

ILLINOIS POLLUTION CONTROL BOARD
October 4, 1973

ENVIRONMENTAL PROTECTION AGENCY)	
)	
v.)	#72-491
)	
COMMONWEALTH EDISON COMPANY)	
(WAUKEGAN STATION))	
ENVIRONMENTAL PROTECTION AGENCY)	
)	
v.)	#72-492
)	
COMMONWEALTH EDISON COMPANY)	
(SABROOKE STATION))	
COMMONWEALTH EDISON COMPANY)	
)	
v.)	#73-40
)	
ENVIRONMENTAL PROTECTION AGENCY)	
(WAUKEGAN STATION, SABROOKE STATION))	

Charles Whalen and Richard Powell of Isham, Lincoln & Beale, appeared on behalf of Commonwealth Edison Company; Nicholas Dozoryst and Kenneth J. Gumbiner, Assistant Attorneys General, appeared on behalf of Environmental Protection Agency.

OPINION AND ORDER OF THE BOARD (by Mr. Dumelle):

On August 8, 1972, pursuant to variance request filed by Commonwealth Edison Company with respect to the above-captioned stations, we entered our Order denying the variances sought, without prejudice. The gravaman of both variance requests was essentially that petitioner should be granted variances from the relevant particulate regulations applicable to the two plants because petitioner's sulphur coal had resulted in the increase of particulate abatement equipment consequential to such low sulphur coal use. (#72-150, 5 PCB 101).

While commending petitioner for its efforts to achieve compliance with the sulphur emission limits by the critical date, namely, May 30, 1975, we concluded that the record does not sufficiently substantiate petitioner's contentions that the use of low sulphur coal resulted in the deficiencies ascribed in particulate collection necessitating the variances sought.

In denying the petition, as to Sabrooke, we observed:

"In short, Edison failed to establish that its present particulate problems at Sabrooke are the necessary result of its commendable effort to reduce emissions of sulfur dioxide. For all we know, as Edison's witness testified (R. 543), Sabrooke has been in violation of the particulate standards all along. If it has been, the recent use of low-sulphur coal cannot excuse earlier violations. While we think Edison would be well advised to proceed posthaste with its plan of conversion to oil, which on this record affords the best and quickest assurance of long-term reduction of both sulfur and particulates (R. 520), we are not convinced from this record that Edison has been doing all it could to keep particulates down in the meantime, or that its present emissions are excusable. The variance request for Sabrooke must be denied without prejudice."

With respect to the denial of the variance for the Waukegan plant, we stated as follows:

"As stated in the introduction to this opinion, we encourage Edison to continue its work with additives to improve electrostatic collection of particulates from low-sulfur coal, and upon adequate proof of necessity we would look favorable upon a limited variance request to shield the activity from possible penalties. However, we do not find satisfactory proof of that necessity in the present record. The predicted emissions from units 6, 7, and 8 are not based upon tests of those or comparable units burning low-sulfur coal (R. 383). They are illustrated by, or based upon, what an Edison witness described as a 'typical curve attempting to predict the behavior of precipitator efficiency with changing sulfur levels,' which he characterized as showing a very rapid deterioration in efficiency when sulfur content falls below 1.5% (R. 133-34; Ex. 23). No attempt was made to substantiate this curve, but it was reportedly based on 'data' supplied by Research Cottrell in 1962 (R. 162-163). We have no way of knowing what these 'data' are, or when, where, and how they were obtained. Indeed, Edison's witness specifically denied that he had any firm information as to the effect of low sulfur coal upon precipitator efficiency."

In denying the variances, we further observed that there was no issue of shutting down the plants involved, but rather on the state of the record, we did not feel justified in granting petitioner the dual elements of protection inherent in a variance, namely, the shield from prosecution for violations of the applicable regulations and a license for continuing pollution pending prospective efforts to achieve compliance.

On December 14, 1972, complaints were filed by the Agency against Commonwealth Edison relative to both of the foregoing stations. #72-491 was a three count complaint relative to the Waukegan station, alleging that Edison, in the operation of its plant, had emitted smoke, odors, and particulates so as to cause air pollution in violation of Section 9 (a) of the Act and in excess of regulatory limits in violation of Rule 3-3.112 of the Rules and Regulations Governing the Control of Air Pollution (Air Rules), and had discharged smoke, in violation of Ringelmann chart limits, contrary to Rule 3-3.122. The Rule violations were alleged to be violations of Section 9(a) of the Act, as well. The violations are alleged to have been committed between June 10, 1970 and December 11, 1972.

#72-492 was also a three count complaint with respect to the Sabrooke station, alleging that petitioners, in the operation of the plant, caused emission of smoke, odor, and particulate matter into the air pollution, in violation of Section 9(a) of the Act, emitted particulates into the air in violation of Rule 3-3.112 and had failed to obtain an installation permit for several fast start turbine peaking units, in violation of Rule 3-2.100. The violations are alleged to have been committed between July 1, 1970 and December 14, 1972.

On January 30, 1973, Commonwealth Edison filed a new variance petition, again seeking relief from the particulate regulations applicable to both Sabrooke and Waukegan, which variances were allegedly needed as a consequence of the burning of low-sulfur coal and the resulting inefficiencies in particulate collection. Specifically, the variances requested were as follows:

"With respect to the Sabrooke Station, Edison requests a variance from the station and from the unit particulate emissions limitations to permit the continued use of low-sulfur coal:

- (a) In Unit 4, until that unit can be shut down for conversion to oil firing on September 30, 1973.
- (b) In Units 3, 2, and 1, until those units

can be shut down for conversion to oil firing on November 30, 1973, February 28, 1974, and September 30, 1974, respectively, on the condition that in the interim those units will be operated only after all other available Edison capacity (excluding Powerton Units 1 - 4 and the fast-start peaking units) has been placed in service, except that any one of the units may be operated at the minimum level necessary to provide steam for water demineralizing and heating the station, or to prevent stack deterioration.

