ILLINOIS POLLUTION CONTROL BOARD
November 15, 1971

In the matter of	)	
	)	
	)	
JOINT APPLICATION OF	)	# 71-20
COMMONWEALTH EDISON CO. AND	)	
IOWA-ILLINOIS GAS & ELECTRIC CO.	)	
(QUAD CITIES PERMIT)	)	

Opinion of the Board (by Mr. Currie):

Like in 70-21, Application of Commomwealth Edison Co. (Dresden #3), decided March 3 and April 28, 1971, this is an application under Title VI-A of the Environmental Protection Act for a permit to operate a new nuclear generating station, this one consisting of two 809-mw boiling-water reactors at the Quad-Cities plant near Cordova on the Mississippi River in northwestern Illinois. We grant the permit on terms similar to those imposed in the Dresden case, with differences indicated below. We note that there are environmental considerations on both sides in this case. Petitioner Iowa-Illinois operates an old, smoky coal-fired power plant in Moline that cannot be retired until Quad-Cities is in operation. Every day's delay in bringing Quad-Cities on line means another day of dirty air in Moline. See Iowa-Illinois Gas & Electric Co. v. EPA, # 71-65 (Sept. 16, 1971).

The statutory framework, the operation of a reactor, the environmental problems and their means of control, the federal radiation standards, their derivation, and their relation to state law, are all explained in detail in our March 3 Dresden opinion and will not be repeated here. The utilities raise once again the argument that federal law deprives us of authority to set standards for radioactive reactor discharges; we adhere to the contrary position for reasons given in the first Dresden opinion, and to the other jurisdicational and statutory interpretation conclusions there reached.

As held in Dresden, our authority in this proceeding extends to all environmental aspects of the Quad-Cities station, the most critical of which are gaseous and liquid radioactive wastes, protection against radiation resulting from accident, and thermal discharges to the river. We also must examine provisions for disposal of solid radioactive wastes, for ordinary chemical waste and sewage, and for control of any conventional air pollutants that may be generated by such sources as boilers. If construction had not yet begun, we should be concerned with plant siting as well. But construction is all but complete. Pursuant to permission granted July 22 (see transcript of Board meeting of that date), fuel loading has been completed in Unit #1, testing at significant power loads is ready to begin, and full commercial service is expected in the near future. Unit #2 is to be loaded in November, with a similar testing schedule contemplating full operation not long after the first of the year. We shall discuss the several points of environmental concern separately.

1. Gaseous Radioactive Emissions. Each of the two generating units is designed to emit no more than 100,000 microcuries per second (uCi/sec) of gross activity, and with fair fuel performance is expected to emit no more than 25,000 uCi/sec as a long-term average (R. 451, 584, 593; Environmental Feasibility Report, p. 21), with monthly averages possibly ranging as much as 4 1/2 times as high (R. 454). Emissions from other sources are far smaller; the principal one is the turbine gland seals, which are expected to emit only 625 uCi/sec (R. 477).

Original AEC emission limits were designed in individual cases so as to assure that the annual radiation dose to a hypothetical person spending all his time in the open air at the plant boundary ("fencepost") would not exceed 500 millirem (mr). In the case of Quad-Cities this standard could be met if emissions (except for the small ventilation stack emissions) were limited to 350,000 uCi/sec when both units are operating at full power and 250,000 when one is (R. 474). Anticipating much better performance than this, Edison and Iowa-Illinois have proposed annual emission limits of 110,000 uCi/sec and of 80,000, for both units or for one, respectively, which would produce a fencepost dose of 157 mr per year (R. 26, 474). As the companies point out, the actual dose to persons living or passing through the vicinity will be significantly lower, since most people live inside houses that provide some shielding, most do not live at the property line, and most spend part of the time away from the site. Natural background radiation in the area is said to yield an annual dose of 100 to 140 millirems (R. 146; Environmental Feasibility Report, p. 22). Moreover, at instantaneous emission levels just under half the annual average limits proposed (52,500 and 37,500 uCi/sec for both units and for one), the companies pledge to make operational changes if possible to reduce emissions at once and to look toward early fuel replacement if necessary, since several months may be required to rectify the situation without unduly interfering with power production (R. 26, 50-52).

