ENVIRONMENT AND HEALTH IN ITALY

Executive Summary

The report entitled "Health and the Environment in Italy", whose main topics are summarised here, was commissioned by the Italian Ministry of Environment to the European centre for the Environment and Health in order to launch a study on environmental exposure in Italy. In particular, the Ministry requested a preliminary report on declared high risk areas of environmental crises, in order to be able to identify possible differences in mortality rates compared to the rest of the country.

Introduction

Human health is influenced by many factors: genetic predisposition, life style, socio-economic status, access to health services, living and working environments. One essential requirement for maintaining an acceptable level of health is that of having good environmental resources available continuously. The quality of air, water, food and housing are determining factors for human health. However, for many population groups neither environmental conditions nor social conditions are always reassuring or sufficiently adequate to avoid being a serious problem for public health.

Tracing the dangers for human health to natural evolution in the environment or on natural disasters becomes irrelevant for the purpose of identifying the availability of resources. Instead, the evaluation of the risks which are presumably run by large population groups exposed to harmful factors or lack of structures and services takes on a more relevant role. In this respect the evaluation of health risks in large industrialised societies tends gradually to be tranformed from a strictly academic question and begins to be part of the economical and political programmes. The estimation of the impact which environmental agents have on health requires the availability of data on levels of exposure of the population. These evaluations are especially complex due to the variability of individual conditions of exposure and to the lack and incongruity of monitoring data. Exposure is therefore estimated by extrapolation as well as by the use of hypotheses or models which, even though reliable, are the cause of often notable uncertainties. For this and other reasons, epidemiological and toxicological studies, carried out on many exposures to substances or situations which are considered to be dangerous, do not provide a complete knowledge of the effects which many agents have on health.

This summary attempts to provide, as far as possible, an estimation of the extent of the Italian population exposed to environmental factors which are potentially harmful to health. Our general picture is incomplete for certain things and too peremptory for other things when compared to the risks it illustrates. What can be said about this incompleteness if not that the subject "which information" is a priority for the environment? On the subject of peremptoriness of the information, on the other hand, provided in the form of tables, without comments, it suffices to say that the pattern chosen takes on importance - losing the characteristics of a public denouncement, which has never been the intention of the report - if it is read as a guide to possible choices in terms of public health with regards to the environment. On this subject we would like to remind you that the volume attempts to isolate the exposures found in the anthropic environment, relegating individual or genetic risk factors to a marginal position.

Some general aspects

If some indicators of the state of health in Italy are compared with those of other European countries, a reassuring image of Italy emerges. General mortality and life expectancy are among the best compared to the rest of Western Europe and are much more favourable than those of Eastern Europe. The following table and the graphs which appear in the Appendix illustrate these trends.

Life expectancy at birth in years (1990)

	Males	*Females*
North	73,3	80,6
Centre	74,7	81,0
South	74,2	79,8

The situation within the country and especially the well known geographical differences can be quickly described by some indicators.

All cause mortality by sex and geographical area in 1970 and in 1989 (age-standardised rates per 1000)

	1970		*1989*	
	M	*F*	*M*	*F*
North	12,0	10,5	8,8	6,6
Centre	10,2	9,6	8,0	6,6
South	10,0	10,4	7,8	7,2
ITALY	11,0	10,3	8,3	6,7

All cause mortality and specific cause mortality indexes are among the indicators which are used to describe the state of health of a population. The first mostly reflects the risks which derive from the society's structure. The second is a more useful instrument when identifying specific factors to concentrate on. In terms of public health, as is well known indexes increase in importance when they are compared to the territory or time, whereas the search for constants in their trends can provide indications of health risks which must be kept under control.

The third table in the appendix shows two maps of Italy which present the distribution by province of "all causes" mortality in Italy (standardised ratios of mortality from 1979 to 1987), together with that of another index which traces the percentage of "avoidable deaths" (between the ages of 5 and 64) following the Rutstein selection of pathologies. The latter helps provide an indication of the overall efficiency of health systems (prevention, diagnosis and treatments) and, therefore also an indication of how much the mortality rate can in theory be improved.

