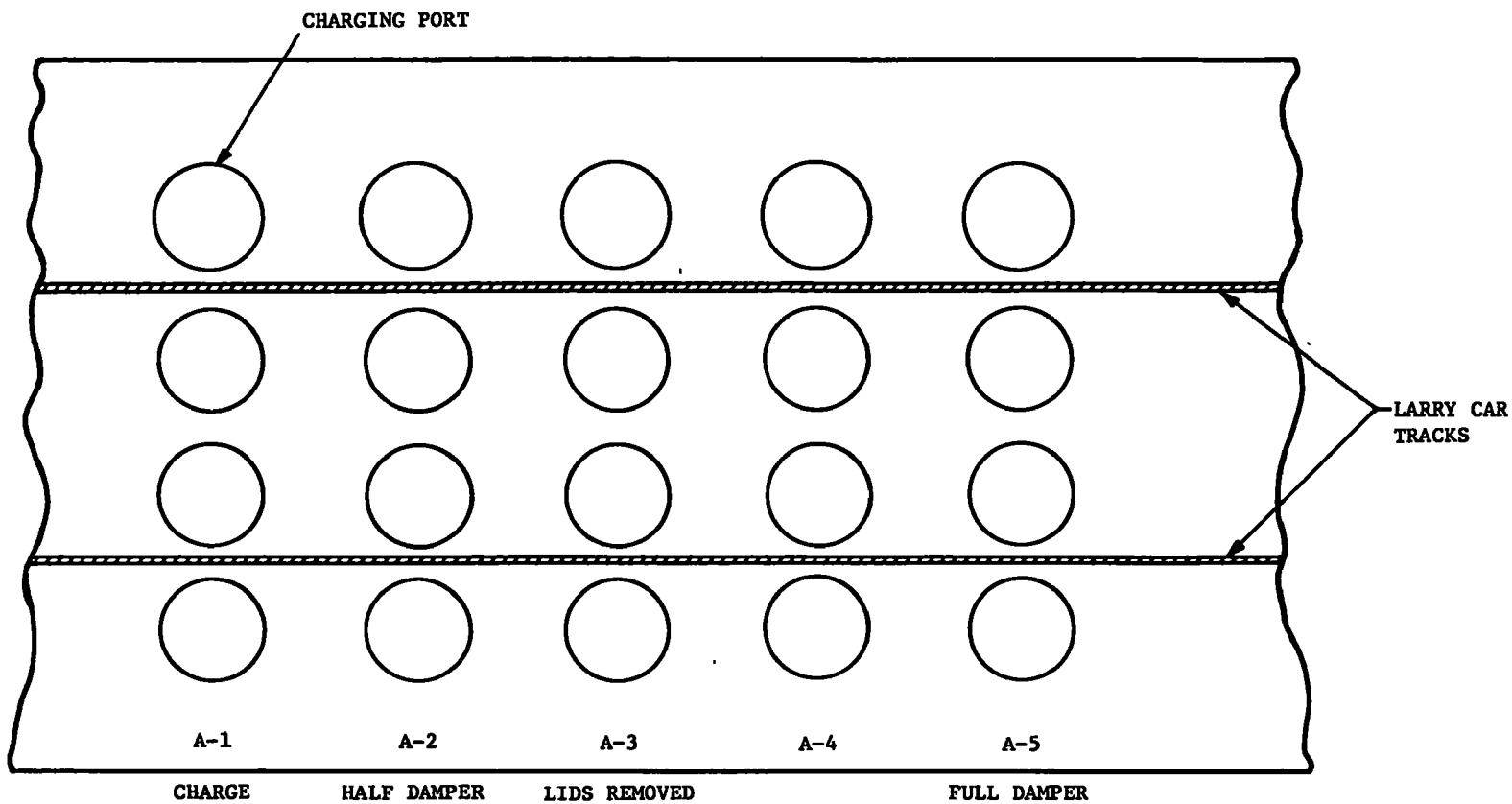

FIGURE 3
OVERHEAD VIEW OF OVEN POSITION IN THE CHARGING SEQUENCE

TABLE 1

DISPLAY OF WEIRTON CHARGING AND DAMPERING SEQUENCE

Charge	Half-Damper	Remove Lids	Damper
A-1	A-2	A-3	A-5
B-1	B-2	B-3	B-5
C-1	C-2	C-3	C-5
A-3	A-4	A-5	A-7
B-3	B-4	B-5	B-7
C-3	C-4	C-5	C-7
A-5	A-6	A-7	A-9
B-5	B-6	B-7	B-9
C-5	C-6	C-7	C-9
A-7	A-8	A-9	A-11
B-7	B-8	B-9	B-11
C-7	C-8	C-9	C-11
A-9	A-10	A-11	A-13
B-9	B-10	B-11	B-13
C-9	C-10	C-11	C-13

oven flue caps two ovens behind. Once this is done, the operator activates the automatic gooseneck cleaner buttons, and the necks of the ascension pipes are purged automatically. The larry operator is now ready to charge, and waits for the go ahead signal from the pusher car. Upon receiving the signal, the operator activates the actuator arm which closes the ascension pipe caps and turns the collecting main steam on simultaneously. When these tasks are complete, the operator presses the master charge button which initiates the actual charge. The larry car now operates automatically until the end of the charge, at which time the lid return cycle is initiated by the automatic timers, or by the operator, depending on the selected mode of operation. After the charge is over, the operator backs up and half dampers oven A-2 to stop cross flow across the oven caused by unequal pressures in the collecting mains. Next the operator removes the lids from the oven being pushed, A-3, which will undergo a decarbonization cycle of approximately 40 minutes. The operator then backs up to the next oven to be pushed, A-5, and full dampers it, while also opening the ascension pipe caps. During the week of March 24-29, the lids were left on the charging ports during decarbonization in order to build up a layer of carbon at the top of the oven. Because of this, lids had to be removed just prior to the gooseneck cleaning step in the ordinary charging sequence. As a result of a lid lifter malfunction, an indicator lamp signaled that a lid had been removed when it had not. The operator, thinking he had a clear port, initiated the charge into a closed port. This caused considerable coal spillage on the oven top before the condition was

detected and the feed stopped. This problem had reportedly occurred several times on the night shift. No problem was discovered in the lid lifter mechanism, but in order to insure proper removal of the lids, the larry car operator would come off his spot following the lid lifter operation, to visually check lid removal. The car was then respotted and the charge was performed in the normal fashion. This practice added several seconds to the normal time required for a charge, but the larry car was generally ahead of the other elements of the operation.

4.3 Leveling Procedure

After the larry car has charged the oven with about 80% of its coal, the leveling sequence begins. The pusher car receives a signal in the form of a loud buzz from the larry car. This buzz is activated by a timer in the master charge button electronic control circuitry. Leveling is then initiated in the pusher car by pushing the automatic leveling sequence button. All leveling from this point in time is automated. The leveling is performed with the coal flowing from the number 2 drop sleeve. This was a very consistent leveling practice at Weirton, and no deviations from this scheme were observed.

There has been a problem at the Brown's Island Battery involving coal spillage during the leveling procedure. During the earlier operation of the Brown's Island Battery, the leveler bar had been inserted into the oven considerably earlier in the charge, and was leveling for some longer period of time. The Weirton personnel observed excessive amounts of coal spillage during this time, and as a result, the leveling sequence was altered. A shorter leveling

period was initiated and the coal spillage was decreased because of the lower number of leveler bar strokes, each of which drags some coal out of the chuck door. This represents a trade-off of changing of the leveling time to prevent coal spillage against the fact that waiting a longer period of time to level causes the open gas passage to both ascension pipes to be reduced.

There having been two alternative coal spillage reduction methods proposed at Weirton. The first was the use of air hoses to blow the coal wedged between the leveler bar baffles loose to keep the leveler bar operating at peak efficiency through each leveling stroke. Heat seemed to be a problem as far as hose maintenance was concerned, and the idea was abandoned. Another proposed solution was the use of a chain to drag along the top of the leveler bar to knock the coal loose between the leveler bar baffles in its reverse stroke.

4.4 Collecting Mains

The Brown's Island Battery utilizes a double off-take collecting main system to service each four charging port oven. The coke side and pusher side collecting mains are interconnected by two overhead cross-over pipes that span the oven approximately at one third and two thirds of the oven's distance lengthwise.

The standard pressure and temperature at which the mains operate are 11 mm and 72°, respectively. These are variable controls and are increased and decreased as the coke plant superintendent deems necessary during different coking schedules and special situations.

4.5 Coal Description

The Brown's Island Battery is equipped with its own separate coal preparation plant which is divorced from the mainland coal preparation plant. The coal is currently sized at 72% passing an 1/8 inch screen.

5.0 CHARGING OBSERVATIONS

5.1 Reporting Procedures

Direct observations of the larry car performance in production operation were made by personnel familiar with details of the charging operation and the coke oven environment. In order to make the observations simple and efficient, no instrumentation was employed to measure emission quantities. The observation scheme relied instead upon the judgement of the observer to assess the relative quantities of observed emissions from some pre-defined points on the larry car. The observer characterized the emissions from each designated point as either a blank box (none observed), L (light flow), M (medium flow), or H (heavy flow). The basis for this judgement was developed by watching several typical charges by the car and moderating the observations based on recalculations of emissions flows on the J & L cars, including the AISI/EPA car. In addition to the flow information recorded, other observations such as the general color of emission, the presence of flame at a point, and the dynamic flow characteristics (puffy, increasing, decreasing, changing to) were also noted.

The points designated for observation were the areas around and immediately above each drop sleeve (boot) seal, the four hopper tops, and the stacks attached to the number 2 and 3 sleeves. It is estimated that these points account for at least 90% of the emissions through the car during a charging operation. All of these points are visible from a point on the oven surface approximately 50 feet in

front of the car. The observer remained at this approximate position throughout the charging operation under observation. From this point, it is generally possible to differentiate emissions from sources other than the car and to judge the flow characteristics.

During the charging operation, a record was made of observations at 15 second intervals. This interval was found to provide a reasonably accurate account of the charging conditions. This interval was too short to allow the observer to record information directly on the form, so a portable tape recorder was used to record the observer's verbal commentary. This technique allowed the inclusion of sufficient detail and added commentary to provide a basis for completion of the observation form. The completed forms are included as Appendix I of this report.