Beyond this, however, as at Dresden, the utilities have begun the design and are committed to the construction of additional control facilities, consisting of a device for recombining hydrogen with oxygen and eight charcoal beds to afford a substantially longer delay before discharge so that short-lived isotopes may decay to insignificance. These facilities will cost $3,500,000 for each of the two generating units (R. 365-72); they will be completed within thirty months after design was started, or about December 1973 (R. 28, 54); they will reduce design level off-gas emissions from each unit from 100,000 uCi/sec to less than 2500 (a factor of 40) (R. 469, 473), and the annual fencepost off-gas dose from both units operating at full power to 2.4 millirems, with an

additional 0.08 mr/yr [0.8?] from the gland seals, which cannot be routed throughthe charcoal system (R. 365-72, 478). Utilizing the expected annual average emissions rather than the design figures, the additional facilities would reduce single-unit emissions to 625 and emissions from both units operating together to 1250, which when added to the gland seal emissions of 625 [each unit?] would yield an approximate site emission of only 2500 uCi/sec and a total fencepost dose clearly less than 5 millirems per year.

The utilities contend that exposure to 170 millirems per year is quite safe, as the AEC standards themselves incorporate substantial margins of safety below dose levels at which adverse somatic or genetic effects have been found (R. 324). There is of course a school of thought that the effects of radiation are in linear proportion to the dose and that there is no threshold (see the March 3 Dresden opinion for discussion). Because of this possibility, and in order to be especially safe in dealing with such a dangerous phenomenon as radioactivity, we adopted in the Dresden case, and reaffirm here, the policy of requiring use of the best practicable technology for controlling radioactive emissions, even though a lesser degree of control might suffice to avoid doses set to give breathing space below levels at which harm has so far been discovered. Accordingly in Dresden we adopted limits whose effect was to require the addition of a recombiner and eight charcoal beds, and we do the same here, as the companies have agreed to do. They have agreed that a fencepost dose of 5 millirems, which will be achieved by this system, is a desirable and achievable goal (R. 324, 474). The AEC has recently required, as a numerical translation of the requirement of best practicable control, that the dose to persons living near the site (which should be less than that at the fencepost) be limited to 5 mr/yr (AEC Release #778, June 7, 1971).

The companies propose an interim emission limit of 110,000 uCi/sec for all sources when both units operate and 80,000 when one operates. The recombiner and charcoal beds will reduce total site emissions by a factor of 30. Therefore, in light of the reasons given above, we shall reduce the proposed limits by a factor of 30, allowing a small leeway in rounding off, to 4000 and 3000 uCi/sec, respectively, as annual averages. These standards, based on poorer than expected fuel performance, will allow some room for less than optimal operation, since the resultant doses are quite small. We do not, however, agree with the companies that we should give such leeway (10,000 uCi/sec) as to ignore the problem of excessive fuel leakage; the policy of best practicable treatment requires both good fuel and good controls. We do agree that there is no need for monthly averages, since at these low levels only long-term exposures are relevant and since monthly values fluctuate enough that meeting a strict monthly standard might impose a significant hardship (R. 454).

very high, short-term emissions of course must be prevented; we think this problem can be adequately handled by the AEC's accident provisions and by requiring the companies, as agreed, to take action when high emission levels (57,500 or 37,500 uCi/sec) are exceeded on an instantaneous basis.

