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Worldwide Report

ENVIRONMENTAL QUALITY

(FOUO 2/81)

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CONTENTS

JAPAN

GOVERNMENT TO RESTRICT TOTAL NO_2 AMOUNT IN BIG CITIES

Tokyo ASAHI EVENING NEWS in English 21 Feb 81 p 3

[Text]

The Environment Agency decided Friday to impose restrictions on the total amount of nitrogen oxide (NO_2), considered the chief cause of air pollution, in the high pollution areas in Tokyo, Kanagawa, Aichi and Osaka prefectures.

Restrictions on the total amount of NO_2 can be imposed through revising the implementation ordinance of the Air Pollution Prevention Law.

But it is possible that it will become a political problem because of strong opposition from industrial circles, particularly the steel industry. Consequently, the Environment Agency asked the chairman and vice chairman of the Liberal-Democratic Party's Environment Committee and Diet members concerned to study the matter and obtained their approval Friday.

The Environment Agency will ask the Cabinet to decide whether the implementation ordinance should be revised by the end of March. If the Cabinet decides in favor of revision, the governors of the stipulated areas will draft plans for reducing the total amount of NO_2. The agency wants this work to start in the latter half of fiscal 1981.

The system of imposing restrictions on the total amount of air pollutants was started in 1974, and such restrictions are imposed on sulfurous oxide in 24 areas throughout the nation.

The Environment Agency called the restrictions on NO_2 drastically in 1978 and announced a policy of attaining the eased standards in 1985.

The agency asked Tokyo, Kanagawa, Aichi, Osaka, Hyogo and Fukuoka prefectures if they could achieve the environmental standard of 0.06 ppm of NO_2 by 1985. The first four concluded they could not, while the latter two said it was possible.

The restrictions on the total amount of NO_2 will be the same type as those on the total amount of sulfurous oxide. In drafting plans, the governors of the stipulated areas will announce the goals for individual factories.

In Tokyo, the stipulated areas include all the 23 wards plus Musashino, Mitaka, Chofu, Hoya and Komae cities. Yokohama, Kawasaki and Yokosuka cities are included in Kanagawa Prefecture. The stipulated areas in Aichi include Nagoya, Tokai and Chita cities, and those in Osaka include Osaka, Sakai, Toyonaka and 14 other cities.

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EMISSIONS CUT SUGGESTED FOR IMPROVING TES SAFETY

Moscow TEPLOENERGETIKA in Russian No 11, Nov 80 pp 2-6

[Article by L.I. Kropp, candidate of technical sciences, All-Union Thermal Engineering Institute: "Perfection of the Power Engineering Industry and the Environment"]

[Text] Heat and electric power stations will preserve their decisive role in the general volume of production of electricity and heat in the visible future. The rising energy needs of the national economy will be covered, in addition to the leading development of nuclear electric power stations in the European sector of the country, mainly by the broader involvement of the Ekibastuz, Kuznetsk, Kansk-Achinsk and certain other promising coal fields in energy production. Taking this long-term trend into account, the environmental protection developments in thermal power engineering must be primarily oriented on increasing the ecological level of solid fuel use, as well as significant resources of natural gas allocated for power engineering needs. From the viewpoint of organizing fuel supply, the latter also signifies that the main mass of natural gas resources must be sent to the municipal TES [heat and electric power stations]. Only temporary surpluses of this fuel may be burned at the condensation electric power stations that are located outside the cities.

The law on protection of the atmospheric air that is based on the principle of restricting the absolute discharge of harmful substances into the air basin and was adopted in the USSR in 1980, has great importance in selecting the environmental protection strategy in power engineering. According to the new law (as a supplement to the extant system of standardizing the permissible harmful pollutant concentrations in the atmospheric air), a system is being prepared for start-up that will regulate the maximum permissible emissions by each enterprise. The law will also significantly affect the selection of technical and technological solutions in primary production. It will ban those that result in increased atmospheric pollution.

At the same time, the sanitary-hygienic habitat standards are becoming stricter. In 1979, the USSR Ministry of Public Health introduced a requirement to compute the total harmful effect of sulfurous anhydride, nitrogen dioxide and carbon monoxide when they are jointly present in the atmospheric air. In the past [4], such a requirement in power engineering only covered oxides of sulfur and nitrogen. In practice this means that the content in flue gases of even an insignificant percentage of chemical underburning in the form of CO (about 0.05%) makes it necessary to reduce the permissible discharges of the two other summing components. An analogous situation occurs when background concentrations of CO are found in the atmospheric air.

One of the possible consequences of the new legislation is a trend towards restricting the height of the TES smokestacks, i.e., weakening the role of flue gas dispersal, with the simultaneous implementation of measures that curtail the absolute discharge of the main harmful components, oxides of sulfur and nitrogen, volatile ash and certain toxic trace pollutants. This trend will also be stimulated by intergovernmental agreements that are concluded in order to restrict the so-called transboundary migration of harmful substances, in the first place, of sulfur dioxide. This is especially important for the TES located in certain regions of the European sector of the country.

In contrast to many technological industries, including nuclear electric power stations, when heat and electricity are produced at the TES, different polluting components of fuel and its combustion products enter the atmospheric air through the purification system almost completely in the form of so-called organized emission that can be evacuated with the help of a powerful centralized gas-removal channel. The role of the scattered, unorganized releases of harmful substances by the main and auxiliary equipment into the production rooms is insignificant in the total material balance. This feature of electricity production promotes an increase in the TES ecological level at all sections of its technological plan: in the process of fuel combustion, as well as in the recovery and neutralization of the combustion products. Based on the change and perfection of the corresponding links in the TES technological plan, it is possible to reduce to a certain degree practically all of the harmful contaminants of flue gases, including sulfuric oxides.

Table 1.