For the Waukegan station, Edison requests a variance:

- (a) From the station particulate emission limit to allow the use of coal at the station having a sulfur content of less than 3%; and
- (b) From the single stack emission limit of 0.60 lbs/MBtu to allow the operation of Waukegan Unit 5 at loadings above 60 megawatts, and to allow the operation of Waukegan Unit 7 at loadings above 315 megawatts, on the condition that those units will be operated above the limits indicated only after all other available Edison capacity (excluding Sabrooke Units 1 - 3, Powerton Units 1 - 4,¹ and the fast-start peaking units) has been placed in service, except that Waukegan Unit 5 may be operated above the limit indicated when required to remove slag accumulations in its boilers."

Recapitulating the pleadings up to this point, we have an Agency complaint against the Waukegan plant covering 7 turbine generating units powered by coal-fired boilers and 2 fast-start peaking units, each powered by 2 turbojet engines. Complaint against the Sabrooke station relates to 4 turbine generating units each powered by a boiler and 4 General Electric fast-start peaking units, each covered by two turbojet engines. Air pollution

¹The Board ordered Edison to only operate the Powerton Units (above 50% of their rated capacity) as the last units to be placed on line in the Edison system PCB #71-129 and extended the order by law in PCB #72-295.

and particulate violation are alleged in both instances, plus the installation of equipment without a permit at Sabrooke, and Ringlemann violations at Waukegan. The variance petition relates to the 4 base load units at Sabrooke, of which units 1, 2, and 3 are controlled by mechanical precipitators and Unit 4 by electrostatic precipitators. The Waukegan station retired Units 1, 2, and 3 in September, 1972 and 4 baseload units remain in service, designated as Units 5, 6, 7, and 8, respectively.

The variance petition, in seeking relief from the particulate emission limits of Section 2-2.111, 3-3.112, and 3-3.122 of the Air Rules alleges, in substance, the following: the units involved in the petition have an aggregate capacity of 1,092 megawatts. Edison's estimated peak demand for the summer of 1973 is 12,810 megawatts. During the summer of 1972, at least 19.6% of Edison's generating capacity was unavailable one-half of the time. Edison alleges that in view of the known capacity reductions, and increase in low-sulfur coal limitations over past summers, it is probable that Edison will have about 2,600 megawatts unavailable during the current summer. A 14% minimum reserve in generating capacity is deemed necessary. Zion Unit #1, having a capacity of 935 megawatts, is not fully operational due to licensing problems with the Atomic Energy Commission. Edison alleges that the 1,092 megawatts attributable to Sabrooke and Waukegan will be needed to meet its 1973 summer peak load and to perform repairs and maintenance on other units during off peak periods throughout the year in order to avoid increased outages in the future.

As stated above, Sabrooke consists of 4 base loaded units having a total megawatt capacity of 146. Particulate emissions are controlled from Units 1, 2, and 3 by mechanical collectors and #4 by an electrostatic precipitator. Conversion to oil is programmed for each of the four units as follows:

- #1 - September 30, 1974.
- #2 - February 28, 1974.
- #3 - November 30, 1973.
- #4 - September 30, 1973.

The mechanical precipitators were designed to have 95% collection efficiency resulting in 0.14 pounds per million Btu particulate emission, whereas field testing disclosed a collection efficiency no greater than 81% and corresponding increase in particulate emissions, all in excess of the relevant Regulations. No improvement in this collection efficiency was made by the manufacturer.

Subsequent to the entry of our Order in #72-150, Edison

shut down Units 1 and 3 and operated Unit 2 at 1/3 capacity in order to provide steam for demineralizing equipment, station heating and to prevent deterioration of the stack. Since said date, Unit 2 has been operated in excess of 12 megawatts and Units 1 and 3 have been placed in service only when required by demands of the Edison system and then only after fast start peaking units have been placed in service, and withdrawn from service before the peakers, after the peak has occurred. The electrostatic precipitator installed on Unit #4 has a design collection efficiency of 95%. Testing of the precipitator in August of 1972 confirmed that when Illinois coal of relatively high sulfur content (3.4%) was utilized, particulate emissions were within regulatory limits (0.38 pounds per million Btu). When low sulfur coal (0.81%) was burned, particulate emissions increased to 5.57 pounds per million Btu greatly in excess of regulatory limits.

During the years 1969, 1970, and 1971, natural gas had been burned at Sabrooke, approximately between 45% and 60% of the station's generating fuel. Presently, natural gas is not available at the Sabrooke station. Conversion of the 4 Sabrooke units to oil firing is scheduled during 1973 and 1974 as noted above. The station is scheduled for retirement in October of 1980.

With respect to the Waukegan station, units 1, 2, and 3, with total capacities of 101 megawatts, were retired in September of 1972. 4 base load units remain in service as follows:

- Unit 5 - 129 megawatt capacity; to be retired in 1976;
- Unit 6 - 119 megawatt capacity; to be retired in 1982;
- Unit 7 - 250 megawatt capacity; to be retired in 1988;
- Unit 8 - 360 megawatt capacity; to be retired in 1993.

After retirement of Units 1, 2, and 3, duct work modifications took place whereby the gas flow from Unit 5 boilers was divided between the Unit 5 precipitator and the precipitator which had been used for Units 1, 2, and 3. Additional duct work is necessary to balance the gas distribution. Unit 5 has been operating at 60 megawatts or one-half capacity since the Board's earlier decision. Edison represents that anticipated emissions will be within regulatory limits of 0.60 pounds per million Btu. Unit 5 has been operating in excess of 60 megawatts during the conduct of efficiency tests, to remove slag accumulations and during periods of peak demand. Unit 7 is equipped with a Koppers electrostatic precipitator with 98% efficiency collection designed for Illinois coal. Actual collections approximate 95% and average emissions are 0.40 pounds per million Btu when operating at 315 megawatts using high sulfur coal (3.1%). Tests performed December 22, 1972 burning low sulfur coal of 0.48%, resulted in precipitator collection efficiency of

74% and particulate emissions of 1.87 pounds per million Btu, approximately three times the regulatory limit. An additive known as Koppers K was injected in the Unit 7 flue gas to improve precipitator efficiency when low sulfur coal was utilized. However, plugging problems resulted and while the system was redesigned, the process was discontinued because no improvement in precipitator collection efficiency resulted even when the system was operating properly.