We are urged by the Attorney General to require still further control systems for gaseous emissions. It is said that freon systems, for example, can provide even greater degrees of control than can charcoal, at lower cost, and can in addition remove from the effluent gas long-lived radioisotopes of xenon and krypton, which are not reduced by the system planned for Quad-Cities (R. 630-31). The companies respond that such systems have not yet been shown commercially feasible for facilities as large as Quad-Cities and that it may be more undesirable to concentrate and store the small quantities of long-lived isotopes produced than to disperse them, highly diluted, to the atmosphere (R. 402-06). We need not decide the tricky issue of commercial availability, for we believe the charcoal system will reduce emissions to a very prudent level indeed insofar as gross activity is concerned. The problem of the long-lived isotope, however, is one as to which we wish to express some additional caution for future guidance. Krypton 85, which will be emitted

years and takes a century to decay to insignificance (R. 650-51). One witness predicted that, unless control measures are instituted, a worldwide buildup of radioactive krypton will occur so that the annual dose to people everywhere from this source will reach 1.7 millirems by the year 2000 and 17-20 millirems 20 to 30 years thereafter (R. 650-51, 664-65). Even these projected levels are rather modest so far as current knowledge of adverse effects goes, and certainly there is no cause for immediate fear. It is not too soon to warn, however, that we do not intend to allow the long-lived radiation problem to become another DDT situation, in which emissions so dilute or so small as to be insignificant in the vicinity of the discharge persist and accumulate to create widespread concentrations of possible adverse ecological significance. We do not today require the capture of Krypton 85 or other long-lived isotopes released from Quad-Cities in present negligible quantities; but we shall require such capture before many more years have elapsed.

Along similar lines, it is worth noting the [illegible] observation that, while gland seal emissions are small in relation to those from the main system as originally designed, they are comparable in magnitude to those from the charcoal bed system (R. 395-97, 477). Moreover, while in plants already built it is impracticable to divert such emissions to the charcoal control facilities, new plants can be built so as to make control of gland seal emissions [illegible]. Though the gland seal emissions are small, they [illegible] controlled in the future if they can be [illegible], in light of the policy of avoiding [illegible].

Construction of the recombiner and charcoal beds at Quad-Cities will not be complete until December 1973, and the plant is ready for operation this year. It is badly needed both to provide more adequate reserve capacity to guard against interruptions of electric service that would impose significant hardships on innocent customers (see the detailed discussion in the April Dresden opinion) and to relieve the load on older fossil-fuel plants that contribute significantly to air pollution. Most significantly, the operation of Quad-Cities will make possible the greatly reduced use of coal at an inadequately controlled station in Moline (see Iowa-Illinois Gas & Electric Co. v. EPA, # 71-165, Sept. 16, 1971). At the same time the emissions from Quad-Cities during the interim before completion of the additional control facilities will be low enough to afford a substantial safety margin below dose levels at which adverse effects have been detected. While we have required that those levels be greatly reduced for additional safety in the future because they reasonably can be, we hold as in the Dresden case that the plant should be allowed to operate in the meantime subject to interim limits, namely, that not more than the proposed 110,000 uCi/sec be emitted from both units, or 80,000 from either alone.[1]

2. Liquid Radioactive Wastes. The planned discharge of gross activity to the Mississippi River from various sources of liquid waste at Quad-Cities is 26 curies per year plus 30 curies of tritium (R. 384). The utilities intend to dilute these radioactive wastes with cooling water to a concentration of 1×10^{-8} uCi/cc (excluding tritium) in the discharge canal. In the river further dilution will reduce concentrations to 7×10^{-10} uCi/cc, affording a safety factor of 2300 below the drinking-water standard of 1×10^{-7} uCi/cc (which is based on a 500 mr/yr dose to a hypothetical person drinking river water exclusively), so that the dose to one drinking solely from the river would be 0.2 millirems per year. Dilution would also leave a large margin below the drinking-water tritium standard of 3×10^{-3} uCi/cc (R. 481-83). On the basis of these facts the companies contend that the expected doses are so insignificant that no further treatment is worthwhile.