The situation in Italy shows two aspects. The first, which has been known for some time, is the lower mortality in the centre/south than in the north. The second shows that, at least according to the Rutstein index, the low mortality rate in the south could be further improved by means of better health assistance and information. In the north the avoidable death rate is

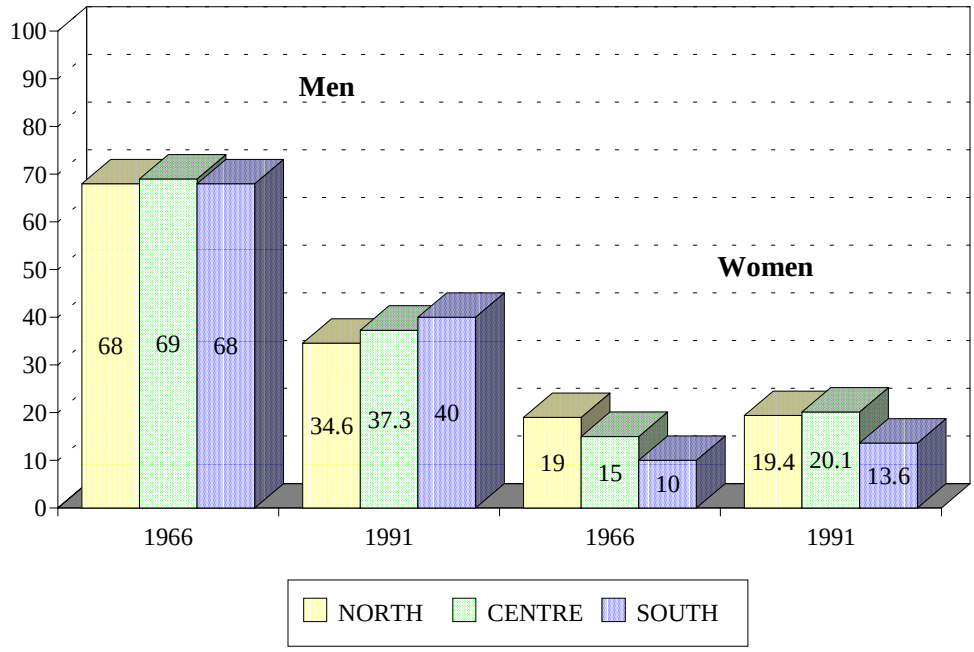
lower, although some provinces have rates comparable with those found in the south. From this point of view, research of the causes which link the variations in the state of health to the geographical area becomes extremely important for the development (not just economic) of the country. The Report summarised here attempts to analyse some of these aspects at various levels.

A first "macro" level

It could be interesting to summarise some general aspects of the Report from the state of health to risk factors in order to provide a complete outline into which some results of the survey on environmental exposure can be placed.

The geographical trend of death by cancer of the lung and of the stomach (the first and second in the list of deaths from cancer among men in Italy), as for ischaemic and cardiocirculatory pathologies, confirm the north-south trend which was described above, if anything increasing the geographical trend. The main associated risk factors are smoking and dietary habits. Using available population data, the percentage of male smokers, homogeneous in 1966, appeared higher in the south in 1991 compared to the centre/north. The exact opposite applies to women. The percentage of female smokers in the south of Italy is lower than the rest of the country for both periods taken into consideration. The marked decrease in the percentage of male smokers during this time in contrast to an increase in the number of female smokers (stable number in the north) should also be pointed out.

Percentage distribution of smokers among the Italian population



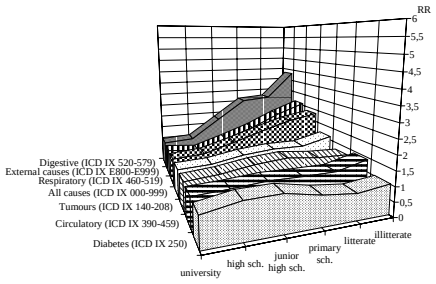
Source: Doxa, 1966 survey and ISTAT, 1990-91 Multipurpose Survey

With regards to diet, the main geographical difference is represented by the type of fats consumed, which in the south are normally of vegetable origin and not of animal origin, as well as a larger use of vegetables themselves in the south.