Unit 8 is a 360 megawatt unit equipped with a Koppers precipitator with collection design efficiency of 98%, using Illinois coal. Tests conducted in September, 1972, indicated that when low sulfur coal (0.45% and 0.82%) was utilized, collection efficiency dropped to 88% and particulate emissions range from 0.34 to 0.62 pounds per million Btu.

An experimental flue gas efficiency system has been installed in Unit 8 and was scheduled to be in service in May of 1973. This system injects gaseous sulfur trioxide into the flue gas. With respect to both Sabrooke and Waukegan, Edison incorporates by reference, previous testimony in #72-150 relating to ambient air quality and the effect of the two stations thereon.

As above set forth, since the rendition of the Board's decision in #72-150 on August 8, 1972, Edison has limited the operation of Sabrooke's Units 1, 2, and 3, and Waukegan Units 1, 2, and 3 until their retirement in September, 1973, and Waukegan Units 5 and 7 as above-described, except when operation in excess of such limits was necessary for the supplying of steam for demineralization, slag removal, precipitator tests, and when necessary, for system demands and only after fast-start peaking units had been placed in service.

Edison represents that the total capacity of its fast start peakers is 1,726 megawatts or approximately 8% of Edison's total capacity. Oil is used for these units, the supply of which has not been assured in the amounts necessary. Estimated requirements for oil assume further the availability of natural gas for use in such units. However, Northern Illinois Gas has instituted a proceeding seeking to completely curtail its delivery of natural gas to Edison. If such natural gas is curtailed, additional oil will be required for the fast start peaking units.

Edison postulates as follows:

"With the present oil and gas shortage, if the fast-start peakers must be operated before Sabrooke Units 1, 2, and 3, and Waukegan Units 5 and 7 are operated above their current restricted loadings, the capability of the fast start peaking

units may become unavailable because of an inadequate supply of fuel, and service to Edison's customers would have to be curtailed. If the Sabrooke and Waukegan units could be operated above their current restricted loadings prior to using fast start peaking units, oil could be conserved for use when system load demands require the full capability of those units and the peaking units. Use of Sabrooke Units 1, 2, and 3 and Waukegan Units 5 and 7 at full capacity ahead of the fast start peaking units in effect 'saves' an estimated two to four million gallons of oil per month."

Edison concludes that precipitator efficiency tests conducted since the Board's rendition of its August 8, 1972 Order, establish that particulate collection efficiency of electrostatic precipitators is impaired when low sulfur coal is utilized in units designed for high sulfur Illinois coal and that increased particulate emissions from Sabrooke Unit 4 and Waukegan Units 5, 6, 7, and 8 are directly attributable to Edison's efforts to reduce SO₂ emission with the employment of low sulfur coal. Flue gas additives have so far not been successful although experimentation is continuing in this respect as an alternative to back-fitting precipitators or installing sulfur dioxide removal equipment on existing units. Edison further alleges that continued operation of the Sabrooke and Waukegan units, presumably at the rates sought by the variance, would have no adverse impact on the air quality in the Rockford or Waukegan areas, and that the use of low sulfur coal will minimize sulfur dioxide emissions at Sabrooke pending implementation of its conversion program at that station to oil firing and that continued use of low sulfur coal at Waukegan will minimize SO₂ emissions pending further development of flue gas additive systems. Lastly, Edison stresses the need for the 1,092 megawatts capacity provided by Sabrooke and Waukegan to meet the 1973 summer peak loads and to permit repair and maintenance during the balance of the year, obviating the likelihood of increased forced outages. Variances are sought as hereinabove set forth with respect to Sabrooke and Waukegan.

The Agency has recommended that both variances be denied. With respect to Sabrooke, the Agency has tabulated particulate emission data based on operating permit applications, the variance petition and calculations based on the foregoing information.

Particulate emission rates from each unit at Sabrooke are demonstrated to be in excess of allowable rates from factors ranging from 3.9 to 25.7 and the weighted site

particulate emission rate of 3.41 pounds per million Btu is 15.7 times the site standard of 0.217. It disagrees with the assertion that Sabrooke has minimized the use of this station which contention is based on the anticipated coal use for Unit 4. It further observes that poor performance of mechanical collectors on Units 1, 2 and 3 is not attributable to the use of low sulfur coal. The Agency contends that Edison's hardship with respect to this station is self-imposed because the inadequate reserve capacity is attributable to the inadequate capacity of the total system in relation to its current needs and unjustified and long-term reliance on inefficient mechanical collectors which increases in use as demand increases. Lastly, the Agency disputes Edison's allegations of net capacity in the amount of 10,504 megawatts. The Agency recommends that the variance should be denied because of the resulting excessive particulate emissions, the adverse impact on the community resulting therefrom, the fact that the hardship, if any, on the petitioner, is self-imposed, the absence of diligence in seeking emission control, and the absence of relationship between the use of low sulfur coal and mechanical collectors as used in Sabrooke Units 1, 2, and 3.