Power of TES, fuel	Method of cyclic desulfurization of flue gases	Specific capital investments for sulfur purification		Specific annual expenditures for sulfur purification		Increase in fuel consumption at TES %
		R/kW	%	kop/(kW·h)	%	
4 x 300 MW, near-Moscow brown coal	Ammonium-cyclic	61.2	39.0	0.55	34.0	16.8
4x800 MW, Donetsk GSSh [gas, seed coal and coal fines]	Ammonium-cyclic	37.0	24.0	0.27	31.7	7.8
	Magnesite	49.6	32.0	0.27	31.7	8.1

The interest in the new technological solutions that promote a more profitable reduction in sulfuric oxide emissions with the use of solid fuel (boilers with fluidized bed, steam-gas units, energy-efficient processes and plans for isolating and recovering pyritic sulfur) is mainly due to the excessively high capital consumption and energy consumption of the traditional methods of cyclic sulfur-trapping at the TES [1]. This is illustrated by the data in table 1, based on the critical analyses of the VTI [F. E. Dzerzhinskiy All-Union Thermal Engineering Institute] and the VGPI TEP [All-Union State Planning Institute "Teploelektroproyekt"] for two power stations that burn coal. The technical and economic indicators are given for the ammonium-cyclic and magnesite methods of desulfurization for roughly 90% of the combustion products of two types of coal, near-Moscow brown coal with sulfur content of 3.3% with combustion heat of 2460 kcal/kg, and Donetsk GSSh with sulfur content of 3.1% and combustion heat of 4730 kcal/kg. Table 1 indicates the complete (national economic) expenditures in calculation for 1 kW of rated output. In the case of successful realization of the product

issued by the sulfur-trapping units, and at the same time, displacement of the corresponding plants, these expenditures are reduced. In addition, a certain reduction in expenditures, for example, with the use of the magnesite method, can be attained by perfecting and reducing the cost of the technology for producing the final desulfurization products.

As is apparent from table 1, the capital investments for sulfur trapping are from 24 to 39%, while the operating expenditures are roughly one-third of the corresponding indicators of the main industry. The high level of capital investments is linked to the enormous volume of gases to be purified and the type of fuel. The increased operating expenses are significantly governed by the high energy capacity of the sulfur trapping systems. The energy expenditures converted to fuel comprise from 9 to 16% of its total consumption. This is much higher than the percentage of all the energy expenditures of a modern coal TES for in-house needs. At the same time, energy-consumption is the main criterion in evaluating and comparing the different measures to reduce harmful emissions. The higher this indicator, the lower the degree of perfection of any technological process, and the more inefficiently the primary resources are used.

From the viewpoint of simplifying the desulfurization systems for flue gases, decreasing the energy consumption, organizing this process without harmful wastes, and at the same time, without creating a TES of complex chemical production, the experience of the FRG (Saaberg-Hëlter firm) to perfect the lime method of purification using commercial gypsum, and the experience of Denmark (Niro Atomizer firm) for the so-called "wet-dry" gas purification are important.

The development and use at TES of steam boilers that burn coal in the fluidized bed significantly reduce the capital and fuel-energy expenditures per 1 T of decrease in the discharge of sulfurous anhydride as compared to the traditional sulfurization methods presented in table 1. One of the advantages of this technology is the possibility of significantly more extensive bonding of sulfur dioxide by the alkaline components of the mineral portion of fuel during its combustion, as compared to the standard coal-dust boilers. Therefore, when boilers are used with fluidized bed, in certain cases the solution to the problem of desulfurization can be drastically simplified, since there is no longer any need to create a complicated technological service that guarantees the introduction of alkaline additives into the fluidized bed, for example, limestone, as well as their subsequent regeneration.

Certain specialists make an excessively optimistic evaluation of the noted capability of the fluidized bed. Table 2, consequently, presents the results of computing the content of free alkali in fuel, usually represented in the form of $CaO^{cв}$, the yield of all sulfur of the fuel in the form of dioxide, as well as their molar ratio. These results are based on the data of [2,3] and are given for certain characteristic domestic fuels. The molar ratio characterizes the theoretically possible degree of bonding of sulfur dioxide with natural fuel alkali during the formation of calcium sulfate. In practice, a certain excess of free alkali above the molar ratio is required. This excess is smaller the more advanced the process.

As is apparent from table 2, the possibility of creating the simplest technology of the fluidized bed for practically complete desulfurization of gases by natural fuel alkali is quite real for the USSR power engineering only with the use of fuels that are in the upper section of the table (shale, all sorts of Kansk-Achinsk coals and Kharanorskiy fuel that is adjacent to it). A definite effect

Table 2.

Fuel (coal, shale)	$CaO^{cв}$ content mg·equiv / kg of fuel	SO_2 output mg·equiv / kg of fuel	Molar ratio $CaO^{cв}/SO_2$ in percentages
Estonian shale	5350	1000	5.35
Berezovskiy	460	125	3.70
Nazarovo	620	250	2.48
Irsha-Borodino	250	125	2.00
Itatskiy	360	250	1.45
Kharanorskiy	260	187	1.40
Angren	350	820	0.425
Chelyabinsk	60	187	0.32
Bikin	50	187	0.27
Kuznetsk T (R, oxidized)	30	187	0.161
Cheremkhovo	40	690	0.058
Volynskiy	70	1630	0.043
Donetsk ASh [anthracite coal fines]	30	1050	0.029
Ekibastuz	<10	500	<0.02

from desulfurization using the technology of the fluidized bed is also possible if Angren, Chelyabinsk and Bikin coals are burned, and to a small degree, Kuznetsk coal. Although all of these fuels, with the exception of shale, have low sulfur content, their combustion in the fluidized bed has a positive effect on sanitation of the air basin when the TES is located, for example, in certain regions of Siberia that are distinguished by unfavorable meteorological features of the atmosphere. It also follows from table 2 that it is expedient to view the fluidized bed as one of the versions of the technology of direct use of Estonian shale in constructing the new power engineering facilities based on this fuel.

The free alkali content is negligible in the mineral portion of all the other coals, as is apparent from table 2. When these coals are burned in boilers with fluidized bed at the TES, therefore, in order to ensure the assigned degree of desulfurization a considerable quantity of imported raw material, the chemical agent, is needed. The creation of special technology is required. The most effective trend for the long-term use of this equipment is its substitution for outdated coal dust boilers that need disassembly, as well as modernization and expansion of the TES that are located in ecologically stressed regions of the European sector of the country and that burn sulfurous coals.

Certain aspects of this progressive trend are not sufficiently clear and need study. It is necessary that the temperature regime of the fluidized bed meet the conditions of irreversible bonding of the sulfur oxides by the alkaline components to the greatest measure. It is also important to organize the technological process so that there is guaranteed output of the final products of the reaction between sulfuric oxides and free calcium oxidesin the form of calcium sulfate, without a noticeable content of sulfides in the removed ash. This is governed by the sanitary-hygienic requirements for the storage and use of ash-slag wastes.

A very promising trend for reducing the discharges of sulfuric oxides that is based on a change in the technology of the coal TES is the preliminary extraction

of pyritic sulfur FeS_2 in the fuel-preparation channel, the collection and burning of this highly sulfurous mixture in a special boiler with desulfurization of the combustion products. Their volume in this technology is comparatively low [1]. It is complicated to select the applicable method for removing FeS_2 in preparation for burning hard coals. As studies show, in contrast to the sulfurous brown coals, the pyritic sulfur in the hard coals is distributed significantly more uniformly in the organic mass of the fuel and can be effectively extracted only with particles 100-200 μm in size. This technology can be combined at the TES with the centralized preparation of coal dust.