A hand-held stop watch was used by the observer to provide timing information on the various segments of the charging operation. An overall time for just the charging operation (coal flow start to last lid on) was obtained for each of the observed charges. In addition, other segments and combinations of segments were timed to provide a comprehensive picture of the cars' operational pace. The total operation during the week of March 11-15 was on a reduced production schedule, therefore, steps involving operator initiated operations may not have been performed in the shortest practical time.

During the period of the observations, the general weather conditions remained relatively constant. No rain was experienced and the temperature ranged from the 50's up to the 70's. Due in part to the location of the oven (unshielded by adjacent structure on an island in the middle of a river), a constant breeze was present, ranging from a light 2-4 mph to continuous 15-18 mph wind. This wind was responsible for the rapid dispersal of emissions as they rose from the top of the oven or car stacks.

5.2 Summary of Performance Observations

The basic impression obtained from the observations is that the larry car is very consistent in its operation. For example, the observed charging times for 57 operations was between 1 minute, 30 seconds and 1 minute, 50 seconds with an average time of 1 minute, 39 and 2/10 seconds. Most of the observed spread in time can be accounted for by variations in the start of the operator initiated re-lidding cycle. A second example is the occurrence of a small puff of emissions from number 2 stack during the first 10 seconds of the charging operation.

Examination of the reporting forms shows that the first 30 seconds of the charge is fairly free from emissions except for this puff. Certainly this is due in part to the mechanical timer control, but the overall consistency of charge quality (emission level) cannot be achieved unless all goes smoothly, such as coal flow, leveling, re-lidding and oven control operation. The dependability was further

attested to by the fact that the lid man spent much of his time riding in the larry car cab. When a malfunction did occur, such as a lid not seating properly, he came down, quickly fixed the problem and returned to the cab. Discussions with the car operators confirmed the fact that little trouble has been encountered with coal flow. They also related a feeling of overall dependability, with some commenting that this car was more complicated than the other cars they had operated but that it worked well "in spite of this." In general, the mechanical problems observed were minor in nature and were handled by the car operator and lid man on duty at the time.

The spotting of the car on an oven is accomplished by aligning a car mounted pointer with flue caps set in the oven top. This is done by sighting down through a window on either side of the control cab. The system appears to provide the needed accuracy and it is simple to use. The only observed problem with the system was the visibility of the pointer and cap during certain light conditions. Late in the afternoon, the sunlight would strike the surface of the cab window in such a way as to obscure the spotting pointer and cap. The condition was similar on both sides of the car. It appears that the problem could be eliminated by shading the lower windows in an appropriate manner.

The drop sleeve units appear to have little problem in seating properly in the open charging ports. The lower portion of the unit can be canted considerably before a reasonable seal is lost.

Mis-spotting of the car can, however, cause a visible gap in the boot-to-oven seal. This seemed to occur primarily when the car was being respotted after a check to insure that all lids had been removed. No explanation was obvious since the same spotting facilities are used for both the initial and re-spotting operations.

The ascension pipe cleaners worked well during the period of observation. No malfunctions were observed and their cleaning ability appeared adequate. It was reported that on two occasions the scraper, or "cooky cutter," had fallen off the end of the ram into the collection main. In order to prevent this, a steel cable has been fastened around the scraper and to the ram shaft. The reported production delay caused by a malfunction of the cleaner involved the premature extension of the ram as the unit was swung down to the operating position. This was traced to a sticking interlock switch in the logic circuit. The event has not been repeated, and no remedial action is felt to be necessary.

The lid lifters performed well during observation. The only problem involved two occasions in which two separate units failed to remove lids. On an occasion, the unit was recycled and operated properly on the second try. On the other occasion, the lid was removed by the lid man without a second try by the lifter. On both occasions, the lifters worked without further problems on succeeding charges. We were told that occasionally the lid detector interlock switch does not actuate when in contact with the lid, and the magnet does not

energize. We were told that on one occasion, the magnet picked up a flue cap cover instead of the port cover. The cap detector interlock was made, and a charge was attempted with the lid in place. This resulted in a considerable coal spill before the coal could be stopped.

No serious problems in unit operation were observed or reported but it was noted that the electrical connections for this unit show rapid deterioration and are reported to be difficult to keep in good repair. No problems were observed in the unit hydraulic system, but it was reported that flexible elbows and couplings in the system had shown some tendency to leak prematurely. A more durable replacement for these units is being sought.

It seemed that the rotating action of the lifter is slow in comparison to the operation of the AISI/EPA car. The time between a rotation in one direction and a reverse rotation is long. This caused no observed problems but a "ready to travel" car condition might be achieved a few seconds earlier if the delay could be shortened.

The car mounted actuators which control steam, ascension pipe cap closure, and damper action, performed with only minor malfunctions during the periods of observation. On several occasions, the lid failed to travel over center when closure was attempted. Recycle of the system did not solve the problem and the cap was closed manually by the lid man. On two occasions, the actuator arms became jammed in the control levers and had to be freed manually using a long pry bar. We were told that the control levers are occasionally bent

causing misalignment of the arms. It was reported that this problem is solved by occasionally checking the levers and re-aligning them using a sledge hammer and wooden wedges. No serious delays have been reported as a result of control misalignment.

The screw conveyor and slide plate valve functioned normally during the observation period. No malfunction in their mechanical operation was observed, however, a coal plug did occur once on number 4 drop sleeve. It was reported that the coal had plugged in the charging port and caused a packing action back through the system. It took about 5 to 10 minutes to clean the plug in the port and complete the charge. During a discussion following the incident, operating and supervisory personnel did not feel that any car associated malfunction had caused the problem. It was suspected that the possibility of late leveler bar entry had caused or contributed to the problem.

During observed activities, attempts were made at timely closure of the slide valves based on an observed drop in screw feed motor operating current. The slight drop in current proved hard to detect and coordination of the activity was difficult to accomplish. The results of the trial runs did, however, indicate the value of timely valve closure by the observed reduction in emissions through the stacks. It appears that a valid and perhaps easier-to-implement approach would be the monitoring of coal flow in the sleeve just above the slide valve. When the detector indicates the end of flow, the valve can be closed immediately and the screw stopped. The sensor might be

arranged to mechanically operate a switch which would provide a signal or initiate closure of the slide plate valves automatically.

The electro-mechanical vibrators were not used in connection with normal charging during the observation periods. They were turned on twice to demonstrate their use to new car operators and they were turned on once as a demonstration for the observer. Conversation with car operators and supervisory operating personnel indicate that the vibrators are dependable in their operation and effective in removing coal clinging to the sides of the hoppers.

5.3 Functional Operating Times

As a part of observation activity, various segments of the charging cycle were timed to determine the cars' current operating pace. This section presents the results of this activity.

During each charge for which an observation record was made, a time for the charge was taken. The total charging time as observed by MITRE was defined as the time period between the initiation of the coal screw feed and the completion of the lid replacement cycle. This "total charging time" was recorded for 57 individual charges, and the average was found to be 1 minute and 39.2 seconds. The maximum charging time observed was 1 minute, 50 seconds, while the minimum was found to be 1 minute, 30 seconds. The occurrence of the coal plug on number 4 sleeve appears in this average as the time elapsed to the first re-lidding. No time was recorded for the clearance of the port and the completion of the charge to the number 4 port.

In addition to the standard time taken for each observed charge, segments of the total charging operation were timed. A summary of these times appears in Table 2. The terms "return to travel" and "ready to travel" refer to a condition in which the car is moving or ready to move to some other location on the oven.

Based on the cycle time from car spotting to travel to the coal bin of 3 minutes, 30 seconds, and the hopper filling time of 1 minute, an 8 minute complete cycle time does not seem unreasonable. The 39 oven per 8 hour shift pace that has been maintained on occasion in the past, represents an average cycle time of 12.3 minutes. It appears, however, that the pacing production system may be the coke side door machine which has a planned operating cycle time of a little over 10 minutes.

5.4 Particulate Sample Collection

As a part of the observations of oven charging activities, a number of particulate samples were taken around the number 2 and 3 drop sleeves and in the free emission plume around the bottom of the charging car. The device used to obtain these samples was designed and constructed by MITRE to perform this specific sampling task. A description of the device and test results is contained in this section.

During the course of testing at the J & L facility, considerable difficulty was encountered in obtaining a particulate sample which could provide meaningful data on the physical characteristics of the emitted material. These problems gave rise to the development by

TABLE 2

OBSERVED OPERATION TIMES

Approximate Time To Fill The Hoppers In the Coal Bin	1 Minute
Ascension Pipe Cleaning Cycle	30 Seconds
Lid Removal/Complete Cycle	16 Seconds
Lid Lifting Cycle/Timed From The Sleeve Raise Until The Lid Was Replaced	8 Seconds
Lid Lifter Oscillation And Return To Travel Ready Status	9 Seconds
Slide Valve Closed To Lid Lifter Ready	32 Seconds
Drop Sleeves Down To Ready Travel	2 Minutes, 10 Seconds
Lids On, Half And Full Damper To Ready Travel	53 Seconds
Spotting Of Car For Charge Through Half And Full Damper Cycle To Coal Bin	3 Minutes, 30 Seconds

MITRE of a direct impaction particulate collection device dubbed the MITRE Carrousel. The device was configured to pass glass microscope slides through the emission duct opening. The slides, one surface of which was coated with silicon grease, collected particle samples for direct viewing and analysis under an optical microscope. Details of this device and its operation are reported in MITRE WP-10480 and the coke oven testing program final report.

A similar approach was selected for use in collecting particle samples during the observations at Weirton. The two major differences were that sample flow through the sampling device was controlled by a fan and the smaller material not deposited on the greased microscope slide was collected on a filter element through which the entire sample flow passed. A simplified schematic of the device is shown in Figure 4, and Figure 5 pictures the device in simulated use.

