ILLINOIS POLLUTION CONTROL BOARD
January 19, 1978

IN THE MATTER OF:	)	
	)	
PROPOSED AMENDMENTS TO RULE 207(a) (4-5) AIR POLLUTION CONTROL REGULATIONS	)	R75-10

OPINION AND PROPOSED ORDER OF THE BOARD (by Dr. Satchell):

This regulatory proposal was filed on July 2, 1975 by the Southern Illinois Power Cooperative (SIPC); an accompanying statement of reasons was filed August 13, 1975. The original petition included the requisite 200 signatures needed for authorization for hearing under Procedural Rule 204. The proposal requested additional language be added to Rule 207(a) (4-5) of the Chapter 2: Air Pollution Control Regulations (Chapter 2) which would exempt from the nitrogen oxide emission standards facilities burning lignite or a solid fossil fuel containing 25% by weight or more of coal refuse in combination with gaseous, liquid or other solid fuel.

The language of the change of Rule 207(a) (4-5) of Chapter 2 as proposed by SIPC is as follows:

(4) for solid fossil fuel firing, 0.7 pounds per million btu of actual heat input, except lignite or a solid fossil fuel containing 25% by weight or more of coal refuse; and

(5) for fuel combustion emission sources burning simultaneously any combination of solid, liquid and gaseous fossil fuels an allowable emission rate shall be determined by the following equation:

$$E = \left(\frac{0.3\ (P_g + P_i) + 0.7\ (P_s)}{P_g + P_i + P_s} \right) Q$$

where: E = allowable nitrogen oxides emission rate in pounds per hour;

P_g = per cent of actual heat input derived from gaseous fossil fuel;

P_i = per cent of actual heat input derived from liquid fossil fuel;

P_s = per cent of actual heat input derived from solid fossil fuel, (except lignite or a solid fossil fuel containing 25% by weight or more of coal refuse;)

Q = actual heat input derived from all fossil fuels in million btu per hour.

Note: $P_i + P_s + P_g = 100.0$

(6) When lignite or a solid fossil fuel containing 25% by weight or more of coal refuse is burned in combination with gaseous, liquid or other solid fossil fuel, the standard for nitrogen oxides does not apply.

The proposal was published in Environmental Register #110, September 25, 1975. Hearings were held on December 8, 1976 in Carbondale, Illinois and on December 9, 1976 in Springfield, Illinois to hear testimony and comments on the proposal. Economic impact hearings were held pursuant to Section 6 of the Environmental Protection Act (Act) on February 23, 1977 in Carbondale, Illinois and February 24, 1977 in Springfield, Illinois. The economic impact study is IIEQ Document #76-26.

The purpose of this change is to allow SIPC to burn coal refuse from gob piles, refuse piles, and slurry deposits in combination with coal in a cyclone furnace. This would allow savings on fuel and would clean up some of the unwanted coal refuse present in southern Illinois as a result of mining activities. This change has already been made in USEPA's Standards of Performance for New Stationary Sources, 40 Fed. Reg. 2803 (1975). This change as stated in the Federal Register was made for purposes of clarification of the application of standards and is expected to apply only to one source.

On two prior occasions the amount of NO_x emissions from SIPC's electric power generating facility on the Lake of Egypt has been before the Board. In both cases, Southern Illinois Power Cooperative v. E.P.A., PCB 75-352, 19 PCB 255 (1975) and Southern Illinois Power Cooperative v. E.P.A. PCB 76-216, 24 PCB 343 (1976), the Board granted variances to SIPC pending the resolution of this regulatory proceeding.

The petition for regulatory change was signed by four petitioners, Southern Illinois Power Cooperative, Egyptian Electric Cooperative Association, Southeastern Illinois Electric Cooperative and Southern Illinois Electric Cooperative. SIPC owns and operates an electric generating plant at the Lake of Egypt in Williamson County, Illinois. The other three petitioners are distribution cooperatives and distribute the electricity

generated by SIPC throughout the rural areas of the southern one-third of the State.

