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# Project Summary

# Emission Testing and Evaluation of the Enclosed Coke Pushing and Quenching System

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**A new coke battery was placed into operation in May 1973 by National Steel Corporation's Weirton Steel Division. Consisting of 87 ovens, each 6 m tall, this battery included features to reduce environmental discharges from coke pushing and quenching operations. Pushing emissions were to be contained by a one-spot coke receiver car and retractable coke guide hood evacuated through a fan-scrubber system on the traction drive car. The hot coke would then be discharged from the receiver car into below-track hoppers from which it was withdrawn and quenched semicontinuously in vibrating conveyors. From the outset, operability of the system was severely reduced by erosion, corrosion, and oxidation of coke handling components and the presence of explosive gas mixtures, especially in the quenching facilities. Extensive efforts were made to resolve these problems. The quench system is currently shut down; alternative facilities are being explored. Emission measurements in the pushing control scrubber exhaust averaged 224 mg/Nm$^3$ (18 g/Mg coke). Operating costs were documented to be $1.23/short ton for the pushing system and $4.58/short ton for the quenching system. These costs are estimated to be 26 and 280 percent, respectively, higher than for conventional uncontrolled coke pushing and baffled quench tower installations.**

***This Project Summary was developed by EPA's Industrial Environmental Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).***

## Introduction

In May 1973, National Steel Corporation's Weirton Steel Division completed the construction of a new coke plant on Brown's Island, at Mile Point 62 on the Ohio River near Weirton, WV. The coke battery consists of 87 ovens, each 6 m tall, with a design coke production rate of approximately 2900 metric tons (3200 short tons)/day. This coke plant features highly advanced production and environmental control facilities. One very significant feature of the coke plant involved the development of new technology for the control of emissions from the coke pushing and quenching operations.

In 1972, Weirton Steel entered into the first of two jointly funded research and development contracts with the EPA for developing an enclosed coke pushing and quenching system. This technology, designed and constructed by Weirton Steel and Koppers Company with the support and cooperation of the EPA, provides for the total enclosure of the coke during the pushing, transfer, and quenching operations. Scrubbers and mist eliminators are used to minimize the particulate emissions from these operations.

EPA contract 68-02-0622, executed in early 1972, covered the design and construction of this system. This contract concluded with the issuance of a design manual.* EPA contract 68-02-1347,

(*) Pengidore, D.A. Enclosed Coke Pushing and Quenching System Design Manual, EPA-650/2-73-028 (NTIS PB 226418), September 1973.

"Emission Testing and Evaluation of the Enclosed Coke Pushing and Quenching System," was executed in June 1973. The purpose of this contract was to document the system's emission control capability, reliability, and operating cost over a 12-month period of performance.

Unfortunately, numerous problems have prevented the continuous operation of this system. These problems have necessitated the complete re-design and replacement of many major components within the system and have resulted in lengthy delays during which the system was inoperative. Programs, costing several million dollars, have been implemented by National Steel to improve the operability of the system between 1973 and 1980. Although significant progress has been made in this regard, continuous operation has still not been achieved due to potential explosive hazards associated with the system.

This report was submitted to the EPA in fulfillment of Contract 68-02-1347. It documents the design of the system after the completion of National Steel's multi-million dollar optimization programs and describes the problems which were encountered. In addition, an analysis of the environmental, energy, and economic aspects of the system is presented. This work was completed as of December 1980.

## Conclusions

The enclosed coke pushing and quenching system demonstration was a full-scale research and development program. Although the program was not totally successful, the technological benefits derived by others from this demonstration cannot be over-emphasized. As a forerunner in the development of enclosed coke pushing and quenching technology in the U.S., this program has influenced subsequent designs by others who learned from the early successes and failures at Weirton Steel.

The enclosed pushing emissions control system is a viable technology which has the ability to comply with reasonably available control technology (RACT) and proposed lowest available emission rate (LAER) standards applicable to the Brown's Island Plant. The maintenance requirements associated with this mobile system are significant, but acceptable. The operating cost for this mobile system is estimated to be $1.35 per metric ton ($1.23 per short ton), which is approximately 26 percent higher than a conventional uncontrolled system. Further modifications are required to eliminate the potential explosive hazard associated with the gas cleaning car. This may be best accomplished via the expansion of gas cleaning car fan capacity and improvements to the battery refractory and heating systems to minimize undercarbonized coke. A major disadvantage of this mobile system is its present reliance on a refractory-lined transfer car which dictates use of an underground continuous quenching system. Consideration is being given to replacing the refractory-lined transfer car with a quench car that is compatible with aboveground quenching facilities.

The anticipated advantage of the underground continuous quenching system was the opportunity for improved control of coke moisture and steam emissions during the quenching operation. Improved control of coke moisture was not achieved by this installation; in the opinion of National Steel, the control of steam emissions became an academic point since, given clean water for quenching, adequate control can be achieved by the installation of mist suppressors in conventional quench towers. The operating cost for the underground quencher is estimated to be $5.05 per metric ton ($4.58 per short ton), an increase of 280 percent above the operating cost of a conventional quench tower. This cost is excessive, not justified by any benefits derived from this technology. The operating experience at Weirton cannot lead to the recommendation that this technology be installed elsewhere; Weirton is considering replacing the underground quencher with an aboveground quenching tower.

The enclosed coke pushing and quenching system demonstration exemplifies the fact that, in many cases, pollution control technology with the capability of high operability and reliability at an adequate particulate removal efficiency is more environmentally effective than technology that operates at low operability and reliability, but with an ultrahigh particulate removal efficiency. Weirton is dedicating future efforts to developing lower cost technology which can achieve adequate emission control and demonstrate the high degree of reliability required for continuous operation. One technology under development at Weirton is the Two-Step Quenching (TSQ) System for pushing emissions control.

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*The complete report, entitled "Emission Testing and Evaluation of the Enclosed Coke Pushing and Quenching System," (Order No. PB 83-206 953; Cost: $13.00, subject to change) will be available only from:*
*National Technical Information Service*
*5285 Port Royal Road*
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