With respect to the Waukegan station, the Agency also recommends denial, based on essentially the same contentions as applicable to Sabrooke, detailing computed particulate emissions substantially in excess of both single stack 0.60 pounds per million Btu and Site 0.24 pounds per million Btu regulatory limits. Unit 5 is incapable of compliance using either high or low sulfur coal. No time schedule for compliance has been provided in this portion of the variance petition although the operating permit application indicates compliance by February 1, 1976. Unit 6 appears to be capable of compliance although the testing does not indicate in all instances the characteristics of the coal burned. No compliance program has been submitted for this unit, although one has been appended to the operating permit application indicating compliance by February 1, 1977 with respect to particulate emissions, by the use of flue gas injection additives. Unit 7 showed violations when 3.2% sulfur Illinois coal is used on loads in excess of 78% and compliance on lesser loads. Collection efficiencies decreased when low sulfur coal was used and particulate emissions resulted, greatly in excess of the regulations. Again, no compliance program is set forth in the variance petition, although the operating permit application indicates compliance by April 1, 1977. Tests performed on Unit 8 in September, 1972, indicated emissions below 0.1 pounds per million Btu when 2.2% sulfur coal was employed indicating collection efficiencies of 98%. When low sulfur coal (0.45% and 0.82%) was employed at 90% load, emissions equal to 1.03 pounds per million Btu

and collection efficiencies of 88% were disclosed. This emission would be 4 times the 0.24 pounds per million Btu site emission limit. Again, no compliance schedule is indicated, but the operating permit application indicates a compliance program based upon the installation of a sulfur trioxide flue gas conditioning system which will be operative by October, 1973.

Particulate emissions from all Waukegan facilities involved in this variance proceeding are controlled by electrostatic precipitators. As stated in the Agency recommendation, no compliance program for the Waukegan particulate emissions has been specified in the variance petition although the operating permit applications do provide compliance dates. The Agency asserts that Edison's decision to use low sulfur coal has resulted in the increased particulate emissions consequential to the decreasing efficiency of the electrostatic precipitator and that this is a self-imposed hardship. In addition, the Agency asserts that the particulate emissions from the Waukegan station have contributed significantly to the poor ambient air quality in the Waukegan area. The Agency recommends that the variance be denied, or if allowed, be granted only for Unit 8 premised on the installation of a sulfur trioxide flue gas system and the submission of a compliance program covering Units 6 and 7 to be completed within 16 months and subject to the posting of a performance bond.

By order of the Board, the enforcement and variance proceedings were consolidated for each station, respectively. Extensive hearings were held in both Waukegan and Rockford. We will consider the enforcement and variance requests as related to each plant, respectively. Notwithstanding the severance of the variance petition and the consolidation of its component parts with the enforcement proceeding respecting Sabrooke and Waukegan, the matter was considered as a single consolidated action and much of the material developed, particularly with respect to Edison's total system and its pervasive fuel and pollution control problems were applicable to both proceedings. Edison's case in chief in support of its petition and in defense of the enforcement actions did develop testimony, lacking in the earlier proceeding (#72-150) that there was a definite correlation between the use of low sulfur coal, burned to decrease SO₂ emissions and the consequential decrease of inefficiency of electrostatic precipitators in abating particulate emissions. (Fancher Ex. 9 - 10, Commonwealth Edison Exhibits 32, 33, 34, and 35.) Electrostatic collection is affected because low sulfur results in high particle resistivity, a phenomenon not relevant to mechanical collection. Accordingly, we are capable of finding, based on the present record which finding

was not supported by the earlier record that increased particulate emissions from Sabrooke Unit 4 and Waukegan Units 5, 6, 7, and 8 are attributable to Edison's use of low sulfur coal burned to reduce sulfur dioxide emissions.

Edison also contends that Sabrooke Units 1, 2, and 3, and Waukegan Units 5 and 7 have been restricted to the extent possible to limit excessive particulate emissions and that any further diminution would result in the interruption of customer service. The present record has incorporated by reference the record in #72-150, which substantiates the demonstrated need for availability of the Waukegan and Sabrooke facility to assure adequate electrical output during periods of peak demand, adequate service notwithstanding outage conditions and to enable ongoing maintenance and repair during both peak and normal service demands periods. The present record supports these contentions (R. 13, 5/14; R. 187, 5/15; R. 20-26, 5/14; R. 193-197, 5/15), absent the production from the Zion unit. However, there is discussion of the effect of Zion on the output of the Edison system in the record (R.12, 5/14). The witness discusses an agreement that might allow the operation of Zion at approximately 50% capacity.

The issue is whether Edison's past performance exonerates it from the imposition of penalties, and secondly, whether what has been done and will be done prospectively by way of abatement is of sufficient degree and magnitude to justify the granting of variances to permit such installation and modification and at the same time, shield the company against the imposition of penalties for future violations. We do not fault Edison for its shift to low sulfur fuels notwithstanding the fact that such shift appears to have resulted in an increase in particulate emissions. The shift to low sulfur fuels is in direct response to the imposition of both Federal and State sulfur dioxide standards, which presumably will be achieved by the May 30, 1975 date, by the use of low sulfur fuel or the installation of such equipment as is necessary to meet the SO₂ standards. Furthermore, we do not believe the Company is compelled to search for optimum fuel which will have both low sulfur attributes and low particulate potential. The problem of both the utility and the Board is to develop not an optimum fuel, but an optimum system, which will permit the continued use of the utility's facility in the generation of power to service the northern Illinois community and at the same time, assure a program that will enable achievement of the air contaminant emission standards applicable not only to sulfur dioxide but particulates as well.