Currently SIPC has three cyclone furnace boilers operating with electrostatic precipitators, each is a 33 megawatt (MW) unit (R. 7, Ex. 2). These units have been in existence since the plant was constructed. A fourth unit is now being built with a rated capacity from 160 to 170 MW (R. 7). This unit will also be a cyclone furnace boiler with an electrostatic precipitator (Ex. 2). The unit is being built to allow the use of a blend of coal and no less than twenty-five per cent coal refuse (R. 17, Ex. 3). The purpose of using the coal refuse is several fold: First, burning the refuse provides low cost electricity; the price of the coal refuse is roughly one-third the price of good coal which results in a lower cost for generating the electricity (R. 16). The coal with which the refuse is mixed costs (at the time of hearing) $18.00 a ton f.o.b. the plant (R. 41). SIPC in 1975 paid $5.50 per ton for refuse of 9,000 btu (R. 41). A premium was paid for higher btu and a deduction was made for lower btu (R. 41). The refuse SIPC has been using has come from 20 to 30 miles from the plant (R. 40). Removing the refuse would also clean up numerous coal refuse or gob piles that are now scattered throughout southern Illinois (R. 6). Not only will this removal improve the area esthetically but as pointed out by the Environmental Protection Agency (Agency) this removal will help reduce acid runoff pollution of streams and lakes (R. 103). Also, as pointed out in PCB 75-352, use of the refuse will use energy that would otherwise not be used.

Refuse piles can contain very high quality coal; for example, "steam coal" was mined for use in locomotives and all the fines were dumped (R. 35). Some of the "chemical coal" refuse has a btu value per pound as high as 12,000 (R. 40).

Refuse piles present a hazard other than possible contribution to water pollution. Under specific conditions they may burn without obvious surface manifestations and people, livestock and other animals may fall into the burning zone (R. 9). In removing the refuse, mining permits will be required. Reexposure of the lower zones of the piles may permit oxidation of reduced sulfur and contribute to acid drainage (R. 109).

Rule 207(4) as it now reads would require that the new unit of SIPC meet the standard of 0.7 pounds per million btu of actual heat input. Coal refuse mixed with coal cannot successfully be burned as a fuel in pulverized coal furnace boilers (R. 103). The Agency pointed out that if pulverized coal furnace boilers could burn coal refuse, the new source performance standard of 0.7 pounds of NO_x per million btu could be met (R. 103). Coal refuse mixed with coal can only be successfully burned in cyclone furnace boilers which, because of higher operating temperatures within the furnaces, are unable to meet the 0.7 pounds per million btu standard (R. 103, 104).

SIPC expects to burn from 25 to 40 per cent refuse coal in their blend (R. 61). Emission tests were run by Burns and McDonnell for SIPC using various mixtures of gob refuse and coal (R. 54). These tests were witnessed by Mr. Don Goodwin and Mr. Robert Walsh from USEPA. The first four tests were run with 25% coal and 75% gob refuse (only nitrogen oxides emitted were determined): No. 1 - discarded, results low-probably because of low absorption time; No. 2 - 0.737 lbs. $NO_2/10^6$btu; No. 3 - 1.171 lbs. $NO_2/10^6$btu; and No. 4 - 1.162 lbs. $NO_2/10^6$btu. The next tests (5 and 6) were run using a 50/50 mixture and gave the following emission values of $NO_2/10^6$btu: 5 - 1.193 and 6 - 0.973 (R. 54-57).

SIPC has run tests using 100% refuse coal, but states it becomes dangerous to handle because it is wet and sticky (R. 60) Also refuse coal is lower in volatiles (3 to 5 per cent) than regular coal and therefore requires a higher temperature to keep it lit (R. 75).

From these tests it is noted that NO_x emissions do not increase significantly with increasing use of coal refuse; rather it is the higher temperatures needed that appear to cause the increase.

Implicit in a rule change is the assumption that control methods are not available. Technology to control NO_x from utility boilers involves two basic approaches: (1) techniques to modify the combustion process, and (2) processes which remove NO_x from the combustion products.