The development and broad introduction into practice of boiler-building plants and heat and electric power stations of measures that ensure reduction in the discharges of nitric oxides with the flue gases as a result of a change in the organic fuel combustion technology is a still unresolved problem. In addition to the evident need for all possible expansion and intensification of these studies for the TES that use solid fuel, this task is still urgent for municipal TETs and large boilers that mainly use natural gas and furnace mazut. In order to guarantee the possible construction or expansion of these facilities, it is necessary to formulate methods for a more extensive reduction in the output of nitric oxides than the double reduction that was achieved in recent years by certain organizations on the gas-mazut energy units of the Kiev TETs-5, the Kostroma GRES and other electric power stations by using two-stage fuel burners, efficient organization of the introduction of inert gases into the burners, and maintenance of the minimum air surpluses in the combustion chamber during lengthy operation. In order to solve this complicated problem, it is expedient to first study the technically attainable maximum decrease in output of nitric oxides, in particular during combustion of natural gas and mazut at the TES, and to establish the degree of additivity of different measures with their complex use for this purpose. Based on the experimental materials of the Institute of Gas of the Ukrainian SSR Academy of Sciences one can assert that by using the technological procedures, the output of nitric oxides during the operation of large gas-mazut boilers can be reduced in the future to 100-200 mg/m^3. At the same time it is urgent to search for applicable methods of reducing the discharges of nitric oxides based on their reduction in the combustion products of any organic fuels, for example, with the help of introducing ammonia gas at a temperature of about 900°C in the absence of a catalyst, as well as by simultaneous purification of the gases of oxides of sulfur and nitrogen, for example, by the ozone method.

A requirement for evaluating the emissions of certain toxic trace pollutants has been advanced in recent years when plans of new and expansion of active TES are examined. It has definite foundations since these pollutants are present in insignificant quantities in the fuel combustion products [2]. They include lead, arsenic, vanadium, mercury, zinc and certain others. The majority of these elements and their compounds are in a solid state at 130-150°C temperature of the exhaust gases. They are trapped to a certain measure with the ash in the ash-traps. Only the compounds of mercury, fluorine and chlorine are mainly in a vapor state and are practically not trapped in the dry ash traps.

Table 3 presents the results of computing the relative harm from discharges of lead, arsenic, vanadium and chrome compounds as compared to the emitted volatile ash during combustion of Donetsk, Kuznetsk and Nazarovo coals, and the degree of ash trapping of 99% as an example. The content of listed elements in the

volatile ash is accepted from the data of V. Ye. Chmovzh (VTI). The permissible concentration of these compounds in the atmospheric air is established from a daily average sample, i.e., in the form of the MPC_{cc} [4]. Correspondingly, when table 3 was compiled, the MPC_{cc} =0.15 mg/m^3 value was used for volatile ash. The data on fuels and their combustion products were taken from [2]. In order to evaluate the effect of trace pollutants, it is customary to assume in the calculations that the trace pollutants are trapped from the gases to the same degree as the volatile ash, i.e., by 99%. It should be taken into account that usually under these conditions, the volatile ash concentration in the atmosphere, that is governed by TES emissions, is considerably lower than the MPC.

Table 3.

Indicators	Coals		
	Donetsk (A^P=23%)	Kuznetsk (A^P=16.2%)	Nazarovo (A^P=7.3%)
Content of trace pollutants in volatile ash, mg/kg of ash:			
lead Pb	170-210	15-30	14-30
arsenic As	80-110	-	28-48
vanadium V	120-170	15-28	8-24
chrome Cr	110-150	23-56	9-15
Relative harmfulness of trace pollutants as compared to discharged ash with 99% trapping,%:			
Pb	1.3-1.6	0.14-0.23	0.1-0.2
As	0.45-0.7	-	0.14-0.28
V	1-1.5	0.15-0.24	0.11-0.22
Cr	1.1-1.6	0.26-0.65	0.14-0.28

It follows from table 3 that in the case of 99% trapping from the flue gases, the content of listed trace pollutants in the solid emissions is so small that their harmfulness can be ignored in the sanitary-hygienic evaluation of the TES. In practice, however, the relative harmfulness of the solid trace pollutants discharged into the atmosphere during the operation of the coal TES can be higher than the values indicated in table 3. This is because the distribution of such elements as lead, arsenic and certain others, is not uniform in fractions of volatile ash that differ in particle size. Their content usually increases with a reduction in particle size [2,5]. For substantiated calculations it is necessary to know not only the content of a certain trace pollutant in the fuel and volatile ash, but also its distribution in different fractions of volatile ash. This requires thorough experimental work.

The calculated estimate of the effect of trace pollutants would be drastically simplified if the USSR Ministry of Public Health agencies had experimentally established MPC_{cc} and $MPC_{m.p}$ standards for the main types of volatile ash that is currently conditionally equated to nontoxic dust. These standards make a summary calculation of the toxicity of all trace pollutants and such compounds as free calcium oxide and free silicon oxide. Serious substantiations for the practical expediency of this approach are the transfer of almost all trace pollutants into the volatile ash during fuel combustion, the giant scales of energy use of the main solid fuels, especially Ekibastuz, Kuznetsk and Kansk-Achinsk coals, as well as the relative stability in their mineral composition.

Table 4.

Measure	Multiplicity of decrease in ash discharge into atmosphere (range)	Supplemental effect
Optimizing agitation regime of settling electrodes	1.3-2.0	Conservation of operating and repair expenditures
Improvement in aerodynamics at inlet to multiple-pole electric filter	1.1-1.4	-
Decrease in coefficient of excess air α, reduction in infiltration on channel with $\alpha = 1.6$ for every $\Delta\alpha=0.1$	1.3-1.4	Conservation of energy resources
Decrease in temperature of exhaust gases in safe limits for the boiler for every 10 K:		
during combustion of sulfurous hard coals and any brown coals	1.1	-
during combustion of low-sulfur hard coals	1.2-1.3	Fuel conservation
Increase in active section or volume of apparatus for every 10%	1.5	-

The discharge of toxic trace pollutants into the atmosphere can be radically curtailed by extensive purification of the flue gases of ash. As the calculations show, the decisive role here is played by the efficient trapping of the finest fractions of volatile ash of 5 μm and lower, since these particles contain the main quantity of trace pollutants. The efficiency of certain ash-trapping apparatus in trapping trace pollutants can therefore be evaluated from the change in the so-called countable concentration of ash particles in the gases. It is understandable that during ash trapping, the mass concentration of volatile ash drops more drastically than the countable.