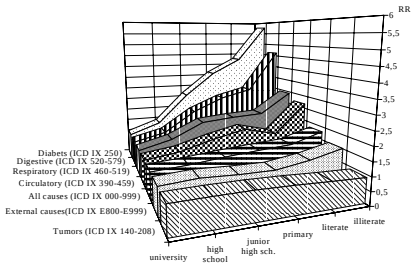
The anthropic environment could therefore play an important role, together with the types of exposure typically linked to the workplace, in determining the differences in mortality which have been observed. In this respect, if the term environment, used in a limited way in this report, is meant as the habitat of population groups, in other words the territory where most of our lives are spent, aspects such as access to services, economic conditions, housing, the quality of air, water, food, communication routes and the absence of other harmful conditions take on a greater importance. There is an inverse relationship between the increase in the socio-economic level and risk of dying. This difference is probably due to the greater possibilities of gaining treatment, greater awareness and prevention and to the middle class's possibility of doing less physically taxing jobs compared to those people with no qualifications. Many illnesses are more common among lower social classes. Below the age of 55 male graduates run half the risk of dying compared to someone who only completed primary school. For women the corresponding ratio is 0.8.

Relative risk of mortality in Italy by sex, educational qualification and cause of death between the ages of 18 and 74 (November 1981 - April 1982) (RR = 1 for graduates)

Men



Women



Source: Reprocessing of ISTAT survey data on mortality differentials (Faggiano, Gnavi, Lemma, Bonetti, Pagnanelli, Costa; 1993)

Exposure to agents which are harmful for human health therefore tend to take on a priority role for public health. Research intent on identifying the actual importance of these causes of morbidity is only at the beginning, especially concerning the estimation of their cost in terms of direct costs and in terms of productive or social loss.

The report "Environment and Health in Italy" has attempted to analyse some environmental areas using available monitoring data and risk evaluations in order to try and quantify the population exposed and to lay down the basis for a broader involvement of the scientific community in this research. Below some aspects contained in the report are summarised.

A second more analytical level

The estimation of the population exposed to substances which are dangerous for human health is carried out in relation to the so-called maximum acceptable doses which are defined by standards and by bodies of legislation. Maximum acceptable doses are established using scientific criteria, but they are subject to changes as new knowledge is collected. Respecting the maximums allows a reasonable belief, but not an absolute reassurance, of the absence of risk for those exposed.

Each substance in the human environment is toxic if it is taken in excessive doses. Ideally, the risk of harmful effects could be estimated if, as well as environmental concentrations, we also knew the various ways of absorption, metabolism, the dose for the target organ, the interactions of the substance and its metabolites with the cell constituents, without forgetting the corresponding heterogeneity of susceptibility of each person in a population. In reality, environmental monitoring initiatives are lacking (in Italy too), as are basic research programmes which could make up for this lack.

Whereas for most toxic effects the idea of the existence of a threshold dose is accepted, below which it is possible to exclude risk, carcinogenic effects are commonly considered to be stochastic (without a threshold). It is possible that this is not the case when the action mechanism is different from an interaction with DNA, but proving the absence of the latter is problematic, as is the demonstration of any "negative". Given the size of the general population, limited risks, created by the presence of small quantities of carcinogenic substances in environmental areas, could lead to a substantial number of excess cancers. However, estimating the risks attributable to exposure in the general environment can be a useless exercise, given the number of assumptions taken for granted (which change each time according to the consistency of the subpopulations groups exposed, the size and the distribution of individual exposure and the differences in individual susceptibility) and the fragility of many of these things. For example, it is not possible to judge the accuracy - and how far it can be applied to Italy - of the estimate that, in the United States, chlorinating water annually causes about 10,000 cases of cancer. Furthermore, whereas the carcinogenicity of a certain number of substances is known to be a certainty, many others are only known to be probably or possibly carcinogenic.