The record indicates that Edison has embarked on efforts,

not successful to this point, to rehabilitate the precipitators to their requisite efficiency when low sulfur coal has been used. In addition, sulfur dioxide reduction systems have been employed at other stations within the system. The Sabrooke station, until recently, had been fueled by natural gas (R. 83-84, May 30). Units 1, 2, and 3 are serviced with mechanical collectors which, of course, are not affected by the interrelation of low sulfur coal and high particulate emissions (R. 451, May 17). Unit 4 is serviced by an electrostatic precipitator where such interrelation does maintain. Sabrooke's units 1, 2, and 3 have spreader stoker boilers and were originally equipped with 92.5% mechanical multiclone collectors to which spirocones were added, increasing design collection efficiency to 95%. (R.3, 5/30). Fly ash reinjection was eliminated in 1971. However, collection efficiency tests conducted on the mechanical collectors demonstrated efficiency of not more than 81% and resulted in emission rates in violation of the Regulations. No modifications were suggested by the manufacturer that would bring the equipment to its designed efficiency of 95% (R.4, 5/30). As a result, subsequent to the Board's August 8, 1972 Order, restrictions were imposed on Units 1, 2, and 3 restricting the capacity of Unit 2 generally to 12 megawatts and restricting operation of Units 1 and 3 to periods when needed by system demands and only when fast start peaking units were in service (R.5, 5/30).

Sabrooke Unit 4 has a pulverized coal dry bottom furnace equipped with an electrostatic precipitator with a design capacity of 95%. Testing in October of 1971 indicated that when low sulfur coal was burned, collection efficiency decreased to approximately 60% (R.6, 5/30). Tests conducted in August, 1972 indicated that with high sulfur coal efficiency ran between 92% and 96% with emission rates in compliance whereas with low sulfur coal range between 0.75 to 0.86 sulfur content efficiency was less than 50% and emission rates were in excess of five pounds per million Btu, greatly in excess of all relevant standards (R. 6, 5/30, Commonwealth Edison Ex. S-4).

Natural gas had been used at the station, at times constituting 90% of the fuel (R. 164, 5/31). During 1969, natural gas produced 60% of the station's total generation, which decreased to 55% in 1970 and 45% in 1971 (R. 83, 84, 5/30, Edison Exhibits 5 - 6). With the unavailability of natural gas in 1971, and the resulting increase in particulate emissions, alternative methods were considered which resulted in the determination to convert proceeding pursuant to a construction schedule calling for shutdown for oil conversion, as follows:

Unit 4 - September 30, 1973;

Unit 3 - November 30, 1973;
Unit 2 - February 28, 1974;
Unit 1 - September 30, 1974.

The present unavailability of oil-firing equipment and controls and the delivery schedule necessitates the sequential shut-down described. Additionally, oil deliveries are scheduled on the basis of consecutive conversions. Low sulfur coal is presently being delivered to the station which results in a projected 24-hour average of particulate concentration of 146 micrograms per cubic meter (R. 200, 5/31), approaching the 150 microgram secondary ambient air quality standard which estimate assumes all 4 Sabrooke units operating at full load using only low sulfur coal and adverse meteorological conditions persisting for the entire period (R. 200-1, 5/31). A projected particulate concentration of 146 micrograms per cubic meter would have a significant health impact upon the citizens in the surrounding area.

The Agency, in urging the imposition of penalties and the denial of the variance, with respect to the Sabrooke station, asserts that Edison was aware of the particulate emissions in excess of allowable limits since Spring, 1971 (R. 27, May 30; R. 196-235, May 31). However, the principal complaints related to sulfur dioxide emissions. The Agency also contends that the shift to low sulfur coal to abate sulfur dioxide emissions should have alerted Edison to the likelihood of increased particulate emissions, particularly with respect to the electrostatic precipitator (Environmental Protection Agency Ex. 60). Consequently, the Agency contends that Edison should have sought fuel with optimum sulfur content to achieve the reduction of sulfur dioxide efficiency. The Agency substantiates that the Company contends that the use of low sulfur coal results in a higher particulate emission, particularly with respect to Unit 4 controlled by an electrostatic precipitator.

Furthermore, August, 1972 tests confirm that multi-clones on Units 1, 2, and 3 were not performing at rated efficiency and that sulfur content does not affect efficiency of the mechanical collection devices. There is no dispute between the parties that particulate violations did and presently occur. Indeed, this is the reason for the variance request. The issue, as heretofore stated, is whether the totality of the circumstances call for the imposition of a penalty and the allowance or denial of a variance. The Agency contends that notwithstanding the institution of operating restrictions at the Sabrooke plant above-described, that little effect on the volume of emissions has resulted.

Of perhaps greater concern than the regulatory viola-

tions which are admitted on all sides, is the impact resulting on the community from the plant emissions. Citizen testimony substantiated the Agency's assertions that a nuisance, at least in the immediate area, was consequential to the Sabrooke operation (R. 133, 137, 159, 160, 181, and 185, 5/31). Furthermore, Ringlemann limits appear to have been exceeded on several occasions (R. 68, 69, 5/30; R. 310- 312, 6/1, EPA exhibit S-5).

Additionally, the Agency has advanced the proposition that a substantial amount of small micron (a micron in diameter equals 0.0000394 inches) emissions escape from both the mechanical collectors and the electrostatic precipitators which result in substantial health hazards to the community. This substantial health hazard will be discussed later on in conjunction with the emissions from the Waukegan plant. With respect to the Sabrooke operation, we are confronted with admitted particulate violations and nuisance impact resulting from the particulate emissions affecting the immediate area. This, standing alone, justifies the imposition of penalties and the denial of the variances requested. However, in mitigation, the corollary of the foregoing violations is that until 1971, the station was operated principally on natural gas, the availability of which was curtailed through no fault of Edison and during the period when such fuel was used, the present pollutional impact had not occurred. It is undisputed that the mechanical precipitators on Units 1, 2, and 3 do not perform as represented when coal is burned, and that efforts to upgrade these facilities have been unsuccessful. The record does substantiate, which the earlier record did not, that low sulfur coal does have adverse consequences so far as the electrostatic precipitators are concerned and Edison's efforts to lessen SO₂ emissions have resulted in increased particulate emissions from decreased efficiency of the #4 electrostatic precipitator. We note that the Company has embarked upon a modification program which will result in the use of oil for fuel with resulting decrease in emissions of both SO₂ and particulates. While we recognize the possible need for the continued utilization of these facilities in the manner and to the degree requested by the Company in order to assure the supply at peak demands, the adequacy of suitable reserves and the capability of effecting repair and maintenance during periods of outage, we feel that the health of the citizens deserves protection. Accordingly, the Board has decided to limit Edison's use of the four units at the Sabrooke station until such time as they have been converted to burn oil. The Sabrooke station is only to be used to avoid a system-wide emergency, and only after all other available Edison capacity (excluding Powerton Units 1,4; Waukegan stations above 315 megawatts; and the fast-start peaking units) has been operated.