Perfection of the operation of electric filters plays a large role in solving the problem of reducing the absolute discharge of volatile ash, including its fine fractions. This is because the majority of energy units that run on coal are equipped with electric filters. In addition to the long-term developments in this area that cover such urgent problems as increasing the reliability of the main assemblies of delivered equipment, creation of different means of conditioning flue gases, and search for more efficient methods of using high voltage rectified current, it is also very important to have the maximum consideration for the operating experience of the TES, the tuning and other organizations. A rough estimate of the comparative efficiency of different measures that reduce the volatile ash emission during the operation of electric filters and which is based on this experience is presented in table 4. Some of these measures are directly linked to a change in the technology of the main industry.

The listed trends do not at all exhaust the ways to perfect the power engineering industry associated with environmental protection. The real outlook for the main production and for reducing harmful discharges is found in the energy-efficient refining of Kansk-Achinsk coals according to the plan suggested by the ENIN [G. M. Krzhizhanovskiy Power Engineering Institute] with combined heat carrier. In this

plan, thermal breakdown of the coal dust is carried out without access of air and rapid heating to 500-850°C with the help of flue gas and products of the actual process, parts of semicoke or coke, circulating in the system. The introduction of a large unit using this method, with output of 1 million T of coal per year that is planned in the near future will permit a more complete evaluation of its ecological indicators. Another serious problem is the organization of ecologically safe storage of enormous masses of ash-slag wastes in the region of powerful coal TES. It is consequently urgent that studies be made on creating the technology to guarantee neutralization, disposal of ash during its removal, and prevention of its possible and noticeable leaching out during lengthy storage.

One should stress in conclusion that in order to successfully solve a vast circle of environmental protection problems in power engineering, a complex approach is necessary. It consists of combining ecologically efficient changes in the technology of the main production with perfection of diverse means for purifying the polluted gas streams.

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BOOK EXAMINES CLIMATE OF PAST, FUTURE

Leningrad KLIMAT V PROSHLOM I BUDUSHCHEM in Russian 1980 (signed to press 30 Jun 80) pp 2, 351

[Annotation and table of contents from book "Climate in the Past and Future", by Mikhail Ivanovich Budyko, Gidrometeoizdat, 4,100 copies, 352 pages]

[Text] Patterns of natural and anthropogenic climatic change are examined. The physical mechanism of climatic variations in the geological past and in the present era is discussed. A theory is proposed for the prediction of climatic change. This theory is tested by means of data on past climatic conditions and is employed to predict the climate of the future. It is assumed that global climate in the future will depend considerably on anthropogenic factors and, in particular, on an increased quantity of carbon dioxide in the atmosphere. Conclusions are drawn regarding climatic conditions in coming decades. The effect of climatic changes on natural conditions and on economic activity is discussed.

The book is intended for specialists with an interest in global climatic variations.

Contents

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ENVIRONMENTAL POLLUTION REPARATIONS, RESTORATION THEORY

Paris FUTURIBLES in French Feb 81 pp 17-20, 22-32

[Article by Jean-Philippe Barde[1]]

[Text] Compensation for damage caused by pollution: this is a concept which has stirred up a great deal of controversy. For the economist, the polluter's obligation to pay for the cost of damage caused by his waste products is an absolute prerequisite for economic efficiency, since it encourages the polluter to clean up to a nearly optimum extent.

This so-called "internalization of external costs" logic is at the root of the famous "paying polluter principle" and pollution taxes. Determining whether this payment for damages should or should not be used to compensate "victims" is no longer a question of efficiency, but one of equity considerations.

For the militant ecologist, the concept of compensation is frankly heretical and scandalous: we should live in an unpolluted and therefore undamaged society--consequently, compensation represents nothing less than buying the right to pollute.[2]

For the jurist, finally and above all, reparation for "ecological damage" represents an application of the general principles of liability law. But in view of the many victims and the complexity of the "matters" involved, law and jurisprudence often prove to be poorly adapted for such a situation. Adaptation is the urgent requirement: adapting to new circumstances and practices; adapting to rapidly changing needs; this requirement is so real in the case of the environment that we must ask ourselves whether we are not moving toward an actual "right to the environment." This is certainly what Gilles J. Martin wonders in his recently published work[3] and in which connection we would like to develop the following thoughts.

A Real and Permanent Need

It must be said and repeated, of course, that "it is better to prevent than to cure" and that compensation for pollution victims is only a stopgap measure intended to bandage the shameful wounds caused by pollution which, in general, should be eliminated by preventive measures. Unfortunately, in many cases it must be admitted that pollution is the cause of damage for which reparation should be made.

First of all, there is accidental pollution. We can mention the most spectacular cases, which have made the news, such as the many oil slicks (Torrey Canyon, Olympic

Bravery, Amodo Cadiz, etc.) or chemical accidents (Seveso). But for all these disasters, which are unfortunately already numerous, how many cases have there been of river contamination and groundwater pollution? Accidental pollution is not unusual and the victims should be able to obtain reparation easily. But, for example, we are aware of the immense difficulties which victims of the Amoco Cadiz oil slick are currently having in obtaining full compensation.

We should note that "accidental" pollution may be due to a case of force majeure, to negligence or to deliberate nonobservance of regulations (red mud).

But apart from these accidents, environmental damage may occur simply because, due to economic and technological limitations, total elimination of pollution does not exist. In fact, except in unusual cases (total ban of highly toxic products), pollution prevention permit a continuation of what is called "residual pollution," i.e., pollution whose discharge is permitted by emission standards. In general, standards are set by public authorities so that the environment will be in a state that is considered "acceptable," a concept which is nevertheless rather vague and which has several meanings. In reality, this concept of acceptability is quite relative; it may have an economic, technological or political content, or all three at once; it may be an optimum, an ideal or the lesser of two evils, thus depending on the case there will still be "victims" of "legal pollution" which is no less damaging even though it is residual.

Let's look at a few examples.

The emission standard may be based on ordinary technological requirements without the ipso facto result of an environmental state in which there are no longer any victims. This is the case of standards based on the "best technology available" or "feasible."

The standard may be established on the basis of economic requirements, i.e., so that excessive financial burdens are not imposed on polluters. Actually, we will most often find a combination of technological and economic requirements through the application of concepts such as the "best available technology which is economically sound." These technological, and particularly economic, limitations may well permit the continuation of excessive pollution, a cause of significant damage (for example, fluorine near former aluminum plants or an excessive noise level next to an urban freeway).