Confronted with a similar situation in the Dresden case, we pointed out that dilution is not an adequate substitute for treatment because it is better to keep harmful materials out of the environment than to dilute them. This is especially true of materials, such as certain radioisotopes, that retain their dangerous properties for long times after discharge and that can be biologically concentrated by organisms as they move up the food chain. A utility witness acknowledged that cesium, for example, concentrates in fish by a factor of 100 or 1000 (R. 333-34). A zoologist for the Attorney General testified

1. These figures were substantially confirmed by additional testimony in the Dresden case, #70-21 (Oct. 19, 1971), which predicted annual emissions in the neighborhood of 67,500 uCi/sec from one unit.

that strontium 90 is concentrated 20,000 to 30,000 times (R. 2168). It may therefore be that the most limiting aspect of liquid waste discharges is not drinking water but aquatic life. It is true that the total quantity of activity to be discharged to the water is quite small as compared with that to be discharged to the air (26 curies per year as compared with several thousand microcuries per second, even after maximum control). But the discharge is to a much more limited receptacle, the river, not to the enormous atmospheric reservoir; and, in light of the policy of keeping as much radiation out of the environment as we reasonably can, we think it important to consider possibilities for reducing liquid radioactive discharges still further.

In response to our concern over this issue, the utilities have with accustomed thoroughness described for us two alternative systems that would provide dramatic additional reductions in radioactive discharges to the river. Neither system will remove tritium from water, for the evidence is that cannot be done. But the "maximum recycle" plan, by the addition of extra ion-exchange demineralizers in the floor drain system, would reduce non-tritium activity to 2×10^{-5} uCi/cc before mixing, reduce the total non-tritium discharge from 26 Ci/yr to 1.2, and reduce the non-tritium dose to a hypothetical river drinker from 0.2 to 0.009 millirems per year. This system would cost $5,000,000 and require 24 months to construct (R. 372-77, 483). Or, with the "maximum treatment" plan, utilizing further concentration, distillation, and ion exchange, the companies think it probable they could meet the effluent standards without any dilution (except for tritium). With this alternative, non-tritium releases would be only 0.0004 Ci/yr and the dose to a river drinker 0.000003 millirems per year. The estimated cost of this alternative would be $9,000,000 and the time for construction 36 months (R. 377-83, 483).

We think the "maximum recycle" system is a desirable addition to the Quad-Cities plant, in that for a price that is only 2 1/2% of total plant cost it will reduce radioactive discharges from 26 Ci/yr to 1.2. The companies have agreed to the installation of a similar system at Dresden (#70-21, hearings, Oct. 19, 1971, Ex. 1). Although the need for such a system is greater there in order to avoid radiation buildup in the largely closed cooling system planned to meet the thermal standards for the Illinois River, we agree with the Attorney General's witness Dr. Devolpi that this additional caution is worth the money in dealing with something so dangerous as radiation (R. 630). On the other hand, we shall not be dogmatic in insisting on a complete absence of dilution irrespective of the costs and benefits of so doing. The important policy is that dilution not be employed in lieu of reasonably practicable treatment; when all reasonable means of treatment have been applied, and the costs of further treatment are excessive, dilution should not be forbidden. In the Dresden case we announced the general policy against unnecessary dilution. In the light of additional evidence received since that decision, we think the further reductions below the already small discharges from the proposed "maximum recycle" system that would be afforded by the "maximum treatment" system would not at the present time be worth the $4,000,000 extra cost.

Thus we shall order Edison and Iowa-Illinois to reduce gross activity discharges, exclusive of tritium, to 1.2 Ci/yr and to 2 x 10^{-5} Ci/cc before mixing, by December 1, 1973, and in the meantime to meet the gross activity limit of 1 x 10^{-7} uCi/cc after dilution, at the point of discharge to the river. As in the case of gaseous discharges, there is no serious risk from the discharges during the interim, and to require the stricter standard to be met at once would keep the plant closed for two years, imposing an unjustified hardship.