The intent of the device is to draw a representative sample through the first orifice in the sampling head at a velocity approximating the concentrated emission plume velocity in free air. The value of this velocity was selected based on in-duct and free space velocity measurements made during the coke oven tests at J & L and was nominally 10 ft/sec. The stream from this orifice is directly perpendicular against the greased surface of the microscope slide shown in Figure 6. The slide is held in clips in a chamber in such a way that the sample flow can pass around all four edges. The sample flow continues through an exit orifice at the rear of the chamber and

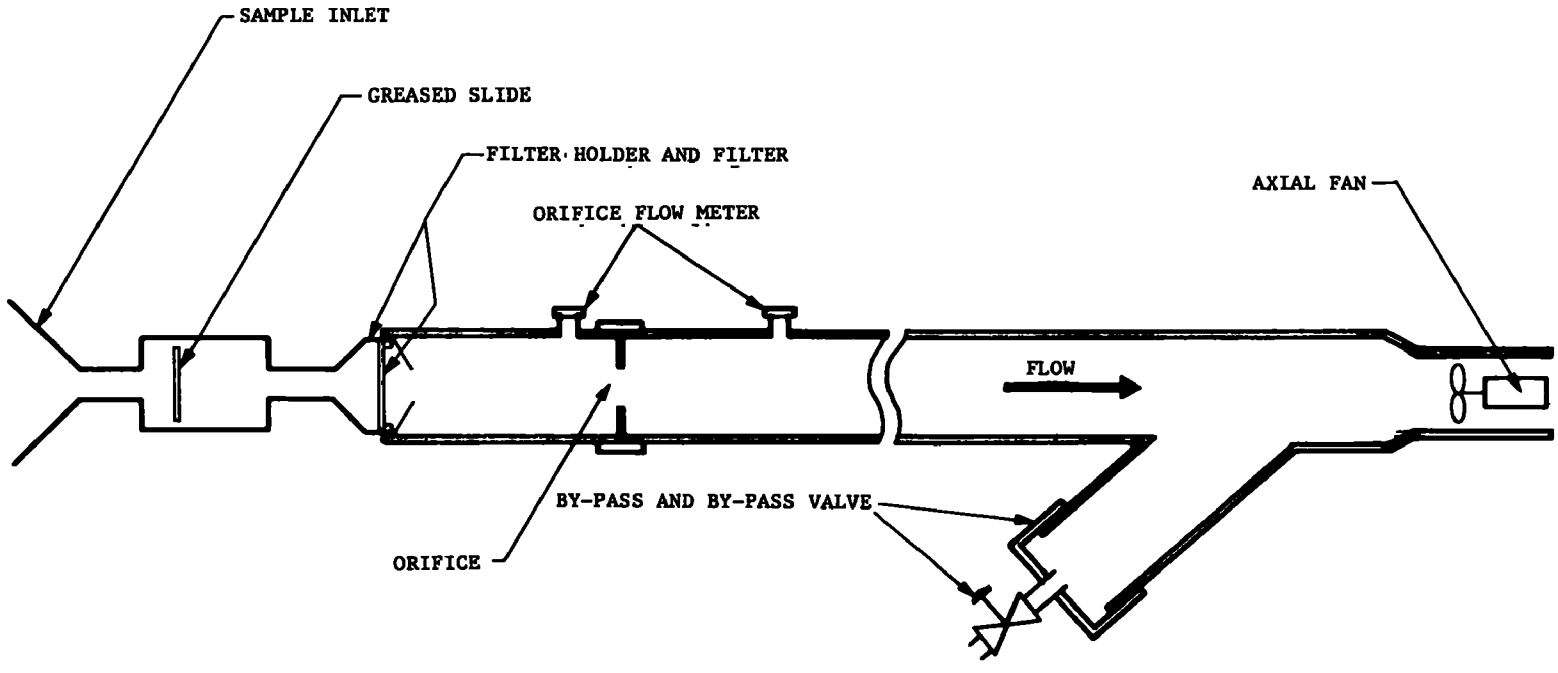

FIGURE 4
SIMPLIFIED SCHEMATIC DIAGRAM

FIGURE 5

PARTICULATE SAMPLER IN SIMULATED USE

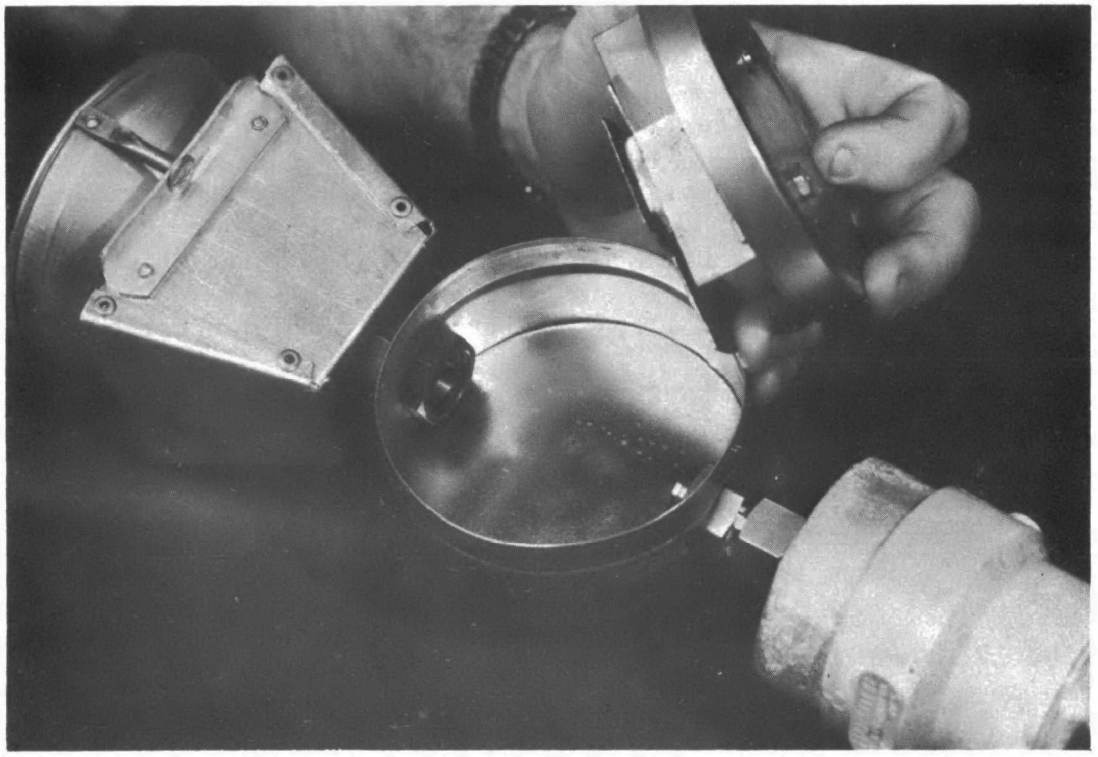

FIGURE 6

SAMPLING HEAD

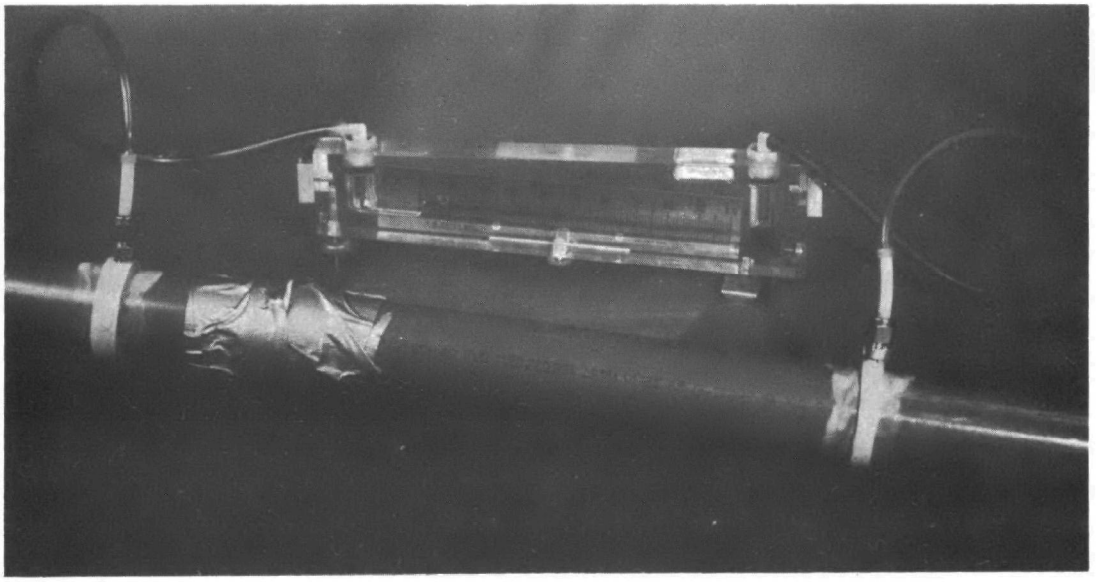

FIGURE 7

ORIFICE ASSEMBLY FOR SAMPLE FLOW MEASUREMENT

into a filter element holder. The filter element which restricts particle passage down to approximately .7 μ is pre-weighed to allow measurement of the deposited material. From the filter, the air flow passes into a 1-1/2 inch tubular passage which serves two functions; a handle extension, and a housing for an orifice flow meter (Figure 7). The flow meter provides a facility for measuring sample volume flow and thus the capability for determining sample velocity at points of interest in the system. In order to adjust the flow through the sampling system, a controllable bypass circuit is provided, as shown in Figure 8.

The following is a brief description of the samples collected based on visual observations of the greased slides, the filter elements, and the loose particulate catches. No detailed analysis of these elements has been undertaken at this time, but this brief summary will indicate the success of the sampling technique and equipment.