In general, we are witnessing a gradual strengthening of emission standards before attaining an environmental state that is truly "acceptable" to everyone. During these initial periods, residual pollution may be considerable.

For all these reasons, reparation continues to be an essential complement to preventive measures.

Thus in France, the polluter's observation of antipollution regulations does not exempt him from liability; government permits are granted "subject to the rights of others," i.e., that anyone who believes that he has suffered injury from a polluting installation can demand reparation even if that installation's emissions are in accordance with government permits.

An Essential Component of Environmental Right

The jurist is therefore faced with a need for reparations for damages of an exceptional scope and varied nature. As Gilles J. Martin tells us,[4] we have gone far beyond the concept of a "public nuisance," traditionally invoked in law, toward an actual right to an unpolluted environment, a right which must not just be recognized but which must be respected. To vindicate this right, the jurist is not helpless, far from it. But the instruments at his disposal often prove to be poorly adapted to the vague, complex and somewhat general phenomenon represented by pollution. Permitting victims of environmental damage to obtain quick and equitable reparation is therefore an essential component of this right to an unpolluted environment.

The victim of pollution is faced with a whole series of problems in vindicating his rights. We can identify at least six of them, which will only be mentioned briefly: 1. Difficulty in establishing a causal relationship between the source of pollution and the damage caused: actually, the relationship is mediate (via the mediums receiving the pollution), composite (synergy, indirect effects), the sources of pollution are sometimes multiple or diffuse (several polluters), etc. ... a great many factors which often make the establishment of this causal relationship complex and uncertain. 2. As a result of the preceding situation, the person with the burden of proof is often in a very unfavorable position: there is a distinct lack of correspondence between the polluter and the victim, especially since the former, generally an industrial company, has greater financial or even political possibilities of defending its interests. In most cases, there will be an unequal ratio of strength between a weak victim of pollution and a strong polluter. 3. The slow progress and high cost of legal proceedings, of course, represents a powerful counterincentive for a victim to vindicate his rights. 4. The establishment of acquired rights is particularly delicate: if a polluting plant injures persons already settled, the right to reparation is difficult to challenge. On the other hand, if persons decide to settle in the vicinity of a polluting plant, possible litigation will be particularly complex. 5. It may happen that the polluter is still unidentified. Must the victims then forgo any reparation? 6. Finally, the polluter may be insolvent.

How can these problems be solved? According to Gilles J. Martin, the basic principle is to give the victim a real "positive prerogative" based on explicit recognition of this right to an unpolluted environment, as already mentioned. To this end, the jurist will be able to propose a whole series of legal arrangements or even reforms and in this regard, we refer the reader to G. J. Martin's book, in which the author provides a very astute and very clear legal analysis.

We would in turn like to point out two essential components: 1. Systematizing recourse to the principle of liability without fault. 2. Establishing specific means of acquiring reparation for damage due to pollution, with regard to both their organization and financing.

Objective Liability

Objective liability exists when the person who caused the damage is held liable by the mere fact of the existence of the damage, whether or not he has committed an offense. Each time that pollution causes "abnormal" or "excessive" damage, the victim will be entitled to reparations; such would be the case of "residual pollution"

mentioned above: if abnormal damage is caused, the polluter will be held liable, even if he observes the pollution standard, for it is the extent of the damage which entitles someone to reparation. It is clear that recourse to this concept of objective liability for an abnormal public nuisance greatly improves the legal standing of the victim, who will be exempt from furnishing proof of a polluter's offense. The latter will therefore have to behave so as to respect the right of others to an unpolluted environment, i.e., not to cause abnormal damage; "the threshold of abnormality is crossed when use of the environment makes it partially or totally unfit for other uses." [5] Thus it is no longer the concept of an offense that will entitle someone to reparation, but rather the abnormality of the damage caused. Thus G. J. Martin talks about a "shattering of the traditional bases of liability."

In the case of the environment, this principle is now widely recognized by jurisprudence in France and other countries, particularly in Japan, when pollution causes significant damage.

But it must be noted that the principle of objective liability also constitutes an important component of international agreements setting up the means of acquiring reparation for damage due to ocean shipping of hydrocarbons[6] and the agreements concerning the coverage of risks associated with the production of nuclear power.[7] All of these agreements sanction the principle of objective liability, regardless of the extent of the damage.

Organizing Collective Financing

These international agreements are also setting up means of financing procedures for acquiring reparations for damages by requiring operators to sign a financial guarantee with an insurance company or a bank, within set limits.

Compensation funds for various types of pollution and damage are nevertheless being established in many countries. These funds actually constitute a mutual aid association, whether funded by polluters or by the government; thus these are means akin to insurance.[8]

Although the boundary is not always very distinct, it is possible to differentiate between compensation funds for accidental pollution and compensation funds for "continuous" pollution.[9]

In the case of compensation funds for accidental pollution, we can cite: the Canadian Maritime Pollution Claim Fund for compensating victims of marine pollution from hydrocarbons (fishermen, communities, etc.) when the polluter cannot be identified. The fund is sustained by a tax of 15 cents per ton of petroleum shipped. In the United States, in the state of Maine, the Maine Coastal Protection Fund, financed by a tax of 0.5 cent per barrel of oil shipped, is used to finance not only compensation for victims but pollution prevention measures as well. Finally, a fund for protection against marine pollution has been set up in Finland.

With regard to compensation funds for continuous pollution, in the Netherlands the 1972 Law on Air Pollution provides for the establishment of a fund ... "from which any person who has, on Dutch territory, suffered damage resulting from atmospheric pollution and for which he cannot be reasonably asked to pay, may, on request, be

awarded compensation determined on the basis of equity and although reasonable compensation has not been or cannot be obtained elsewhere (Article 64)."

This fund is sustained in particular by a special tax on fuels (gasoline, gas oil, gas, coal, etc.).[10]

But the case of Japan must especially be mentioned, where the "Law on Health Injuries Related to Pollution (1973)" applies to both atmospheric and water pollution; it makes no distinction between accidental pollution and continuous pollution. The law distinguishes between "nonspecific" and "specific" illnesses.

"Nonspecific illnesses" are health injuries related to atmospheric pollution, i.e., chronic bronchitis, bronchial asthma, asthmatic bronchitis and pulmonary emphysema. The right to reparations for these types of illnesses has been established in so-called "Category I" geographic zones, i.e., zones designated by ministerial decrees and in which a particularly high frequency of these illnesses has been recorded.

"Specific illnesses" are called such because they refer to illnesses caused by specific water pollutants such as mercury, cadmium and arsenic. They include Minamata disease, itai itai and arsenic poisoning. The right to reparation is established in "Category II" zones, i.e., zones in which a frequency or particularly high risk of this type of illness has been demonstrated.