Current technology falls in the first category above and involves: (1) low excess air firing, (2) two stage combustion, (3) Flue gas recirculation and (4) furnace design modification (R. 150-151). SIPC uses the first technology (low excess air firing) which probably explains the values of NO_x emission obtained in the tests (about 1.05) compared to predicted values of 1.2 to 1.6 lbs. of $NO_x/10^6$btu (R. 149). The two stage combustion has been the most successful with up to 50 per cent reduction for coal firing in some type units. It is the only currently available effective means of lowering coal-fired NO_x emissions (R. 151-152). This method has not been applicable to cyclone type furnaces because of the furnace configuration (R. 152).

Other experimental stage technologies show promise. For example, gas phase reduction of NO_x by injecting small quantities of ammonia into product gases at temperatures of 1300 to 2000°F has reduced NO_x by 90 per cent (R. 151).

Testimony was given that many of the processes which remove SO_2 also tend to remove NO_x (R. 174). The new unit (Unit 4)will be equipped with a limestone scrubber supplied by Babcock and Wilcox. It is called a "TCA" system which was believed to stand for "Turbulent Contact Adsorbant" (R. 201). Dr. Kenneth Noll made estimates of NO_x removal of 30 to 60 per cent for this site by the SO_2 scrubber with a good probability that at least 30 per cent would be removed (R. 181-182). By using low excess

air (test results slightly over 1.0 lbs. $NO_x/10^6$btu) and with a NO_x removal of about one-third by the SO_2 scrubber, SIPC's Unit 4 should be operating at or very near the 0.7 lbs. $NO_x/10^6$btu emission requirement for new coal fired sources.

The Agency performed a modeling study at SIPC's site to determine the impact on air quality that would be caused by NO_2 emissions from the additional fourth unit. The results of this study were specifically limited to this site by the Agency (R. 104). The result of the study was a showing of minimal impact upon ambient NO_2 air quality near the site (R. 104). Two simulations were performed. The first simulation was run using stack emissions data supplied by SIPC. The second simulation utilized theoretical maximum stack emission rates which the Agency computed, based on emission factors, to represent the most conservative conditions. Conservative conditions would be associated with the highest ambient NO_2 levels (R. 104).

The three existing units, according to the modeling, would contribute a maximum concentration of 8 micrograms per cubic meter (R. 105). Adding the fourth unit to the first three produces a predicted maximum concentration of 9 micrograms per cubic meter (R. 105). The ambient NO_2 air quality in the region, according to the Agency's 1975 Annual Air Quality Report, is 22 micrograms per cubic meter (R. 105). Thus the maximum NO_2 concentration, taking into account all four units and the ambient air quality, is 31 micrograms per cubic meter (R. 105). The national health related standard is 100 micrograms per cubic meter of NO_2. The 31 ug/m^3 of NO_2 is substantially below the health related figure.

The Agency agreed (R. 171-172) with Dr. Kenneth Noll's statement made at the first Economic Impact Hearing that it would be difficult to establish a damage function for either the background or the elevated NO_x level since both are below the level at which a damage response to humans or the natural environment can be measured with presently available methods (R. 150).

The economic impact of the regulation is essentially all positive. In addition to the aforementioned benefits of refuse coal removal to the environment, at $3.50 per ton of refuse coal an annual fuel cost saving of 1.6 million dollars is anticipated (R. 153).

The economic impact study was done by Dr. Kenneth Noll, Air Resources Engineering consultant, and was published as "Technical and Economic Evaluation of NO_x Control for Coal-Fired Cyclone Furnaces", IIEQ Document No. 76-26.

The Agency does not oppose this rule change to allow SIPC to burn coal refuse; however, the Agency did make three specific recommendations: first, that a definition of coal refuse be included as part of Chapter 2; second, that all the references to lignite be removed; and third, that the proposal be made site specific.