The material deposited on the slides was fairly uniform in size characteristics. An area of one of the greased slides is shown in Figure 9. The deposits, as expected, are concentrated in about a 3/4" circle corresponding to the inlet orifice position and size. Some of the larger particles are located on the periphery of the slide indicating some reentrainment or "particle bounce." Many of the larger particles did not adhere to the slide and were caught in the filter element. This would seem to indicate that although they

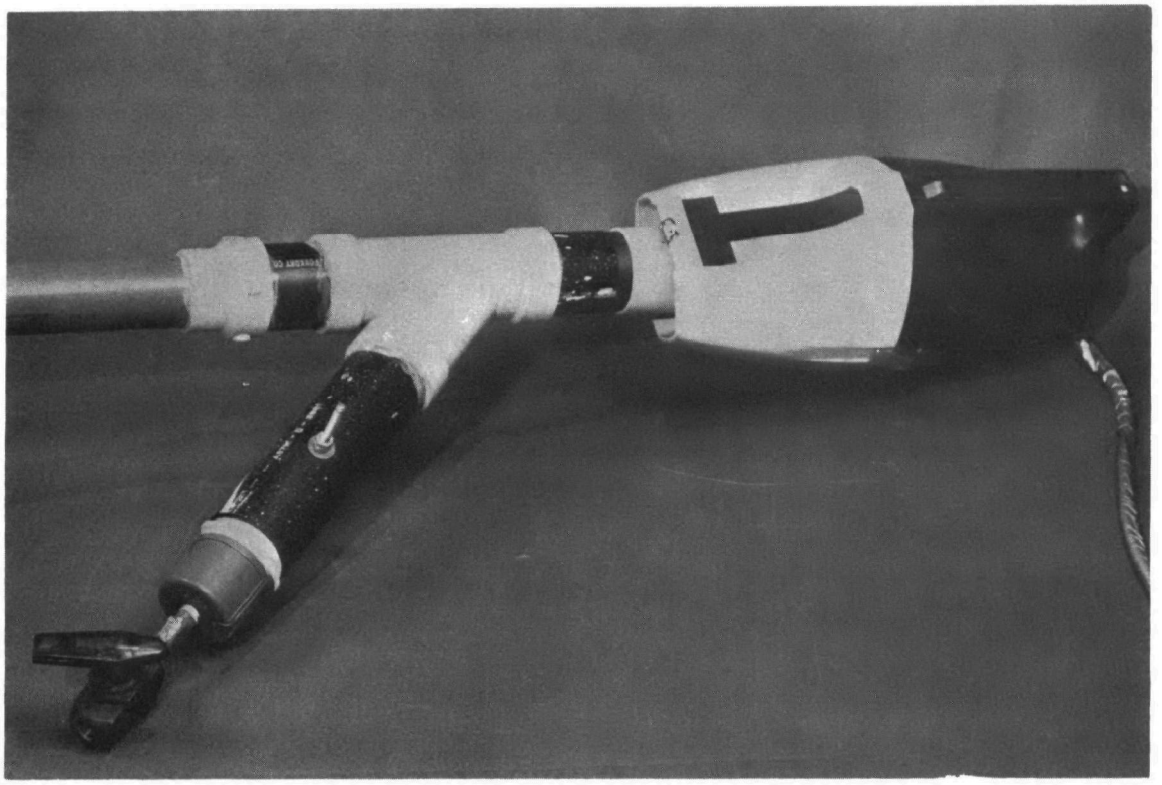

FIGURE 8

BYPASS AND FAN ARRANGEMENT

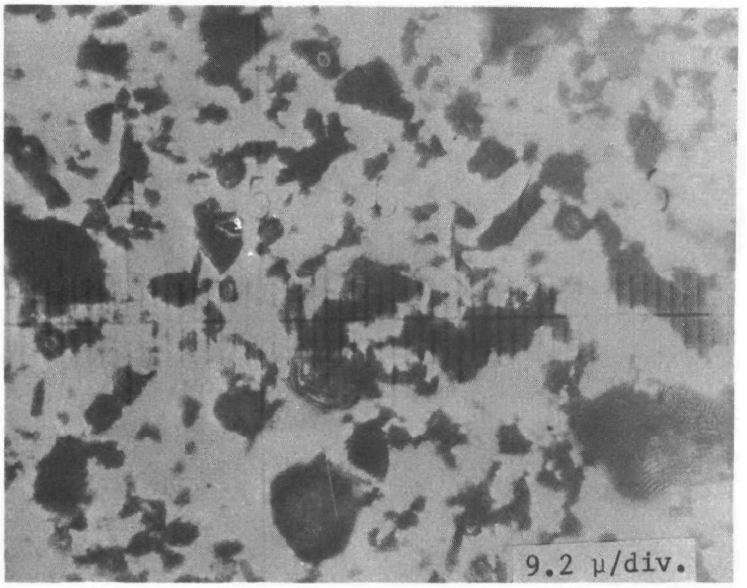

FIGURE 9

TYPICAL AREA OF GREASED SLIDE, CHARGE TO OVEN C-22 ON 3/13

impacted on the slide, their larger size and aerodynamic resistance caused them to be dislodged and blown off the greased surface.

One of the cleanest charges observed was made while the particulate sampler was in use. This was a charge to Oven B-13, at approximately 11:25 a.m. on 3/26/74. Examination of the slide showed a very light deposit of uniformly distributed particles. Few extremely large particles were found on the slide or on the filter holder. There was a minimal amount of loose material found in the system. One point of interest is the brownish color of the filter element as opposed to the black color of sample filters from other tests. The filter element pictured in Figure 9 had the lowest sample weight for filter deposits recorded for the seven tests.

Two of the filter elements exhibited a shiny black surface characteristic and fairly heavy sample weights. The surface of the filters as shown in Figure 10 appears to have been wiped with a rather thick liquid. The deposits show a pool like characteristic which produces the shiny surface. This is in contrast to the surface of the other four samples, example in Figure 11 , which show a large number of distinguishable particles. The only obvious differences between the two groups of charges was that there was considerably more visible fire on the two tests on which the filters with the shiny surfaces were obtained. The sampler was not operated in the direct flame but the heat may have had a polishing or melt/flow effect on the filters or it may have changed the characteristics of particulate material emitted.

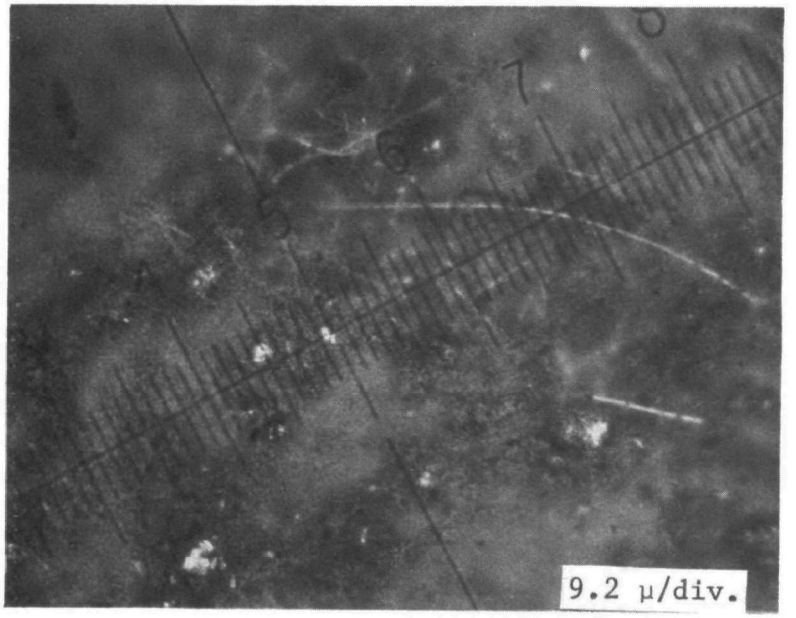

FIGURE 10

TYPICAL FILTER ELEMENT AREA, CHARGE TO OVEN B-13 ON 3/26/74

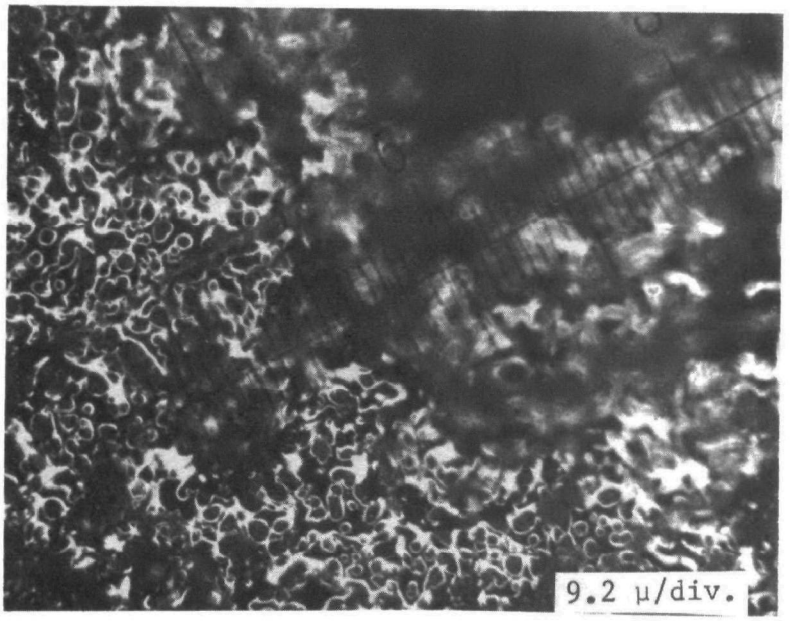

FIGURE 11

TYPICAL FILTER ELEMENT AREA, CHARGE TO OVEN C-24 ON 3/15/74

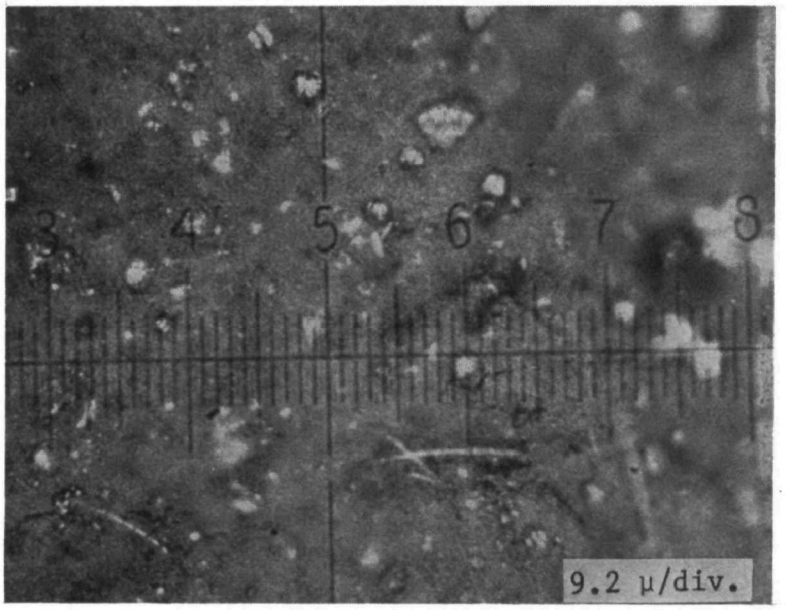

FIGURE 12

TYPICAL FILTER ELEMENT AREA, CHARGE TO OVEN A-11 ON 3/26/74

No further analysis of the samples is planned at this time, but they will be preserved should there be further interest in information which they may provide.