3. Heat. Two thirds of the heat generated in a nuclear power plant cannot be translated into electricity; it is a waste product that presents its own disposal problems. The companies' original plan was simply to discharge the heated cooling water (which at low flow will comprise 1/4 to 1/5 of the river's entire flow and which will be 23° warmer than the river) into the main river channel (R. 698-99, 715, 731, 768). In the summer of 1970, however, a study demonstrated that this scheme would violate the then existing water quality standard (SWB-12) (R. 768), which limited stream temperatures to 90° F. and to 5° above natural temperatures outside a mixing zone extending 600 feet in any direction from the point of discharge. So the companies proposed to install a diffuser, a pipe extending most of the way across the river, discharging heated water at various points in order to maximize rapid mixing with the cooler river water (R. 722). It was their contention that with such an arrangement the standard could be met (R. 824).

But the old standard, we concluded in a recent rule-making proceeding (#R 70-16, Mississippi River Thermal Standards, adopted Nov. 15, 1971), was inadequate to protect the river against a substantial risk of ecological alteration, since it would allow the whole river to be raised by 5° nearly all the time. For this reason we adopted a new standard that imposes monthly maximum temperatures, based upon federal recommendations derived from prevailing temperatures and the requirements of the biota at various seasons, that must be met during all but a few days each year at the edge of the 600-foot mixing zone. The companies' evidence, not substantially contradicted, is that they can meet the new standard too with their diffuser alone, avoiding the expenditure of $40,000,000 or more for cooling towers or spray ponds. We find it probable on this record that they can and therefore will not require the installation of alternative cooling devices at this time. We do require that the companies conduct a detailed study of the effects of discharges and that additional measures be taken if significant harm is shown to occur.

A more difficult issue is what to prescribe while the diffuser is being built. As in the Dresden case, we find it somewhat surprising that the companies did not discover until 1970 that the long-existing standards would require even so much as a diffuser pipe, with the unhappy result that even the diffuser will not be

available before February, 1972 (R. 9). Indeed, later dalays resulting from permit proceedings before the federal government and the Iowa water pollution agency have so far prevented construction of the diffuser and put its operation off until later in the Spring. However, as noted above, the plant is badly needed, and right away, if innocent consumers (and the air-breathing public) are not to suffer. The harm to the river in the meantime, if we impose certain conditions to keep it within bounds, is a risk rather than a certainty; while we would not allow it over the long term, the great probability is that any harm that does occur will be undone naturally by repopulation from unaffected areas after adequate cooling is provided.

So we will allow Unit #1 to be operated, with the discharge improvements promised by the companies, as soon as it is ready. With only one unit in operation, the increase in temperature through the plant will be only 13° (R. 30), and river dilution will be adequate to assure that the whole stream not be raised by 5° even at low water.[2]

Moreover, we shall require the companies to report on the feasibility of installing spray modules in the discharge canal, as at Dresden, to reduce the heat discharged to the river. Unit #2 may be tested during this period, as the utilities request, in order to assure its availability for the peak demands of summer 1972 (R. 31), but, to avoid a full heat load on the river without even rapid mixing, which might do considerable damage, the total station output shall not exceed 809 mw--that of either unit alone--until the diffuser pipe is in operation to assure that large areas are not raised more than 5°.

4. Nuclear Accident. The Attorney General raised the question of the adequacy of safeguards against the possible escape of radioactive materials in the event of an accident. In light of recent controversy over the adequacy of certain systems for cooling reactor cores in the event of a coolant loss, we scheduled an additional two days of hearings, after the record had been closed, to pursue the question. On the basis of the record we cannot find such a significant danger of failure of the emergency cooling system as to lead us to dalay further the operation of this needed facility.

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2. The companies say the area raised by more than 5° will be only 20 acres (R. 791).