In the case of nonspecific illnesses, the system is financed by a tax on emissions of atmospheric pollutants: a tax on SO_2 emissions for stationary installations and a weight tax for motor vehicles. Eighty percent of the tax proceeds comes from stationary sources and 20 percent from mobile sources. The proceeds from this tax increased 17-fold between 1974 and 1976, rising from $9.6 million to $165 million.

Compensation for specific illnesses is paid directly by the polluter or polluters liable in proportion to their contribution to the pollution identified. In this case, the collective character of the financing is much less pronounced, although public authorities can provide the compensation in advance and then demand reimbursement from those liable (recourse action).

In the case of noise, the organization of compensation funds is not unusual:[11]

In France, a special tax for financing the soundproofing of buildings in the vicinity of the Roissy-Charles de Gaulle and Orly airports has been collected since 1973. Each passenger pays 1 franc for domestic flights and 3 francs for international flights. The funds are collected by the airport and distributed by a special commission for maximum financing of two-thirds of the cost of soundproofing public and private buildings. Between 1973 and 1979, Fr 160 million were collected in this way. A reform of the system, in terms of varying the tax on the basis of airplane noise levels, unfortunately failed, since the Council of State ruled that the Airport of Paris, a government establishment, was not authorized to collect this kind of tax.[12]

In Japan, a special landing tax collected since 1975 is used to finance compensatory measures such as rehousing of adjacent residents, land purchases and acoustical insulation of dwellings.

In the Netherlands, the draft amendment of the law on aviation provides for financing compensatory measures by means of a tax on airplane noise. Similarly, the law on noise nuisances (recently passed) provides for reparation in kind (soundproofing of buildings) for owners of buildings exposed to excessive noise levels alongside traffic routes (highways, freeways, etc.). These measures will have to be financed by a tax on motor vehicle noise.

In general, without necessarily setting up funds, several countries are establishing specific means of acquiring reparation for damage due to noise:

In the FRG, the 1974 federal law on pollution provides for reparation in kind (acoustical insulation of buildings) for owners of buildings exposed to a noise level exceeding the prescribed limits and originating from a new highway, freeway or railroad; the same reparation measures are provided in case of significant modification of a highway or railroad. The March 1971 law on air traffic control provides for protective zones around airports, within which compensation may be paid to the residents most affected (compensation for loss of property value, for acoustical insulation of dwellings).

In the United Kingdom, the 1973 Land Compensation Act provides for compensation in specie and in kind for damage due to noise from public works such as highways and freeways every time that dwellings are or will be exposed to a total noise level of 68 decibels A [adjusted] (dBA) or higher, based on the index $L_{10}/18$ hours.[13]

In France, there is no regulation systematizing this approach, but a new trend can be noted in reparation measures for areas bordering on urban expressways. Thus in the suburbs of Lyon, provisions have been made to soundproof 3,000 dwellings located next to urban expressways for a total cost of Fr 40 million. This practice also seems to be taking hold in the Paris area.

Main Components of a Reparation System

Although still recent, the experience of the various compensation systems mentioned above makes it possible to draw certain conclusions concerning the main components needed for setting up such systems. Each one deserves a detailed analysis; we will confine ourselves to a brief survey.

Damage

Any reparation system must provide for regulations which permit as precise a determination as possible of the damage entitling someone to reparation.

It is especially important to provide for whether damage from residual pollution entitles someone to reparation. Such is the case of the systems used in Japan, the Netherlands, the United Kingdom and in France, which establish a permanent right to reparation without the pollution necessarily having an abnormal, excessive or accidental character, with regard to current standards.

Moreover, specific measures can be provided for certain types of accidental pollution (nuclear power, hydrocarbons, chemical products). Special measures for accidental chemical pollution should especially be provided.

The type of pollution must also be specified in advance, i.e., the pollutant, the receiving medium and the respective type of damage. Thus in the case of a victim, the very fact of being affected according to a predetermined causal process entitles him to reparation.

It is important to define the type of compensable damage, such as injury to health (list of illnesses), property damage (buildings, crops, etc.), loss of amenities, etc. It is obvious that a specific but limitative list must be drawn up.

Compensation can apply to past damage (for example, following accidental pollution) or to future damage (purchase of an easement as compensation for a right to pollute, soundproofing of dwellings).

The geographic zone of pollution may possibly be defined, as is the case in Japan: length of residence in this zone then constitutes one of the factors to be considered.

Finally, there may be the question of whether or not to establish thresholds below which no compensation can be paid. The question is delicate, since the establishment of such thresholds is contradictory to the general environmental right which the principle of reparation establishes, or at least it limits this right. It is also necessary to carefully examine the relationships between such thresholds and the emission standards for pollutants and environmental quality. If the threshold (for example, sulfur content of the atmosphere) is below the quality standard, it constitutes an explicit recognition of the inadequacy or provisional nature of quality objectives; if it is the same as the standard, the threshold establishes that once the objectives are achieved, the environment is in an "acceptable state" for everyone and thus rules out the right to reparation for any pollution level less than or equal to the quality standard (in this case, the regulation according to which permits are issued "without prejudice to the rights of others" no longer applies, at least partially). Finally, if the threshold is higher than the standard, there is an obvious contradiction between the environmental policy and the reparations procedure.

However, damage thresholds can be set in various ways. The Airport of Paris applies compensatory measures only to residents of so-called "loud noise" zones defined by a noise exposure index.[14] British law provides for compensation only in the case of noise levels exceeding 68 dBA (L_{10}/18 hours).

In general, the damage process will have to be described beforehand, i.e., the links in the chain from the source (to be named as well) to the victim.

Reparations

Reparation may be payable in kind (for example, soundproofing) or in specie (or both).

It may be individual or collective (for example, payment to a local community).

It is especially important to develop standards for evaluating compensation in order to avoid complications, arbitration and disputes.

It must be noted that in an industrial and highly urban society, pollution prevention measures are not always adequate and some people may suffer injuries which are often quite serious: accidental pollution is always possible, as demonstrated by the news;

moreover, so-called "residual pollution" may sometimes prove to be injurious; finally, negligence or nonobservance of regulations is always to be feared. We might add that environmental policies have not yet reached an entirely satisfactory stage: they are still being developed step by step and standards are strengthened only gradually; thus it is not surprising that in the course of this long and difficult process, some victims of pollution have to suffer more than others, not to mention the possible failures of certain policies.

Thus it is a question of providing for equitable compensation for these victims of pollution. It is therefore necessary to establish three essential components: a right, an organization and financing.