On balance, we see no useful purpose in assessing a major penalty on the facts of this case, as applied to Sabrooke and will thus assess a nominal \$1,000 penalty for violations of Section 9(a) of the Act, and Rule 3-3.112 of the Air Rules. We grant a variance to operate Sabrooke unit subject to the restrictions found in the order to follow and consistent with the continuing conversion of the facilities to oil burning equipment and adherence to the time schedule for compliance as represented on pages 12 - 13 of this order. Following conversion to oil, such units may be operated without restriction from 1(b) of this order.

The Waukegan station presently consists of four base load units generating 946 megawatts, Units 1, 2, and 3 having been retired in September, 1972. All units are presently serviced by electrostatic precipitators. The gas flow from the Unit #5 blowers is divided between the Unit #5 precipitator and the precipitators which had been used for Units 1, 2, and 3. Further duct work is necessary to achieve equal distribution of gas flow which is anticipated to be completed by Spring, 1974. Edison represents that this unit will be in compliance if coal with sulfur content of 1.6% or greater is burned (R. 284, 5/15). Since the Board's decision in #72-150, this unit has been operated at 60 megawatts or one-half capacity. Operation in excess of this amount has occurred during testing, slag removal, and system demand periods, the latter occurring when Edison's fast start peaking units have been placed in service.

Unit 6 employs a precipitator designed for 98% collection efficiency using Illinois coal (R. 284, 5/15). Actual testing indicates efficiency no greater than 95% when burning coal with 2.26 to 2.65% sulfur. Edison contends that when low sulfur coal is burned in this unit, a carbon carryover problem will result, which can cause fires and resulting damage to precipitators (R. 285-286, 5/15, Fancher direct). Efforts to resolve this problem have not been successful to date.

The Unit 7 precipitator has a design collection efficiency of 98% with actual efficiencies ranging between 83% and 94% and emission rates between 0.32 and 0.82 pounds per million Btu. Tests conducted in May, 1972 indicated average collection efficiencies of 95% and average emission rates of 0.40 pounds per million Btu, when the unit was operated at a loading of 315 megawatts and 3.1% sulfur coal was utilized (R. 288, 5/15, Commonwealth Edison Ex. 13, R. 13). Tests conducted in December, 1972 indicated that when low sulfur coal, having an average

sulfur content of 0.49% was utilized at 309 megawatts, precipitator collection efficiency was reduced to 74% and emissions were 1.87 pounds per million Btu. Since August 8, 1972 Unit 7 has been restricted to 315 megawatts, which will achieve compliance when Illinois coal is used, except when increased to meet system demands and after fast start peaking units have been placed in service (R. 198-99, 5/15).

After the May, 1972 tests on Unit 7, a flue gas additive process was designed, known as Koppers K, with a view towards restoring collection efficiency. This system did not prove successful and was subsequently abandoned.

Unit 8 is a 360 megawatt unit using a precipitator designed for 98% collection efficiency using Illinois coal. Tests conducted in September, 1972 indicated that when low sulfur coal (between 0.45% and 0.82% was used, collection efficiency dropped to 88% and particulate emissions ranged between 0.34 and 0.52 pounds per million Btu. This unit is included in the variance request, notwithstanding the apparent compliance, because when its emissions are combined with others of the Waukegan units, the station emission limit of 0.24 pounds per million Btu will be exceeded.

At the present time, a liquid sulfur trioxide injection system is being installed on Unit 8, which is expected to be operational by September of this year, which, if successful, would be used in other units to restore precipitator collection efficiency lost through the use of low sulfur coal. Here again, the Company has substantiated the fact that the use of low sulfur coal has, indeed, degraded the efficiency of particulate collection by electrostatic precipitators (R. 285, 287, 293, 297). Edison argues that its achievement of the sulfur standards can only be realized by the use of low sulfur coal, which, at the same time, produces the increased particulate emissions and that further developmental work and experimentation are necessary before emissions in both categories can be adequately abated. Lastly, Edison contends that its Waukegan emissions do not have a substantial adverse impact on local ground level quality and that neither the primary or secondary ambient air standards will be exceeded as a result of the Waukegan stations' particulate emissions. While disputed by the Agency, Edison contends that the use of low sulfur coal has enabled the Company to achieve sulfur dioxide emissions within the primary and secondary annual ambient air standards on an annual basis. Edison concludes that despite deterioration in collection efficiency experienced where low sulfur coal is utilized, particulate emissions from the Waukegan station do not result in ground level

concentrations exceeding Federal ambient air quality standards whereas prior to the use of low sulfur coal and when all units were operating at full load during adverse weather condition, there was the possibility that short term secondary ambient air quality for SO₂ would be exceeded. As a result, Edison asserts that it should be permitted to use low sulfur coal with resulting particulate violations as requested in its variance petitions.