A highly qualified witness from General Electric, manufacturer of the reactors, testified in great detail as to the integrity of normal controls making the need for emergency cooling highly improbable; to the quadruple emergency systems provided, each independently capable of quelling any foreseeable problem; and to the extensive testing that had been and would be performed to determine and to maintain the adequacy of the systems. He assured the Board that the problems encountered in recently publicized tests were specific to an entirely different type of emergency system that had never been used or planned for boiling water reactors (R. 2336-2426). Dr. Alexander DeVolpi of Argonne National Laboratory suggested that a 1970 incident at Dresden raised questions as to the adequacy of BWR emergency cooling systems, but he was unable to demonstrate that the incident was one in which an emergency cooling system would be expected to operate. Dr. Henry Kendall of MIT emphasized the desirability of further testing of these systems but agreed that the problems recently encountered with cooling systems had no application to the BWR's and had no suggestions for improving the Quad-Cities system. Neither he nor Dr. DeVolpi asked that the permit be delayed or withheld; the latter expressly said that "inherent safety features make water reactors extremely safe" and that the "probability of failure necessitating emergency core cooling is very small" (R. 2428-2542).

While we shall maintain a continuing concern for this and all other matters related to possible radiation hazards, and while we shall provide that the permit may be modified or revoked if this is proved necessary by new information, we do not perceive a justification today for withholding the permit.

5. Other Issues. Because of the advanced stage of construction, siting considerations are of little consequence in this proceeding; suffice it that we see no reason to require that this plant be dismantled and rebuilt somewhere else. Solid radioactive wastes will be contained and shipped to an established burial site (Environmental Feasibility Report, p. 36), and we have no evidence to indicate any undue dangers in the plans for this operation, either at Quad-Cities, in transit, or at the ultimate disposal site. The appropriate disposal of such dangerous wastes, however, is an important subject with which we expect to have more to do in the near future. The Attorney General raises the question of nuclear accidents, but we think the evidence insufficient to show the need for additional precautions on this score beyond those already

provided. The gaseous radiation controls agreed to by the utilities will add significantly to accident protection (R. 641-42). The sewage treatment system and the gas-fired boilers are designed to comply with all relevant regulations, and there is no indication that any nonradioactive solid wastes generated at the site will be improperly disposed of. No chemical water contaminant problems appear; the use of sodium hypochlorite for condenser cleaning will add some chlorine to the river, and chlorine and its compounds can be toxic to fish; but the undisputed testimony is that the small amount of chlorine added will be rendered innocuous within two minutes by the chlorine demand in the river (R. 285-87).

The Attorney General moved on November 11 that we further delay decision in this case pending study of the transcript of a recent Iowa hearing with respect to the effects of the proposed diffuser. We denied this motion 4-1, Mr. Dumelle dissenting, on the ground that ample opportunity had already been afforded for the presentation of evidence and that there was no justification for the extraordinary course of reopening and further delay.

In conclusion, we should like to commend the applicants for a thorough and lucid presentation of the relevant facts, and to thank the Attorney General for his participation, which provided the adversary proceeding that is so necessary to adequate resolution of the issues by the Board.

Mr. Dumelle dissents for reasons to be stated in a separate opinion.

This opinion constitutes the Board's findings of fact and conclusions of law.

ORDER

After due notice and hearing, and for the reasons given in the Board's opinion, a permit is hereby issued to Commonwealth Edison Co. and Iowa-Illinois Gas & Electric Co. to operate Units ##1 and 2 at the Quad-Cities Nuclear Power Station near Cordova, Illinois, subject to the following conditions:

General Conditions

1. This permit shall not release the permittees from any liability or obligation imposed by Illinois statutes or local ordinances and shall remain in force subject to all conditions and limitations now or hereafter imposed by law. The permit shall be permissive only and shall not be construed as estopping or limiting any claims against the permittees for damage or injury to person or property resulting from any acts, operations, or omissions of the permittees, their agents, contractors or assigns, nor as estopping or limiting any legal claim of the state against the permittees, their agents, contractors or assigns, for damage to state property, or for any violation of subsequent regulations or conditions of this permit.