A right means the explicit recognition and codification of basic principles derived from each individual's right to an unpolluted environment. As G. J. Martin notes, this right is already solemnly proclaimed internationally by Article 1 of the Declaration of Stockhol (1972) and by the Council of Europe. This environmental right is also established in certain national laws (United States) or even in constitutional texts (Spain, Article 45 of the new constitution; Portugal, Article 66; Switzerland, Article 24; Greece, Article 24; Hungary, Article 57; Poland, Article 12). From a right to the environment, we are moving toward the development of a right of the environment, i.e., the development of a consistent set of regulations[15] governing these conflicting relationships between these various users of "environmental goods" (air, water, space, etc.).

There are already general laws on the environment (for example, the 1976 law on the protection of nature), a whole series of very diverse regulations recognizing certain principles of right, as well as an actively developing jurisprudence. It is time to assemble and coordinate this disparate mosaic, these "successive layers of limited regulations."[16]

An organization means the establishment of effective means and procedures to permit rapid and equitable reparation for damage: definition of the types of pollution, of the types of damage, of their process of occurrence, of their evaluation procedure, etc.

Financing means providing for the system's proper operation and guaranteeing the payment of compensation. In general, we find that the solution of compensation funds financed by taxes has multiple advantages: collective financing ("establishment of a mutual aid association for risks"), equity (financing by polluters) if necessary, an encouraging effect if actual pollution taxes are involved. The funds may be regional, national or even international (marine pollution): in this instance, the solution must fit the type of problem involved. (We might note that insurance of pollution risks (liability insurance or damage insurance) may also provide a partial answer to the problem of financing compensation. This is a considerably different approach, of course, since insurance companies would administer the system and not public authorities. But it may be noted that the establishment of compensation funds represents a solution verging on that of insurance, since a sort of mutual aid association is established.)

What sort of place must reparation have in environmental policies? We have to answer that it should have an important place as a principle of equity but as limited a

place as possible in practice: prevention of damage must continue to be the golden rule and we must proceed so that minimum damage occurs. Reparation thus adds the requirement of equity to that of efficiency; organizing means protecting victims but also, to a certain extent, encouraging polluters to exercise care, for a properly operating reparations system can be a powerful incentive not to pollute. Finally, reparation constitutes a powerful instrument for the emergency and application of a "right of the environment." To achieve this, the jurist, economist and public official can and must make their efforts converge.

Determination of Pollution Thresholds

Why is one level of atmospheric pollution established as an objective rather than another? By virtue of what criteria is a certain pollution level considered to be acceptable? Since this involves public choices, it would be tempting to reply: "By virtue of a political choice," implying: by means of delicate balances between different criteria. What criteria? Answer: economic, ecological, technological, sociopolitical, geographic and other criteria ...

Let us try to define these criteria briefly.

For the economist, the acceptable state of the environment is the one which makes it possible to maximize the difference between the advantages of a policy (avoided damage measured in economic terms) and its costs (costs of fighting pollution). In other words, it is a state corresponding to "optimum pollution," i.e., a situation in which society manages its resources in the most rational way, from an economic standpoint.

The ecologist would instead define the acceptable state of the environment as the absence of disturbance to ecosystems, actually a state of nonpollution. In reality, any pollution in an ecosystem constitutes a shock which initiates an imbalance that increases with the quantity of pollutants.

We will note the incompatibility between the ecological criterion and the economic criterion. In the first case, any pollution, even at very low levels, is unacceptable; in the second case, pollution is still acceptable as long as it does not reach the level beyond which it results in a social cost; such a level generally proves to verge on the medium's maximum assimilation capacity. For example, it is only when a lake approaches eutrophication that serious annoyances arise for man (social costs). Actually, what constitutes a ceiling in ecology is only a threshold in economics.[17]

The acceptable state of the environment may also be based on sociopolitical criteria: polls on the perception of individuals, votes and referendums on the objectives to be achieved.

Technology may also be a decisive factor in the selection of a pollution level: the control of emissions will be based on the level of purification technology (Anglo-Saxon practice of the "best available or feasible technology").

An antipollution strategy is also dependent on negotiations with polluters, in which ratios of strength are decisive: establishment of emission standards case by case, "industry agreement," etc.

The acceptable state of the environment is thus a completely relative concept. It is a relative concept geographically: ignoring differences between countries, it will be noted that a relatively high pollution level, tolerated in certain urban and industrial areas, may be considered absolutely unacceptable in a rural area; a noise level of 60 or 65 decibels in front of dwellings is accepted in the city and rejected in the country. Thus objectives vary according to circumstances. It is also a relative concept from the standpoint of time: the acceptable level, if precisely defined, corresponds to an environmental standard, an objective to be achieved in the future. In the best of cases, a long- or intermediate-range policy is established to achieve this objective. It is also not unusual for there to be one or more revisions of these objectives according to economic and political circumstances (cf. revisions of automobile emission standards in the United States).

Public preferences may also change with lifestyles. At any rate, what is acceptable to some is not always so for others; it must be recognized that a certain elitist ideology sometimes tends to impose a preference for a certain type of environment which does not necessarily correspond to the aspirations of other classes of the population.

We should also note that the perception and definition of an acceptable state of the environment are highly dependent on the available means of observation and measurement; we still do not know how to evaluate pollution and nuisances well, whether in physical or economic terms. Deeper knowledge may lead to a revision of objectives and priorities.

The acceptable state of the environment is thus a relative concept: relative according to the criteria, relative in space, relative in time and finally, relative according to political means.

Oil Slicks: Who Pays?[18]

In early 1980, the approximately 250,000 residents of coastal villages near the Niger River delta (in the Nigerian state of Rivers) watched their livelihood disappear under conditions totally beyond their control. On 17 January, a Texaco drilling platform exploded offshore (due to human error, the company explained). In 2 weeks the equivalent of 280,000 barrels of oil spilled into the sea. With the help of wind and swells, the oil slick spread over nearly 100 km of coastline and penetrated the Niger River delta as far as 30 km from the sea. The effects of this accident, which attracted hardly any attention, are extremely serious.

The villages of the Niger River delta earn their living from fishing. Fishermen spend a large part of the year on the coast and go back to their inland villages from time to time. Crops are rare in this region. Essentials are bought with the income from fishing. In 1 night, the only source of revenue had vanished. With no other means of existence, most of the fishermen left the delta to return to their villages.

Following the explosion, Texaco strove to stop the flow of oil and tried to limit the pollution by strewing sawdust on the beaches and detergent on the oil slicks. But the Rivers state public authorities were informed very late. Immediate assistance of 1 million nairas (slightly more than $2 million) was sent to the disaster area

and the national emergency assistance agency later released 2 million nairas. Texaco in turn donated about $900,000, less than one-sixth of the funds granted by Nigerian public authorities, but nothing obliged the company to do so from a legal standpoint.