5.5 Gas Constituent and Concentration Measurements

During the week of 3/11/74 to 3/15/74, gas constituent and concentration data were obtained for a select group of pollutants. The pollutants measured were as follows:

Pollutant	Detector Tube Concentration Range
NO_2	0.1-50 PPM
CO	10-3000 PPM
CO	.001-.1%
CO_2	.01-10%
H_2S	1-800 PPM

The gas measurement was performed with an MSA universal tester using MSA detector tubes.

The gases were measured in the plume surrounding the drop sleeve during the charging operation, and also on the oven top during ambient conditions when a charge was not taking place near the measurement area.

The gas concentrations that were obtained proved to be inconsistent, which in turn made it difficult to draw any meaningful conclusions from them. The reasons for this difficulty were the wind conditions that prevailed at the oven top at Brown's Island coupled

with the relatively low order of emissions to be measured. These conditions contributed to a highly dispersed and rapidly dissipated emission condition.

These emission plume characteristics were in contrast to the emission plumes at Jones and Laughlin Pittsburgh Works, where the emission plumes were less dispersed and slower to dissipate. The concentrations that were obtained are as follows:

Weirton Steel

Ambient Air Data - Oven Top

NO_2	-	No Response
H_2S	-	No Response
CO_2	-	.07%
CO	-	.002%
CO	-	10 PPM

Plume Data - Drop Sleeve During 3/11/74 Charge

NO_2	-	No Response
CO_2	-	No Response
H_2S	-	25 PPM
CO	-	.01%
CO	-	50 PPM
CO	-	75 PPM
H_2S	-	5 PPM

Plume Data - Drop Sleeve During 3/12/74 Charge

H_2S	-	No Response
NO_2	-	.1 PPM
CO_2	-	.08%
CO	-	.005%
CO	-	125 PPM

Plume Data - Drop Sleeve During 3/13/74 Charge

NO_2	-	.4 PPM
CO_2	-	.3%
H_2S	-	10 PPM
CO	-	100 PPM
CO	-	.02%

Ambient Air Data - 3/11/74 (Battery Top)

NO_2	-	No Response
H_2S	-	No Response
CO_2	-	.07%
CO	-	.001-.1 - .002%
CO	-	10-3000 PPM - 10 PPM

Plume Data - 3/11/74

NO_2 - Around Drop Sleeve	-	No Response
CO_2 - Around Drop Sleeve	-	No Response
H_2S - Around Drop Sleeve	-	25 PPM
CO - Around Drop Sleeve	-	50 PPM
CO - Around Drop Sleeve Oven B-24	-	75 PPM
H_2S - Around Drop Sleeve Oven C-24	-	5 PPM

Plume Data - 3/12/74

H_2S - Around Drop Sleeve Oven C-22	-	No Response
NO_2 - Around Drop Sleeve Oven A-24	-	.1 PPM
CO_2 - Around Drop Sleeve Oven B-24	-	.08%
CO - Around Drop Sleeve Oven C-24	-	.005%
CO - Around Drop Sleeve Oven A-20	-	125 PPM

Plume Data - 3/13/74

NO_2 - Around Drop Sleeve Oven B-28	-	.4 PPM
CO_2 - Around Drop Sleeve Oven C-28	-	.3%
H_2S - Around Drop Sleeve Oven A-1	-	10 PPM
CO - Around Drop Sleeve Oven B-1	-	100 PPM
CO - Around Drop Sleeve Oven C-1	-	.02%

After careful examination of the data presented here, it was decided that no meaningful conclusions could be drawn regarding emissions produced during the charging operation. The ambient data does, however, provide some quantitative information of possible use on oven top conditions. Any application of this data should, however, take into account its short comings in quantity and the highly variable conditions.

6.0 LARRY CAR WORK HISTORY

6.1 Work and Maintenance Schedules

In discussions with supervisory personnel, we were told that no formalized arrangement for rotation of the oven equipment has been established. The philosophy which prevails is to let the shift foreman select the equipment to be used. This usually means the continual use of one car until either a malfunction occurs or the car is placed in standby to be checked by the motor inspector.

The motor inspector will generally notify the foreman the day before he intends to check the car. The foreman can then set the car out at the beginning of the shift during which the car is to be inspected. The actual time of inspection during the shift is based on the inspector's work load. In conversations with the "greasers," we were told that they normally grease the car on a daily basis while it is in operation. This is usually accomplished during periods when the car is in the coal bin being filled. The daily greasing is confined to 36 hand fittings and operation of the central lubrication system.

In addition, the greasers try to catch each car out of service at least once a week to check all machinery requiring lubrication. This complete check requires from 1-1/2 to 2 hours and includes such items as the checking, cleaning, and lubricating of semi-exposed gearing and other hard to reach rotating machinery. The hydraulic systems are also checked at this time.

One fact which allows flexibility in scheduling is that the electrical department is responsible for all maintenance and repair work on oven machinery. They have the capability within their shop

to handle all but the heaviest mechanical repair jobs. It is their responsibility to coordinate work on those jobs for which they require assistance. This seems to provide prompt attention to problems as they arise and centralizes the responsibility for their resolutions. This arrangement is in contrast to the situation which existed at J & L in which the foreman or car supervisor was responsible for coordination of the various craft shops needed for a repair job, such as millwrights, riggers, electrical, line and wire, pipe fitters, etc. The crafts in turn would then schedule work priorities based on minimization of production disruption. In some instances, this caused delays when one craft was not available and other work could not proceed until their segment of the job was complete.

6.2 Significant Events

As a part of the observation activity, a compilation of significant events such as breakdowns causing loss of production, was undertaken. We were told that no formalized reporting system on specific events is established, but that information of this type could be obtained from operating supervisors based on their personal recollections and notes. This approach was pursued through informal talks with these individuals.

The conversations disclosed only two occasions during which production was lost because of larry car problems. The first occasion involved the loss of 4 to 6 hours of production when one of the cars became immobilized over an open port. This resulted in damage to drop sleeve hydraulic systems and one ascension pipe cleaner and

associated control system. Analysis of the event indicated that the following sequence of events may have occurred.

1. At the end of a charge, the operator observed an unusually heavy concentration of flame from around one drop sleeve.

2. He reacted in a proper manner by attempting to move the car away from the flaming port. In his attempt to clear the car for motion, the operator accidentally pushed the ascension pipe cleaner actuating button. The cleaner extended and became wedged between ascension pipes as the car moved.

3. The operator stopped the car when he realized what had happened, but its proximity to the open flaming port caused considerable damage before the lid could be replaced.

Some portion of the cleaner assembly had to be cut away before the car could be moved off the oven. In addition, the second car was undergoing maintenance at that time and was not ready for immediate service. Work necessary to get the standby car into service was rushed to completion and production was resumed with certain functions being operated manually in the bypass mode.

The car which had burned was repaired to a point where it could perform production charging in approximately 8 to 10 hours. Several of its functions would have had to be operated in the bypass mode and the damaged ascension pipe cleaner was inoperable.

The second event occurred when an interlock switch on the ascension pipe cleaner failed causing the ram to be extended prematurely. The extended ram contacted the overhead trolly track as the unit swung down to the operating position. Power was lost and a portion of the

"hot rails" was badly damaged. It required approximately 1/2 hour to resolve the problem and resume production. The standby car could not operate until the hot rail was cleared.

6.3 Operator Performance

The larry car operator performance at Weirton seemed to be of a highly consistent level. This can be attributed to the fact that the Brown's Island Battery is highly automated, and the larry car operators' performance is limited to the task of driving and spotting the larry car, and operating the charging/aspirating mechanisms with the aid of automated control circuitry. The fact that the car is automated leaves relatively few decisions to the individual discretion of the driver, since he follows a predescribed charging scheme formatted by the oven superintendent.

6.4 Future Modifications

As far as MITRE could ascertain from its experiences on the oven and conversations with battery personnel, the Brown's Island Battery is being modified in every area that seems to need further design and planning. At the present time, attention is being given to three specific areas; leaking ascension pipe caps, level sensing in the charging car hoppers, and increased aspiration in the collecting main system.

Experimentation is currently taking place concerning the ascension pipe caps in order to discover new methods of reducing the emissions that occur immediately after the charging operation. Various materials and seating configurations are being implemented experimentally on the oven, and are being observed during normal operating conditions so as to determine the advantages and disadvantages of each.

The Brown's Island Battery is also working on a method for sensing the coal level in the larry car coal hopper. The reason for this is to signal the larry car operator when all coal has been discharged through the drop sleeve into the oven. Prior to this, the larry car operator had been using his own judgement as to the emptiness of the hopper, or allowing the automatic charging cycle to initiate slide valve closure. As a result, the slide plate valve is left open for an undetermined amount of time after the coal discharge is complete. It is this undetermined period of time that allows charging emissions to escape to the atmosphere via the open slide plate and coking stack. The Brown's Island personnel feel that a reduction in charging emissions would be accomplished if the slide plates were closed immediately following the emptying of coal, and as a result, are presently devoting attention to this problem. During the week of March 24th, the electrical department was experimenting with a current sensing device attached to the drive motor of the screw that feeds coal to the drop sleeve during the charging operation. Theoretically, when the screw feed cylinder of the larry car is free of coal, the operating load of the motor, which is normally 15-20 amps during the coal feeding sequence, is decreased by 2-4 amps. This reduction could be sensed by the current sensing device. This drop in the current load could then be used as a signal for the larry car operator to close the slide plate valve, thus closing the charging emission escape route.

Experiments are also under way concerning oven aspiration and steam ejector operation. Different ascension pipe plumbing configurations are being considered and tried experimentally on the oven during normal charging conditions.