2. This permit is subject to modification or revocation, and may be suspended at any time for failure to comply with the terms stated herein or with the provisions of any other applicable present or future regulations or standards of the IPCB or its predecessors or successors, and is issued with the understanding that it does not estop the Board from subsequent establishment of further requirements for treatment or control at any time. The Board upon notice and opportunity to be heard may reopen this proceeding at any time for the purpose of such revocation or modification in order to prevent or reduce possible pollution of the environment.

3. The permittees or their assigns shall defend, indemnify and hold harmless the State of Illinois, its officers, agents and employees, officially or personally, against any and all actions, claims or demands whatsoever which may arise from or on account of the issuance of this permit, or the construction or maintenance of any facilities hereunder.

Special Conditions Relating to Radioactive Discharges

[1. Policy of the Board]

It is the policy of the IPCB that all radioactive pollution of the environment shall be held to the lowest level that is attainable within the limitations imposed by technological feasibility and economic reasonableness. In no case shall members of the public be exposed to radiation beyond the limits recommended by the International Commission on Radiological Protection, nor shall radioactive emissions ever exceed the limits imposed by the United States Atomic Energy Commission. In addition, the actual levels

of radiation exposure of members of the public shall be kept as far below those limits as possible, consistent with technological feasibility and reasonableness of cost.

[2. Radioactive Discharges Generally]

In keeping with the above policy of the IPCB, all practical measures for treatment, control and containment of radioactive wastes from Quad-Cities Units 1 & 2 nuclear generating plant of the Commonwealth Edison Company shall be employed for the purpose of preventing the release of radioactivity to the environment. Such measures shall include at least, but not be limited to; all measures for the treatment, control and containment of liquid and gaseous radioactive effluents that are indicated in the Final Safety Analysis Report of the Quad-Cities Units 1 & 2 nuclear generating plant.

[3. Liquid Radioactive Discharges]

(a) The annual average gross beta-gamma radioactivity of liquid effluents released to the Mississippi River shall not exceed 10^{-7} uCi/ml (100 pCi/l).

(b) Total activity discharged to the Mississippi River in any year, exclusive of tritium, shall not exceed 26 curies.

(c) Tritium discharged to the Mississippi River in any year shall not exceed 30 curies.

(d) On and after December 1, 1973, total activity discharged to the Mississippi River in any year, exclusive of tritium, shall not exceed 1.2 curies, and gross activity exclusive of tritium shall be reduced to 2×10^{-5} Ci/cc before dilution.

[4. Gaseous Radioactive Discharges]

(a) Gross beta-gamma radioactivity of gaseous emissions released to the atmosphere from either Unit 1 or Unit 2 shall not exceed an annual average of 80,000 microcuries per second, and emissions from both units operating at the same time shall not exceed an annual average of 110,000.

(b) If gaseous radioactive emissions at any time exceed 37,500 uCi/sec from either Unit 1 or Unit 2, or exceed 57,500 uCi/sec from both units operating at the same time, the permittees shall initiate operating procedures, to the extent permitted by power demand, to reduce such release.

(c) On and after September 1, 1973, gaseous radioactive emissions from either Unit 1 or Unit 2 shall not exceed an annual average of 3000 uCi/sec, nor shall emissions from both units operating at the same time exceed an annual average of 4000 uCi/sec.

[5. Heated Water Discharges]

(a) With the discharge improvements described in the Supplement to Appendix C of the Application as Amended, Units 1 and/or 2 may be operated until April 1, 1972, at a total output not to exceed 809 mw, without regard to the heat limitations of regulations SWB-12 as amended by #R 70-16 or of successor regulations, provided that:

(i) until operation of the diffuser is achieved, effluents shall not exceed ambient river temperatures by more than 12°F; and

(ii) within thirty days after receipt of this permit, the permittees shall submit a statement regarding the feasibility and cost of installing spray modules to reduce the heat discharged in the interim before completion of the diffuser. The Board upon receipt of such statement will take such further action as appears appropriate.