Nature is slowly regaining the upper hand. Fish are coming back and so are the fishermen. But the return to normalcy will not occur tomorrow. This incident highlights the need for stricter regulation in countries off whose shores drilling platforms are operating. In this regard, developing countries are behind the industrialized world: they need laws to protect their own nationals and to enable them to control the operations of multinational corporations. West African countries do not suffer only from oil slicks. Their shores are also exposed to the effects of ballasting and tank cleaning operations performed by ships crossing the Gulf of Guinea.

By a certain twist of fate, a Texaco representative had held a seminar in Port Harcourt in November 1979 concerning the measures to be taken in the event of oil pollution. He suggested confining oil slicks by means of a kind of boom and then drawing off or burning the oil. His proposals were well received but were not considered at all at the time of the accident 2 months later. The price was paid by 250,000 Nigerians.

FOOTNOTES

1. International official, coauthor of "Economie et Politique de l'Environnement [Environmental Policy and Economics], Paris, PUF [French University Press] 1977. The opinions expressed in this article are those of the author and are not representative of the organization to which he belongs.

2. See our article, "Ecology and Economy," NUISANCE ET ENVIRONNEMENT, May 1976.

3. "Le Droit a l'Environnement" [The Right to the Environment], Publications Periodiques Specialisees, 11 Rue d'Alger, Lyon 1978, 292 pp. See also: P. Girod, "La Reparation du Dommage Ecologique" [Reparation for Ecological Dam Damage], Paris, LGDJ 1974. (This article reflects personal considerations and in no way constitutes a summary of G. J. Martin's work, even if we refer to it often therein.)

4. G. J. Martin, op. cit.

5. G. J. Martin, op. cit.

6. "Agreement on Civil Liability for Damage Due to Pollution from Hydrocarbons" (Brussels, 29 November 1969). Brussels agreement of 18 December 1971 establishing an international compensation fund.

7. OEEC [Organization for European Economic Cooperation] agreement on civil liability concerning nuclear power (Paris, 29 July 1960). Supplementary agreement on civil liability concerning nuclear power (Brussels, 31 January 1963). IAEA [International Atomic Energy Agency] agreement on civil liability concerning nuclear damage (Vienna, 21 May 1963). Brussels agreement on liability of nuclear-

powered ship operators (25 May 1962). These agreements are analyzed in "Aspects Juridiques de la Pollution Transfrontiere" [Legal Aspects of Pollution Across National Borders], Paris, OECD [Organization for Economic Cooperation and Development].

8. Civil liability insurance for the risk of pollution is partially covered in France by the GARPOL insurance pool established in July 1977. The coverage offered has numerous limitations, however.

9. "Continuous" pollution means pollution discharged continuously in a legal ("residual" pollution) or illegal way.

10. Cf. "La Pratique des Redevances de Pollution" [The Practice of Pollution Taxes], Paris, OECD, 1980.

11. For a detailed analysis, see: "Reduire le Bruit dans les Pays de l'OCDE" [Reducing Noise in OECD Countries], Paris, OECD, 1978.

12. Cf. LE MONDE of 21 February 1978.

13. L_{10} = noise level exceeded 10 percent of the time for an 18-hour period.

14. Noise index of 96 corresponding, for example, to 250 planes per day, each producing 102 PNdB [perceived noise decibel].

15. Just as recognition of the right to work has given rise to the appearance of a duly codified right of work (G. J. Martin, op. cit.).

16. G. J. Martin, op. cit.

17. See J. P. Barde and E. Gerelli, "Economie et Politique de l'Environnement," Paris, PUF 1977.

18. By John Madeley, EARTHSCAN, vol. 3, no. 8.

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FEDERAL REPUBLIC OF GERMANY

STUDY SHOWS POOR AIR QUALITY IN CITIES

Hamburg STERN in German 12 Feb 81 pp 209-210

[Article by Sebastian Knauer: "Thick Air"]

[Text] A new study shows that the FRG is the world leader in air pollution.

VOLKSBLATT BERLIN provides its readers with a new consumer service. However, the tips have nothing to do with potatoes, vegetables or pork, but rather with the commodity "air." In a regular column called "Smog" information is provided about the condition of air in large cities. The quality of the 10,000 liters of air which every person uses each day is so poor that the best advice is actually not to breathe.

This is the finding of political scientist Martin Jaenicke, 44, professor at the Free University of Berlin. He compared the sulfur dioxide and dust pollution level of 97 large cities in 17 Western industrial countries. Both substances are the cause of stubborn troubles in the respiratory passages and infectious diseases.

In respect to dust pollution Munich, Nuernberg and Hamburg rank ahead of the American industrial city of Chicago on the international hit list for pollution. The air in Essen, Cologne and the spa Wiesbaden has more sulfur dioxide than the metropolis of Tokyo with 12 million people. Among the leaders, Berlin is surpassed only by Ankara, with a reading over the legally permitted maximum value.

After a decrease in the amount of pollutants in the first half of the 1970's the air along the Spree River has been getting thicker again since 1976--likewise in Duisburg and Mannheim. Prof Jaenicke says: "The air pollution in the FRG is not acceptable by international standards."

The judgment applies to an environmental policy which began quite early to fight for clean air. In 1961 Willy Brandt promised "blue sky over the Ruhr." In 1974 the "Technical Instructions for Maintaining Clean Air" were tightened up. Some 4 years later after investments of millions in filter plants Minister of the Interior Gerhart Baum expressed the hope that "in general no dramatic increase in air pollution need be feared."

In the past year more than 4 million tons of sulfur dioxide were released in the air in the FRG. Half of that came from coal power plants, primarily obsolete plants. Yet the power producers hesitate to modernize these plants since the filth spreaders have been running profitably for decades.

And in the future, thanks to EC law, new coal plants will be permitted to release more harmful substances into the air. Concealed in an EC ordinance, observed only by experts, concerning "maximum values and acceptable values of air quality," German environmental law was torpedoed. Effective 1983 the permissible maximum values for airborne dust will be relaxed. An additional one-third of the fine dust which deposits environmental poison in lungs will be permitted in the future.

In the licensing procedures for new coal power plants less strict values are being employed today. Environmental researcher Jaenicke says: "The air is once again available for polluting."

How the citizen is to behave in the event of a smog alarm is revealed in Berlin by a friendly voice on the environmental protection telephone: "Avoid heavy domestic tasks, don't light any candles, cooking and baking made the air worse in the home."

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