APPENDIX I

LARRY CAR OBSERVATION LOGS

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/11/74
TIME 3:40
OVEN C-22

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE								
15 SEC.			PS					
30 SEC.		MF		MF		MF		
45 SEC.				LF		LF		
1 MIN.		L		F		F		
1 MIN. 15 SEC.			MS→F	F	MS	F		
1 MIN. 30 SEC.			MS	F	MS	F		
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:50							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS .01 Concentration of CO.
Reading Taken at #2
Drop Sleave

REMARKS:

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/11/74
TIME 3:55
OVEN A-24

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE								
15 SEC			SPF	MBL		F→MBL		
30 SEC				M		FL		
45 SEC				L		L		
1 MIN				F		F		
1 MIN 15 SEC	LPF		LS		MS			
1 MIN 30 SEC								
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:35							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS 25 PPM of H_2S at #2 Drop Sleeve

REMARKS

THE MITRE
MCF 2495 12/73

RLB
OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY: National Steel
PLANT: Weirton Steel
BATTERY: Brown's Island

DATE: 3/11/74
TIME: 4:10
OVEN: B-24

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE								
15 SEC.			SP	LF		LF		
30 SEC.		L		LF		LF		
45 SEC				LF↓		LFP		
1 MIN.		L→M	LS	F	L→SF	F		
1 MIN. 15 SEC.								
1 MIN. 30 SEC.								
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:32							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER:

MANUAL GAS 75 PPM of CO at #2
Drop Sleeve

REMARKS:

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/11/74
TIME 4:18
OVEN C-24

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE								
15 SEC			SP	LF		LF		
30 SEC				LFP		LFP		
45 SEC				LFP		LFP		
1 MIN				L↓FP		L↓FP		
1 MIN 15 SEC			MS		MHP MS			
1 MIN. 30 SEC								
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:32							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS 5 PPM of H_2S at #2 Drop Sleeve

REMARKS The number three drop sleeve malfunctioned, and the lid did not release. Recycling of the lid lifter mechanism in the manual mode corrected th problem.

THE MITRE
MCF 2495 12/73

Robert W Bell
OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY: National Steel
PLANT: Weirton Steel
BATTERY: Brown's Island

DATE: 3/12/74
TIME: 1:26
OVEN: C-18

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE								
15 SEC.			SP	M		MF		
30 SEC.				MF		MF		
45 SEC.				M		LF		
1 MIN				M		F↑		F
1 MIN. 15 SEC.			MS		MS	F		
1 MIN. 30 SEC.								
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:40							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER:

MANUAL GAS

REMARKS:

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/12/74
TIME 2:10
OVEN B-20

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE								
15 SEC				M		MF		
30 SEC				LF		F		
45 SEC				LF		F		
1 MIN		M		M	LS	L		
1 MIN 15 SEC			MS	F	MS	F		
1 MIN. 30 SEC								
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC.								
2 MIN 30 SEC.								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:35							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER Dry Bulb 46 RH 70%
Strong North Wind

MANUAL GAS

REMARKS

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY: National Steel
PLANT: Weirton Steel
BATTERY: Brown's Island

DATE: 3/12/74
TIME: 2:22
OVEN: C-20

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE								
15 SEC.				M→H		MF		
30 SEC				M		F		
45 SEC.		L		LF↑		F↑		
1 MIN.					MS			
1 MIN 15 SEC.			FS		FS			
1 MIN. 30 SEC.								
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:38							

↑ = INCREASING
S = STACK
L = LIGHT FLOW
BL = BLACK

↓ DECREASING
HP = HOPPER
M = MEDIUM FLOW
Y = YELLOW

→ CHANGING TO
F = FIRE
H = HEAVY FLOW
P = PUFFY

WEATHER:

MANUAL GAS

REMARKS: MITRE particulate test run.

MITRE
MCF 2495 12/73

RWB
OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/12/74
TIME 2:35
OVEN A-22

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			SP					
15 SEC				M		M→LF		
30 SEC				M		LF		
45 SEC				M		FP		
1 MIN				M↑		MF		F
1 MIN 15 SEC			MS		MS			
1 MIN 30 SEC				F		F		F
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:44							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY· Brown's Island

DATE 3/12/74
TIME: 2:47
OVEN· B-22

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			SP					
15 SEC.		F		L→MF		L→MF		
30 SEC.		FP		LFP		LFP		
45 SEC.		LFP		LFP				
1 MIN		F↑		L↓F↑		L↓F↑		
1 MIN. 15 SEC.					MS		HP P	
1 MIN. 30 SEC.								
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:35							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER: _____

MANUAL GAS _____

REMARKS. _____

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/12/74
TIME 2:58
OVEN C-22

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			SP					
15 SEC				M		MF		
30 SEC				M		LF		
45 SEC				MY		F		
1 MIN				L→M		F		
1 MIN 15 SEC			MS+HP		MS+HP			
1 MIN 30 SEC								
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC								
2 MIN 45 SEC.								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:34							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/12/74
TIME: 3:10
OVEN A-24

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE								
15 SEC.								
30 SEC								
45 SEC.								
1 MIN								
1 MIN. 15 SEC.								
1 MIN. 30 SEC.								
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:30							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER:

MANUAL GAS .1 PPM Reading NO_2 On #2 Drop Sleeve

REMARKS. Routine of larry operator seems variable. When the larry car came on the spot he half-dampered instead of waiting until the charge was complete.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/12/74
TIME 3:28
OVEN B-24

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			LSP					
15 SEC				LFP		M		F
30 SEC				M		F		
45 SEC		F		L		F		
1 MIN								
1 MIN 15 SEC			SP	F	MS	F		
1 MIN 30 SEC								
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC.								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:32							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS Half damper after charge, then unlid, then full damper. Vibrators were used as a demonstration for new larry operator.

MITRE
MCF 2495 12/73

RWB
OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/12/74
TIME. 3:38
OVEN C-24

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			SP					
15 SEC				M		MFP		
30 SEC				LFP		LFP		
45 SEC				LFP		LFP		
1 MIN				L↓FP		L↓FP		
1 MIN 15 SEC.			LS	L	LS			
1 MIN 30 SEC			MS		MS			
1 MIN. 45 SEC.								
2 MIN.								
2 MIN 15 SEC.								
2 MIN 30 SEC.								
2 MIN 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:43							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER·

MANUAL GAS .005% CO at #2 Drop Sleeve

REMARKS Regular sequence after charge. The overall charge looked very good, with very light smoke from the stacks.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/12/74
TIME 3:59
OVEN A-26

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			LSP					
15 SEC				LF		LF		
30 SEC				LF↑		LF↑		
45 SEC				L↓F		L↓F		
1 MIN		M			MS		L HP P	
1 MIN 15 SEC								
1 MIN 30 SEC								
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC.								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:35							

↑ = INCREASING
S = STACK
L = LIGHT FLOW
BL = BLACK

↓ DECREASING
HP = HOPPER
M = MEDIUM FLOW
Y = YELLOW

→ CHANGING TO
F = FIRE
H = HEAVY FLOW
P = PUFFY

WEATHER

MANUAL GAS 125 PPM CO at #2 Drop Sleeve

REMARKS Normal sequence after charge. End of charge looked cleaner than usual.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE: 3/12/74
TIME: 4:32
OVEN C-26

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE								
15 SEC				L		LFP		
30 SEC				LFP		LFP		
45 SEC				L↓		L↓		
1 MIN				LF		LF		
1 MIN 15 SEC			MS					
1 MIN. 30 SEC.								
1 MIN. 45 SEC.								
2 MIN								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:40							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER:

MANUAL GAS

REMARKS: Long wait before charge. Electrical Department looked over the bottom of the car but did nothing.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/13/74
TIME 5:02
OVEN C-1

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			SP					
15 SEC				L		L		
30 SEC				L		LF		
45 SEC				LFP		LFP		
1 MIN				L↓		L↓FP		
1 MIN 15 SEC	MH	FL→M	MS	M	MS			
1 MIN 30 SEC.								
1 MIN. 45 SEC								
2 MIN								
2 MIN. 15 SEC								
2 MIN 30 SEC								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:40							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS .02% CO at #2 Drop Sleeve

REMARKS 4:10 complete cycle

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/15/74
TIME. 10:25
OVEN A-20

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE		MF		M				
15 SEC				M↑		M↑		
30 SEC		F		H		MF		L
45 SEC.		M		H		MF		L
1 MIN		M	M	M	M	M→F		L
1 MIN. 15 SEC.		F	M↓	L	M↓	F		L
1 MIN. 30 SEC.								
1 MIN. 45 SEC.								
2 MIN								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:45							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS: An ascension pipe lid did not come down, and as a result, the smoke at the drop sleeves was worse than usual. Smoke from stacks stopped quicker than usual. Car was run in the manual mode.

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/15/74
TIME 10:55
OVEN C-20

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			SP					
15 SEC				FM		MF		
30 SEC				FM		M↑F		
45 SEC				FM↓		M↓F		
1 MIN		M		FM		LF↑		
1 MIN 15 SEC	M			HF↑		LF		
1 MIN 30 SEC			SM↑			MF		
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:43							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE: 3/15/74
TIME: 11:15
OVEN. A-22

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			MP					
15 SEC				MB		MB		
30 SEC.				M↑		M↑		L
45 SEC				M↑		M↑		L
1 MIN.		L		M↑		M↑		L↓
1 MIN. 15 SEC.		L	M	M↓	SH	M		
1 MIN. 30 SEC.		L		L↓	SM	HY		L
1 MIN. 45 SEC.								
2 MIN.								
2 MIN 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:42							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS:

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/15/74
TIME 11:30
OVEN B-22

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE				MF		MF		LF
15 SEC				L		LF		F
30 SEC						LFP		LP
45 SEC						F↑		F↑
1 MIN		L	L	L	M	F↑		LFP
1 MIN 15 SEC		L↓	L	M↑	M↓	HF		FL↓
1 MIN 30 SEC								
1 MIN 45 SEC								
2 MIN.								
2 MIN 15 SEC								
2 MIN 30 SEC								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:47							

↑ = INCREASING
S = STACK
L = LIGHT FLOW
BL = BLACK

↓ DECREASING
HP = HOPPER
M = MEDIUM FLOW
Y = YELLOW

→ CHANGING TO
F = FIRE
H = HEAVY FLOW
P = PUFFY

WEATHER

MANUAL GAS

REMARKS MITRE particulate test run. Heavy fire on Number 3 Drop Sleeve

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE: 3/15/74
TIME: 11:40
OVEN: C-22