With respect to the Waukegan operation, the Agency, in seeking the imposition of penalties and the denial of the variance, stresses the frequency of particulate violations from the Waukegan station, both as to single stack limitations and site limitations. As noted above, while there may be some dispute as to the degree and intensity of the violations occurring, neither Commonwealth Edison nor the Environmental Protection Agency contends that the operations are in compliance. Total plant emissions ranged from 0.32 pounds per million Btu, using coal of 2.67% sulfur, to 0.8 pounds per million Btu, using coal with sulfur content of 0.3%. These figures do not appear inconsistent with measurements made by Edison. On the basis of testimony by witnesses, Rosenthal, Salawitz, Jones and Antonopolous, we must find that Rule 3-3.112 has been violated at times both when high sulfur coal and when low sulfur coal were burned.

Modeling evidence was introduced by EPA witness Melvin (R. 202, 204, 5/24, EPA Ex. 56). The data encompassed both short term concentrations under worst case conditions and annual and seasonal mean ground level concentrations, taking into account the meteorological conditions resulting from the proximity of Lake Michigan, an element allegedly not taken into consideration by Edison witnesses who had concluded the absence of adverse ground level impact from the Waukegan station, which conclusion the Agency seriously disputes. We find that EPA witness Melvin's testimony has raised serious health questions. The concentration levels projected are:

- 1) Maximum 24 hour
Particulate 2100 ug/m³
SO₂ 4 ppm
- 2) Mean 24 hour
Particulate 260 ug/m³
SO₂ 0.25 ppm
- 3) Minimum 24 hour
Particulate 166 ug/m³
SO₂ 0.17 ppm

Dr. Ruy E. Lorenzo, Professor of Medicine and Chief

of the Pulmonary Diseases for the Medical Center at the University of Illinois, testified that the maximum concentrations projected by Melvin would result in a critical public health hazard (R. 31,33, 5/16). In answer to a question as to the significance of the mean values predicted by Mr. Melvin, Dr. Lorenzo stated:

"0.25 (ppm SO₂) is a number associated with the increased daily death rate, and if together with increased particulates present, as in this example of 260 micrograms per cubic meter, one could expect statistically significant increments in mortality and increased absence of industrial work." (R. 32, 5/16)

Dr. Lorenzo described the minimum particulate predicted values as having

"been associated with increased respiratory diseases in children and increased death rates for persons over fifty years of age." (R. 34, 5/16)

The testimony of Mrs Foley regarding the physical effects of Waukegan Station emissions upon her husband and herself graphically illustrated the public health consequences predicted by Dr. Lorence and the accuracy of Mr. Melvin's model. Mr. Foley chokes, gags, and vomits when exposed to Waukegan emissions and is forced to stay indoors unless he is wearing a gas mask. Mrs Foley experiences a burning sensation in her lungs and throat. (R. 59 and 61, 5/23) As in Sabrooke, the Agency stresses the purported adverse health consequences attributable to the emission of small micron particles not controlled by the abatement equipment presently installed on the furnaces, together with the synergistic effects of exposure to sulfur dioxide and particulate emissions concurrently.

Dr. Lorenzo stated that particles with a 0.5 to 5 micron diameter cause the greatest health problems since they are more difficult for the human body to eliminate than particles over 10 microns in diameter. (R. 36, 5/16) The Agency states that 75% of particles emitted by a cyclone-type boiler (Waukegan Unit 6) are less than 10 microns in diameter and that 98.5% of these particles will escape from an electrostatic precipitator. (R. 108, 113, 5/23) Agency testimony is that 32% of the particles from a pulverized coal boiler (remaining Waukegan units) are less than 10 microns in diameter and that 87.8% of those particles would escape on electrostatic precipitators. (R. 109, 113, 5/23) This EPA testimony when compared with Dr. Lorenzo's testimony bears witness to the very great health hazard that the Waukegan unit presents.

Substantial evidence was submitted demonstrating the subjective impact of the Waukegan emissions on persons located in the vicinity of the plant. (R. 30, 5/15; R. 59-61, 5/23) In addition, the nuisance attributes of the settling of large particles on property was testified to by persons in the vicinity. (R. 3-9, 5/23/73; R. 55-60, 5/17/73; R. 433-437, 6/17/73) We find that operation of the Waukegan units to have resulted in air pollution in violation of Section 9(a) of the Act.

Waukegan presents a more difficult problem of resolution perhaps than Sabrooke for several reasons. In the first place, the adverse pollutional impact on the community is manifest, both as to the health and comfort aspects and the detrimental effect on surrounding property, which condition is brought about, in part, by the location of the Waukegan station at lake level and the location of the major portion of the city on the contiguous bluff resulting in stack emissions being virtually at ground level. Furthermore, as compared with Sabrooke where conversion to oil will presumably bring the operation into compliance in the near future, Edison appears to be seeking an open-end variance for Waukegan. Its response, of course, is that in its efforts to minimize sulfur dioxide emissions, the use of low sulfur coal has degraded the electrostatic precipitators, necessitating further experimentation in additives and other abatement equipment and devices that will enable the precipitators to perform to the degree of efficiency to bring the particulate emissions into compliance. Coupled with this, of course, is the continuing need for use of the facility to achieve system demands during peak and outage periods.

We do not fault the company for its switch to low sulphur fuel, in an effort to achieve compliance with the sulfur dioxide regulations. However, this happening, in and of itself, cannot justify an open-end variance of the sort and to the degree sought by the Company with respect to its Waukegan facilities without some limitation as to time of compliance and degree of emission. We believe that the Company has presented adequate proof that the burning of low sulfur coal does, in fact, degrade the precipitator efficiency. (R. 531, 195-196, 234, 5/31/73) Furthermore, on the state of the record, the change in operation which has certainly increased the rate of particulate emissions, at the same time sulfur dioxide emissions were decreased. The Board notes that the monthly average sulfur content of the coal consumed at Waukegan has ranged from 0.97% to 2%. Low sulfur coal is that coal which contains less than 1% sulfur by weight. Remaining is the need to determine what steps should be taken to bring the operations into compliance, and how long we may reasonably allow. The

company, as to Waukegan, has not given us a definitive time schedule, and we find this to be a serious omission in its variance petition.