(b) On and after April 1, 1972, Units 1 and 2 shall be operated only in full compliance with all provisions of SWB-12 as amended by #R 70-16 or of successor regulations, with regard to heated discharges.

[6. Reporting and Monitoring]

(a) Liquid discharges. Prior to any release of radioactivity in liquid effluents, each batch will be counted for gross beta activity, excluding tritium. Records of the radioactive concentration and volume of each batch of effluent shall be maintained as well as records of the amount of circulating water available for mixing. At least once per month a gamma scan of typical batches of effluent shall be performed to determine the gamma energy peaks of these batches. Isotopic analyses of representative batches of effluent, including determination of tritium, shall be performed and recorded at least once per quarter. If the monthly gamma scan reveals energy peaks other than those determined by the previous isotopic analyses and if the difference is significant, a new set of isotopic analyses will be performed and recorded.

(b) Airborne activity. Radioactive gases released from the reactor building stack and plant chimneys shall be continuously monitored. To accomplish this, at least one reactor building stack monitoring system and plant chimney monitoring system shall be operable at all times. Daily samples of the air ejector effluent will be taken. Within one month after initial

commercial operation of the unit, an isotopic analysis will be made. From this analysis a ratio of long lived to short lived activity will be computed. If a ratio based on any daily sample indicates a change greater than 20 per cent from the previous isotopic analysis, a new isotopic analysis will be performed and recorded. In any event, a new isotopic analysis will be performed at least quarterly. Gaseous releases of tritium shall be calculated monthly from measured data. Records from the continuous monitors, the daily samples and the isotopic examinations shall be maintained.

(c). All effluent and environmental monitoring program results shall be reported monthly by the Permittees to the Environmental Protection Agency (EPA). All monitoring program results shall also be available for inspection by the Environmental Protection Agency at the plant site at any time.

[7. Emergency Situations]

The Permittees shall cooperate to the full extent necessary with the EPA and with the Illinois Department of Public Health for purposes of development by those agencies of an adequate and effective emergency protection plan designed to immediately control and minimize the effects of any accidental release of unexpectedly large quantities of radioactivity from the Quad-Cities nuclear generating plant. In particular, the permittees shall immediately notify both the EPA and the Illinois Department of Public Health of any uncontrolled release of unexpectedly large quantities of radioactivity to the offsite air and/or water environment due to operational failure of any of the power plant systems, and shall report monthly to the Board and EPA any activation of the emergency core cooling system, whether spurious or real, exclusive of today.

[8. Time of Permit]

This permit shall expire on November 15, 1973. If the permittees wish to continue operation of Quad-Cities Units 1 and 2 beyond that date they shall file with the IPCB an application for a renewal permit on or before August 15, 1973. Said application shall contain complete information and data:

(a) concerning the radioactive emissions, gaseous and liquid, up to that date,

(b) concerning the status of the construction and installation of the radioactive control facilities required by this permit, and

(c) concerning thermal discharges and their effects on the Mississippi River. Said application shall also include such other information and data as required by the Board to evaluate the impact on the environment of Quad-Cities Units 1 and 2.

[9. Compliance with Existing Laws]

The permittees shall conform to all existing and future laws and regulations in other aspects of the operation of Quad-Cities Units 1 and 2, including among other things the operation of boilers, the operation of sewage treatment facilities, and the disposal of solid waste, and shall procure from the Environmental Protection Agency such permits as may be required for various aspects of that operation.

I, Christan Moffett, Acting Clerk of the Pollution Control Board, certify that the Board issued the above Permit this 15th day of June, 1971.

Christan Moffett