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			MP					
15 SEC				MB		MBF		FP
30 SEC.				M↑H		MF		F
45 SEC.				M		LF		
1 MIN				L		F↑		F
1 MIN 15 SEC.		L	M	M	M	M		FL
1 MIN 30 SEC.		L	M	F	M			
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:37							

↑ = INCREASING
S = STACK
L = LIGHT FLOW
BL = BLACK

↓ DECREASING
HP = HOPPER
M = MEDIUM FLOW
Y = YELLOW

→ CHANGING TO
F = FIRE
H = HEAVY FLOW
P = PUFFY

WEATHER

MANUAL GAS

REMARKS:

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/15/74
TIME 11:52
OVEN A-24

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			SMP					
15 SEC						FLB		
30 SEC				MB		FL		
45 SEC	P			L		LFP		
1 MIN				M↑	MS	F	P	
1 MIN 15 SEC		L	LS	FL	MS			L↑
1 MIN 30 SEC.						MF		
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC.								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:38							

↑ = INCREASING
S = STACK
L = LIGHT FLOW
BL = BLACK

↓ DECREASING
HP = HOPPER
M = MEDIUM FLOW
Y = YELLOW

→ CHANGING TO
F = FIRE
H = HEAVY FLOW
P = PUFFY

WEATHER

MANUAL GAS

REMARKS

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT. Weirton Steel
BATTERY. Brown's Island

DATE: 3/15/74
TIME: 12:10
OVEN B-24

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			LSP					
15 SEC		F		FM		M↑		
30 SEC				H				
45 SEC				FM		HY		
1 MIN				M↓		M↓		M
1 MIN 15 SEC.			SM↑	M	SM↑	M		L
1 MIN. 30 SEC.			SM↓		SM			
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:38							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER:

MANUAL GAS

REMARKS:

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/15/74
TIME 12:21
OVEN C-24

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			SP					
15 SEC				MF		MF		
30 SEC				MF		MF		
45 SEC				LF		LF		
1 MIN			M↑	M	M↑HP	MF		L
1 MIN 15 SEC		L	H	H		F	P	L
1 MIN 30 SEC								
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC.								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:38							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS MITRE Particulate Test Run

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY: National Steel
PLANT: Weirton Steel
BATTERY: Brown's Island

DATE: 3/15/74
TIME: 12:39
OVEN: A-26

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			SP					
15 SEC				M↑		M↑		
30 SEC.				M		M→H		
45 SEC		L		M		H		
1 MIN.		L		M		H		
1 MIN. 15 SEC.				MY		MY		
1 MIN. 30 SEC.	H↑		SM	L	SM	L		L
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:39							

↑ = INCREASING
S = STACK
L = LIGHT FLOW
BL = BLACK

↓ DECREASING
HP = HOPPER
M = MEDIUM FLOW
Y = YELLOW

→ CHANGING TO
F = FIRE
H = HEAVY FLOW
P = PUFFY

WEATHER:

MANUAL GAS

REMARKS:

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/15/74
TIME 12:54
OVEN B-26

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			LSP					
15 SEC		F		M		LF		
30 SEC		FP		M		LF		
45 SEC				M↑		F		
1 MIN				F		FP		
1 MIN 15 SEC			MS		MS↑		HP P	
1 MIN 30 SEC			M↓	F	M	F		
1 MIN 45 SEC.								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC.								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:40							

↑ = INCREASING
S = STACK
L = LIGHT FLOW
BL = BLACK

↓ DECREASING
HP = HOPPER
M = MEDIUM FLOW
Y = YELLOW

→ CHANGING TO
F = FIRE
H = HEAVY FLOW
P = PUFFY

WEATHER

MANUAL GAS

REMARKS Patching door jam.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY. Brown's Island

DATE. 3/15/74
TIME· 1:36
OVEN. C-26

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			LSP					
15 SEC				L		MF		
30 SEC.				LPF		LPF		
45 SEC				L		LF		
1 MIN.						F		
1 MIN 15 SEC		F	LS	L	M↑S	L		
1 MIN. 30 SEC				L		L		
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:37							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER:

MANUAL GAS

REMARKS· Very clean charge. Good coordination demonstrated between larry car and pusher car. Leveling bar went in on signal from larry car.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/15/74
TIME 1:52
OVEN A-28

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE								
15 SEC				L		LF		
30 SEC						FP		
45 SEC			L			FL		
1 MIN			L		M	FL		
1 MIN 15 SEC			L		L↓	L		
1 MIN. 30 SEC								
1 MIN 45 SEC.								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC.								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:33							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS Very good charge

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE: 3/26/74
TIME: 9:58
OVEN: B-9

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			LSP			LFP		
15 SEC				LFP		LF↓		
30 SEC.				LF↓				
45 SEC								
1 MIN								
1 MIN 15 SEC.	M	F	MSMHP		MS	F		F
1 MIN. 30 SEC.								
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:40							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER:

MANUAL GAS

REMARKS: Fairly clean charge. Very little smoke during middle of charge. Hopper smoke.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/26/74
TIME 10:08
OVEN C-9

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			LSP					
15 SEC				LFP		FP		
30 SEC				L↑FP		FP		
45 SEC				L↓		FP		
1 MIN								
1 MIN 15 SEC			MS	F↓	MS	F↓		
1 MIN 30 SEC								
1 MIN 45 SEC								
2 MIN.								
2 MIN. 15 SEC								
2 MIN 30 SEC								
2 MIN. 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:40							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS End of charge was very clean, with very little smoke around drop sleeves. Stack smoke was unusually light.

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY. National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE· 3/26/74
TIME· 10:23
OVEN A-11

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			HSP					
15 SEC.				MF		MF		
30 SEC.				M↓FP		M↓FP		
45 SEC				MF		MF		
1 MIN				LF↓		LF↓		
1 MIN. 15 SEC.		F	MS↑	F	MS↑	F		
1 MIN. 30 SEC.	L		LHP		LHP			
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:40							

↑ = INCREASING
S = STACK
L = LIGHT FLOW
BL = BLACK

↓ DECREASING
HP = HOPPER
M = MEDIUM FLOW
Y = YELLOW

→ CHANGING TO
F = FIRE
H = HEAVY FLOW
P = PUFFY

WEATHER.

MANUAL GAS

REMARKS: MITRE particulate test run. End of charge had more smoke than usual.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/26/74
TIME 10:45
OVEN B-11

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			LSP					
15 SEC				LFP		FP		
30 SEC				LFP		LFP		
45 SEC				FP		FP		
1 MIN								
1 MIN 15 SEC		F	MS	F	MS	F		F
1 MIN. 30 SEC								
1 MIN 45 SEC								
2 MIN								
2 MIN. 15 SEC.								
2 MIN 30 SEC								
2 MIN. 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:40							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS Lid lifter on Number 4 drop sleeve did not operate, the lid was removed manually by the lidman. A one minute loss is realized if lid-lifter doesn't work. Relidding operation was normal.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE. 3/26/74
TIME. 10:54
OVEN· C-11

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			MSP					
15 SEC.				L↓FP		L↓FP		
30 SEC.				LFP		LFP		
45 SEC								
1 MIN.				LFP		LFP		
1 MIN. 15 SEC.	LHP	F	LHPMS		MS	F		
1 MIN. 30 SEC								
1 MIN 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	Not Recorded							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER:

MANUAL GAS

REMARKS: Takes approximately 15-20 seconds to move off spot, check lids, and re-spot. Smoke was heavier than usual on number two stack.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/26/74
TIME 11:07
OVEN A-13

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			HSP					
15 SEC		FP		MFP		FP		
30 SEC		F		MF		F		
45 SEC				MF		F		
1 MIN		F	MS	F	MS	F		
1 MIN 15 SEC				F		F		
1 MIN. 30 SEC.								
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC.								
2 MIN. 45 SEC								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:38							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS Lid operation satisfactory, larry car appeared to be mis-spotted.

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY: National Steel
PLANT: Weirton Steel
BATTERY: Brown's Island

DATE: 3/26/74
TIME: 11:20
OVEN: B-13

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			MSP					
15 SEC.				MF		MF		
30 SEC.				LFP		LFP		
45 SEC.				L↓F↓		L↓F↓		
1 MIN.								
1 MIN 15 SEC.			MS↑	M	MS↑			
1 MIN. 30 SEC.						F		
1 MIN. 45 SEC.								
2 MIN.								
2 MIN 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:45							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER:

MANUAL GAS

REMARKS. MITRE particulate test run. Charge looked fairly clean. Light flow from stacks. Number two drop sleeve seemed to hold a negative pressure for most of the charge.

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/26/74
TIME 11:33
OVEN C-13

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			LSP					
15 SEC				M		M		
30 SEC				M		M		
45 SEC				LFP		LFP		
1 MIN				HYP				
1 MIN 15 SEC			MS		MS			
1 MIN 30 SEC								
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC								
2 MIN. 45 SEC								
3 MIN*								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:45							

↑ = INCREASING
S = STACK
L = LIGHT FLOW
BL = BLACK

↓ DECREASING
HP = HOPPER
M = MEDIUM FLOW
Y = YELLOW

→ CHANGING TO
F = FIRE
H = HEAVY FLOW
P = PUFFY

WEATHER

MANUAL GAS

REMARKS Lid lifter operation satisfactory, but larry man checked lids. Car re-spotted poorly, drop sleeves misaligned. Poor seal on number one drop sleeve appeared to have caused poor suction on number one and two ports.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE. 3/26/74
TIME: 11:53
OVEN: A-15

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			MSP					
15 SEC		MF		MF		MF		MF
30 SEC.		F		MF		MF		FP
45 SEC.				M		M		
1 MIN		LF		LF		LF		
1 MIN. 15 SEC.				F	MS	F		F
1 MIN. 30 SEC.								
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:40							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER:

MANUAL GAS

REMARKS: Ascension pipe lid did not come down in the automatic cycle, closed manually by lid man. This caused a delay of about one minute. Car leaked badly around all sleeves.