However, rather than deny the petition a second time, and require resort to the variance process over again, we will grant a six-month variance as to Waukegan, subject to the condition that the total station be restricted to 315 megawatts output. In the event of a system-wide emergency, the station may generate more than 315 megawatts only after all other available Edison capacity (excluding only the fast-start peaking units) has been placed in operation. This restriction upon the use of the Waukegan station is to insure that the citizens of Waukegan be protected from adverse health effects which could result from the operation of the station. The Board notes that in the event of an episode, Edison would be subject to the episode requirements found in chapter 2, part IV, of the Air Rules. The variance is subject to the further condition that the Company will submit a definitive compliance program setting forth with particularity the dates that it will bring its operation into compliance in Waukegan. We will reserve jurisdiction for such other orders as may be necessary based upon such submission.

This Opinion constitutes the findings of fact and conclusions of law of the Board.

ORDER

VARIANCES (PCB #73--40)

IT IS THE ORDER of the Pollution Control Board that six months variances be granted to Commonwealth Edison Company from both the station and unit particulate emission limitations contained in Rule 3-3.112 of the Rules and Regulations Governing the Control of Air Pollution, and Rule 203 (g), Chapter 2, Air Pollution Regulations, to permit the continued burning of low sulfur coal at the Sabrooke and Waukegan stations until April 4, 1974, as follows:

1. With respect to Sabrooke Station:
 - (a) For Unit #4 until that unit can be shut down for conversion to oil firing on September 30, 1973;
 - (b) For Units #3, 2, and 1, until those units can be shut down for conversion to oil firing on November 30, 1973, February 28, 1974, and

September 21, 1974, respectively, on the condition that in the interim these units will be operated only after all other available Edison capacity (excluding Powerton Units #1 - 4, the fast-start peaking units, and the Waukegan Station above 315 megawatts) has been placed in service, except that any one of the units may be operated at the minimum level necessary to provide steam for water demineralizing and heating the station, or to prevent stack deterioration.

2. With respect to the Waukegan Station:

- (a) From the station particulate emission limit, Rule 3-3.112 of the Air Rules, and Rule 203(g), to allow the use of coal at the station having a sulfur content of less than 3%; and
- (b) From the single stack emission limit of 0.60 lbs/MBtu and the site emission limit of 0.24 lbs/MBtu, Rule 3-3.112 of the Air Rules, and Rule 203(g), on the condition that the total Waukegan Station not be operated above 315 megawatts (one-third of total rated capacity), unless all other available Edison capacity (including the Sabrooke Station and the Powerton Units #1 - 4, but excluding the fast-start peaking units) has been placed in service.

All of the foregoing variances as to the Waukegan Station are subject to the following terms and conditions:

- (1) Emissions in excess of applicable regulatory site and unit limits shall be permitted only when necessary to meet peak summer demands, system demands when outages necessitate utilization of such facilities and to adequately assure necessary maintenance and repair within the system.
- (2) Within 30 days from the date hereof, Commonwealth Edison Company shall submit to the Board and the EPA a definitive schedule setting forth the steps that will be taken to bring its Waukegan Station into compliance with the relevant particulate regulations applicable to both the station and the individual units comprising the station.
- (3) Commonwealth Edison shall submit reports to the Agency and the Pollution Control Board stating when the facility has exceeded 315 megawatts, and the circumstances existing necessitating

such use. Such reports will be submitted within two working days.

3. Edison is to establish a nine station network of Hi-Vol samplers and SO₂ monitoring devices. Location of the monitoring networks and all other relevant details shall be subject to Agency direction and approval. Daily data is to be furnished to the Agency.
4. Edison shall prepare a detailed analysis of the impact, upon Edison's generation system, if the individual units at Waukegan were shut down until such time as they comply with existing rules and regulations. Such analysis shall include a listing of all planned outages for maintenance shut-downs in the Edison system, both as to dates of shut-down and output of the units; all emergency shut-downs in the Edison system; and the impact of Zion production upon Edison's system output. This analysis shall be provided to the Agency by December 4, 1973.
5. The Board retains jurisdiction for the entry of such further orders as may be appropriate for Waukegan based on the submissions directed to be filed by Edison. In addition to the foregoing, Edison shall continue with experimentation in the use of additives to achieve compliance by its electrostatic precipitators and shall report to the Agency and to the Board such action as it has taken with respect thereto and the results achieved.
6. Edison shall post a \$500,000 bond with the Agency by November 4, 1973 to guarantee its performance and compliance with this Order. Such bond shall be reduced in the following manner:
 - (a) \$100,000 for each unit at the Sabrooke Station, when it has been converted to oil subject to the schedule contained in this order;
 - (b) \$50,000 when the duct work modification on Waukegan Unit #5 is complete;
 - (c) \$40,000 when the air monitoring equipment has been installed and operated at the Waukegan Station; and
 - (d) \$10,000 when the Agency receives the report required by clause 4 of this variance order.

ENFORCEMENT (PCB #72-491, #72-492)

1. Edison shall pay the sum of \$1,000 as penalty for violating Sections 9(a) of the Act and Rule 3-3.112 of the Air Rules at their Sabrooke Station.
2. Edison shall pay the sum of \$30,000 as penalty for violating Sections 9(a) of the Act and Rule 3-3.112 of the Air Rules at their Waukegan Station.

Such payment shall be made by certified check or money order payable to the State of Illinois and shall be made to Fiscal Services Division, Illinois Environmental Protection Agency, 2200 Churchill Drive, Springfield, Illinois, 62706.

I, Christian L. Moffett, Clerk of the Illinois Pollution Control Board, certify that the above Opinion and Order was adopted by the Board on the 4th day of October, 1973, by a vote of 5 to 0.

Christian L. Moffett