The Agency proposed that a definition be added to Rule 201 of Chapter 2: Air Pollution Control Regulations. The definition proposed by the Agency is the same as that used in Chapter 4: Mine Related Pollution with deletions of reference to other than coal mining. The Agency proposed definition reads:

> Coal refuse: Gob, coal, rock, slate, shale, mill tailings and other sludge or slurry material intended to be discarded, which is connected with the cleaning, screening and preparation of mined coal.

The Board agrees that a definition of coal refuse is desirable. The definition used by USEPA (R. 122, 40 Fed. Reg. 2803 (1975)) states:

> "Coal refuse" means waste products of coal mining, cleaning and coal preparation operations (e.g. culm, gob, etc.) containing coal, matrix material, clay and other organic or inorganic material.

The Board finds that the second definition (absent the examples of culm, gob, etc.) is simpler and more precise. The regulation proponents had no objection to either definition.

The proposal before the Board tracks the language used by USEPA which includes lignite. SIPC indicated that this inclusion was for power companies in North Dakota and South Dakota and not at the request of SIPC (R. 24). To burn the lignite the cyclone furnace must be designed for that purpose (R. 24, 25). There are no lignite deposits in Illinois (R. 107). Considering these facts there appears to be no need for lignite to be included in the language of the regulation.

The Agency recommended that the proposal be made site specific. The proponents do not oppose this modification. The evidence presented by SIPC in support of this regulation referred only to the effects of the change in the vicinity of the Lake of Egypt. The Agency's modeling study is applicable only to SIPC's facility. The economic impact study was also site specific (R. 179). The testimony further indicates that it is probably not feasible for others to use this same process. Trucking more than 50 miles makes the use of refuse uneconomical (R. 27). Since only "dry" refuse coal can be accepted, a separate large bunker is required (R. 47). In addition, dual fuel mixing methods must be used (R. 80-81). Provisions to accept both rail and truck shipments are necessary. Coal refuse mixed with coal cannot successfully be burned in pulverized coal furnace boilers, and can only be successfully burned in cyclone furnace boilers (R. 103-104). Because of the many site specific aspects of this proceeding the Board sees no problem with adopting the regulation as limited to the site of SIPC's Lake of Egypt plant.

PROPOSED ORDER

It is the order of the Board that:

1. The following definition for "Coal Refuse" be added to Rule 201, of the Board's Chapter 2: Air Pollution Control Regulations:

> Coal Refuse: Waste products of coal mining, cleaning and coal preparation operations containing coal, matrix material, clay and other organic and inorganic material.

2. Rule 207(a) (4-5) of the Board's Chapter 2: Air Pollution Control Regulations shall be amended to read as follows:

> (4) for solid fossil fuel firing, 0.7 pounds per million btu of actual heat input except the standard for nitrogen oxides does not apply when solid fossil fuel containing 25% by weight or more of coal refuse is burned in Southern Illinois Power Cooperative's Unit No. 4 at its Lake of Egypt Power Plant; and
>
> (5) for fuel emission sources burning simultaneously any combination of solid, liquid and gaseous fossil fuels,
>
> (A) an allowable emission rate shall be determined by the following equation:

$$E = \left(\frac{0.3(P_g + P_i) + 0.7(P_s)}{P_g + P_i + P_s} \right) Q$$

where:

E = allowable nitrogen oxides emission rate in pounds per hour,

P_g = per cent of actual heat input derived from gaseous fossil fuel,

P_i = per cent of actual heat input derived from liquid fossil fuel,

P_s = per cent of actual heat input derived from solid fossil fuel, and

Q = actual heat input derived from all

fossil fuels in million btu per hour.

Note: $P_i + P_s + P_g = 100.0$

(B) the standard for nitrogen oxides does not apply when solid fossil fuel containing 25% by weight or more of coal refuse is burned in combination with gaseous, liquid or other solid fossil fuel in Southern Illinois Power Cooperative's Unit No. 4 at its Lake of Egypt Power Plant.

I, Christan L. Moffett, Clerk of the Illinois Pollution Control Board, hereby certify the above Order was adopted on the 19th day of January, 1978 by a vote of 5-0.

Christan L. Moffett

Christan L. Moffett, Clerk
Illinois Pollution Control Board