MITRE
MCF 2495 12/73

RWB
OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/26/74
TIME 1:24
OVEN A-19

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			MS					
15 SEC				LFP		LFP		
30 SEC				L↓FP		L↓FP		
45 SEC.								
1 MIN				L↓FP		L↓FP		
1 MIN 15 SEC	L			L↑F		M↑F		
1 MIN 30 SEC								
1 MIN 45 SEC								
2 MIN.								
2 MIN 15 SEC								
2 MIN. 30 SEC								
2 MIN. 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:38							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT. Weirton Steel
BATTERY Brown's Island

DATE: 3/26/74
TIME: 1:39
OVEN: B-19

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			LPS					
15 SEC		F		L↑F		L↑F		F
30 SEC.		F		LF		LF		
45 SEC.		F		LF		LF		F
1 MIN.			MS	F	MS	F		
1 MIN. 15 SEC.								
1 MIN. 30 SEC.								
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:40							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER:

MANUAL GAS

REMARKS: Larry car appeared to be misaligned on the charging ports. A lot of smoke and fire at the beginning of the charge. Drop sleeves were tilted. Number two and number four lids were cocked and burning.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/26/74
TIME 1:54
OVEN C-19

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			MSP					
15 SEC		M↑F		M↑F		M↑F		
30 SEC		F		MF		MF		
45 SEC				L↓F		L↓F		
1 MIN		F↓		F↓		F↓		
1 MIN 15 SEC		M		LF		LF		H
1 MIN 30 SEC		F						F
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:43							

↑ = INCREASING
S = STACK
L = LIGHT FLOW
BL = BLACK

↓ DECREASING
HP = HOPPER
M = MEDIUM FLOW
Y = YELLOW

→ CHANGING TO
F = FIRE
H = HEAVY FLOW
P = PUFFY

WEATHER

MANUAL GAS

REMARKS Number one and four drop sleeves had heavy smoke. Car was spotted okay.

MITRE
MCF 2495 12/73

BNB
OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY: National Steel
PLANT: Weirton Steel
BATTERY: Brown's Island

DATE: 3/26/74
TIME: 2:18
OVEN: A-21

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			HSP	HP		HP		
15 SEC.		F↓		FP		FP		
30 SEC.		FP		MF		MF		
45 SEC				LF		LF		
1 MIN.			MS	F	MS	F		F
1 MIN. 15 SEC.								
1 MIN. 30 SEC.								
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:38							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER.

MANUAL GAS

REMARKS: MITRE particulate test run. Operation was ahead of schedule and larry car was detained in coal bin.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/26/74
TIME 3:09
OVEN A-23

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			HPP					
15 SEC		MF		MF		MF		
30 SEC		MF		MF		MF		
45 SEC		M↓FP		M↓P		M↓P		
1 MIN	M		MS	FP	MS	F		
1 MIN 15 SEC				F		F		
1 MIN. 30 SEC								
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:40							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS Heavy smoke at start of charge, car appeared to be properly spotted.
More smoke from drop sleeves than usual.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE: 3/26/74
TIME: 3:20
OVEN: B-23

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			LPS					
15 SEC.		MFP↓		MF		MF		
30 SEC.				L↑F		L↑F		
45 SEC.				FP		FP		
1 MIN				LFP		LFP		
1 MIN. 15 SEC.			MS	F	MS	F		F
1 MIN. 30 SEC.								
1 MIN 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:41							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS: Larry operator is still checking to make sure lids are off. Car appears to be off spot, sleeves are tilted.

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/26/74
TIME 3:33
OVEN C-23

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			MSP					
15 SEC				MFP		MFP		
30 SEC				MF		MF		
45 SEC								
1 MIN						F↓		
1 MIN 15 SEC		LP			MS			
1 MIN. 30 SEC								
1 MIN 45 SEC								
2 MIN								
2 MIN. 15 SEC								
2 MIN 30 SEC								
2 MIN 45 SEC								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:42							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS Good negative aspiration observed on number two and number three drop sleeves, fire was being drawn in. Drop sleeve alignment appears to be better the first time they are lowered rather than the second time.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY: National Steel
PLANT: Weirton Steel
BATTERY: Brown's Island

DATE: 3/26/74
TIME: 4:02
OVEN: A-25

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE								
15 SEC		F		F		F		
30 SEC.		F		F		F		
45 SEC.		F		F		F		F
1 MIN.		F		F		F		F
1 MIN. 15 SEC.		F		F		F		F
1 MIN. 30 SEC.		F		F		F		F
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	Not Recorded							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER:

MANUAL GAS

REMARKS. First charge of new shift, suction appeared to be malfunctioning, although the lid man disagreed. Much more fire than usual in the drop sleeves.

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/26/74
TIME 4:19
OVEN B-25

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE								
15 SEC		MFP		MFP		MFP		
30 SEC		L↓FP		L↓FP		L↓FP		
45 SEC								
1 MIN				F↓		F↓		
1 MIN 15 SEC			LS		MS			
1 MIN 30 SEC								
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC								
2 MIN 45 SEC.								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:39							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS Good charge.

MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY: National Steel
PLANT: Weirton Steel
BATTERY: Brown's Island

DATE 3/26/74
TIME. 4:34
OVEN C-25

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			MSP					
15 SEC.				FP		FP		F↓
30 SEC.		F↓		LFP		LFP		
45 SEC				F↓		F↓		
1 MIN						F		
1 MIN. 15 SEC.				MP				
1 MIN. 30 SEC		L		F	L	F		
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:39							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER.

MANUAL GAS

REMARKS.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/27/74
TIME 3:34
OVEN A-25

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			MSP					
15 SEC				LFP		LFP		
30 SEC				L↓FP		L↓FP		
45 SEC				FP		FP		
1 MIN		M		F		F		
1 MIN 15 SEC	HP		MS		MS			
1 MIN 30 SEC								
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:40							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS Coke side ascension pipe lid failed to close. Lid man closed it manually.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE. 3/27/74
TIME: 3:43
OVEN· B-25

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			MSP	M↑				
15 SEC.		M		MFP		MFP		
30 SEC.		MFP		MFP		MFP		
45 SEC.		F↓		M↑FP		M↑P		
1 MIN		LFP		LFP		LFP		
1 MIN. 15 SEC.			MS		MS		L	
1 MIN. 30 SEC.				FP		FP		
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:42							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER.

MANUAL GAS

REMARKS: More smoke than usual at the beginning of the charge. Smoke especially heavy on drop sleeves one, two, and three. Charge seemed normal toward the end.

THE MITRE
MCF 2495 12/73

RWB
OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE 3/27/74
TIME 4:06
OVEN C-25

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			MSP					
15 SEC				MF		MF		L
30 SEC		L		L↑FP		L↑FP		
45 SEC				LF		LF		
1 MIN		M		F		F		
1 MIN 15 SEC				F		F		
1 MIN 30 SEC								
1 MIN 45 SEC								
2 MIN								
2 MIN 15 SEC								
2 MIN 30 SEC								
2 MIN 45 SEC								
3 MIN								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:41							

↑ = INCREASING ↓ DECREASING → CHANGING TO
S = STACK HP = HOPPER F = FIRE
L = LIGHT FLOW M = MEDIUM FLOW H = HEAVY FLOW
BL = BLACK Y = YELLOW P = PUFFY

WEATHER

MANUAL GAS

REMARKS It appeared that all hoppers and stacks puffed back at the end of the charge.

THE MITRE
MCF 2495 12/73

OBSERVER

LARRY CAR OBSERVATION LOG

COMPANY National Steel
PLANT Weirton Steel
BATTERY Brown's Island

DATE. 3/28/74
TIME: 2:54
OVEN A-27

	PUSHER SIDE		CENTER		CENTER		COKE SIDE	
	1		2		3		4	
	HOPPER	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER/ STACK	DROP SLEEVE	HOPPER	DROP SLEEVE
CHARGE			MSP					
15 SEC.				L↑		L		
30 SEC.				MF		LF		
45 SEC				LFP		LFP		
1 MIN.		F		LF		LF		
1 MIN 15 SEC.			MS		MS			
1 MIN. 30 SEC.			-					
1 MIN. 45 SEC.								
2 MIN.								
2 MIN. 15 SEC.								
2 MIN. 30 SEC.								
2 MIN. 45 SEC.								
3 MIN.								
END OF CHARGE								
LID REPLACED								
TOTAL CHARGING TIME	1:38							

↑ - INCREASING ↓ DECREASING → CHANGING TO
S - STACK HP - HOPPER F - FIRE
L - LIGHT FLOW M - MEDIUM FLOW H - HEAVY FLOW
BL - BLACK Y - YELLOW P - PUFFY

WEATHER:

MANUAL GAS

REMARKS: Sleeve up to lid at eight seconds. Eight to nine seconds to rotate.

THE MITRE
MCF 2495 12/73

OBSERVER

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-650/2-74-062-a	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Coke Oven Charging Emission Control Test Program--Supplemental Observations		5. REPORT DATE September 1974
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) R.W. Bee and R.W. Spewak		8. PERFORMING ORGANIZATION REPORT NO. MTR-6684
9. PERFORMING ORGANIZATION NAME AND ADDRESS The Mitre Corporation, Westgate Research Park, McLean, Virginia 22101		10. PROGRAM ELEMENT NO. 1AB013; ROAP 21AFF-004
		11. CONTRACT/GRANT NO. 68-02-0650
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development, NERC-RTP, Control Systems Laboratory, Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Supplemental; 3-4/74
		14. SPONSORING AGENCY CODE
15. SUPPLEMENTARY NOTES		

16. ABSTRACT The report compares operational information for two coke charging cars operating to reduce charging emissions from the Brown's Island battery of National Steel's Weirton Steel Division with that for a larry car developed jointly by the American Iron and Steel Institute (AISI) and the U.S. EPA. A direct comparison is made in areas where similarities between the two designs are strong; in areas with contrasting features or procedures, their success is reported relative to design intent and EPA objectives. Both designs have had reasonably good success both in automation of oven controls and in improving operator environment. Both represent substantial improvements in emission control: although the AISI/EPA car appears to be more capable of sealing emissions during the charge, it is less consistent than the Weirton car in overall emission control. Facts presented by the report originated in three areas: a desciption of the Weirton coking system, including oven configuration, larry car operation, and general coke oven charging procedures; observation of the two Weirton larry cars during coal charging operation; and interviews with coke plant personnel responsible for operating the larry cars.

17 KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution	Air Pollution Control	13B
Iron and Steel Industry	Stationary Sources	11F
Coke	Emission Observations	21D
Metallurgical Fuels	Operability Assessment	
Coking	Larry Car	11H
Charging		

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