In Italy, the debate on socially acceptable risk has been limited up to now and there does not seem to have been - for substances present in the general environment - circumstances in which the evaluation of the relationship between carcinogenic risk and benefit for a part of or all society has been put into definite terms.

Air

Air is one of the environmental media for which the lack of available data, is added to the need for epidemiological knowledge and estimations of risk that are not satisfied by the current systems and methods of sampling. The placement of urban sampling stations in non-residential areas, or places chosen under different criteria in different cities, the type of recording and the little use of monitoring of some substances (e.g. total suspended particulate is measured but not its inhalable fraction) represent some examples of the lack of communication

between various bodies. It should also be pointed out that that the most recent legislation concerning the quality of air, although not still fully applied, are capable of partly resolving these problems, especially those concerning data on the concentration of various compounds.

As a general trend, we can state that the available data on the Italian environmental situation, even though they are limited in number and quality, indicate the presence of numerous areas, especially urban areas, that have pollution levels higher than those indicated by European guidelines. Contamination by suspended particles and by nitrogen dioxide is of particular importance**.** The diffusion of ozone, even though the levels of contamination are still largely undocumented, seems to be an important and diffuse phenomenon. The increase in the number of cars in circulation is responsible for most of the pollution recorded.

Concentration of main pollutants and health implications

Pollution level trends for sulphur dioxide (SO_2) are decreasing and many situations in Italy seem to be under control. The alteration in fuel quality has played an important role in improving air quality. According to available data, no urban area exceeds the annual median of average daily concentrations of 50 $\mu g/m^3$, while in cities such as Turin and Milan the WHO guideline of 125 $\mu g/m^3$ in 24 hours is exceeded during 2% of the days of the year. The situation can be different in densely populated urban areas that are close to industrial sites (especially thermo-electrical plants). In these area the standards of air quality seem to have been respected over long periods of time according to statistics, although in the areas of Genoa and Priolo (SR) the guideline of 125 $\mu g/m^3$ is exceeded in more than 2% of the days of the year. However, sudden loads of activity in certain moments of the day can bring about high levels of concentration over short periods of time (concentrations higher than 350$\mu g/m^3$ lasting from a few minutes to 1-2 hours). As international literature documents short term health effects for such peaks of exposure, it is necessary to maintain extreme caution when controlling emissions of this pollutant. With regards to industrial areas, it should also be pointed out that Italian studies concerning children residing close to thermo-electrical centres have shown health effects even in the presence of average annual concentrations that are in line with guidelines. These effects can also be attributed to potential and reoccurring episodes of acute pollution (by SO_2 and by dust), or to the environmental toxic substances, resulting from combustion processes, which are normally not subject to controls. Greater attention should be paid, however, to the characterisation and the nature of pollutants close to industrial sites, to the presence of peaks of exposure and to the simultaneous presence of various environmental toxic substances.

Most Italian cities, at least for those with available data, show an excess of the annual guideline of 60 $\mu g/m^3$ for pollution by total suspended particulate (TSP). For more than half the days of the year in Rome, Milan, Bergamo, Turin, Modena, Bologna, and Pisa, the concentration of TSP is higher than the guideline and levels of 125 $\mu g/m^3$ over 24 hours are exceeded for at least 5% of the days. This picture is probably shared by many other cities. In Turin and Milan the number of days in which the guidelines are exceeded is doubtless greater.

The increase in levels of pollution by nitrogen dioxide (NO_2) is an important and serious phenomenon in Italy, and is a direct consequence of the worsening of the traffic

problem. Most cities for which data are available show daily concentration levels that are higher than 150 $\mu g/m^3$ (WHO guideline) for several days per year.

Ozone concentration levels vary greatly both geographically and in time as the formation of ozone depends largely on weather conditions, as well as on the availability of precursors (NO_x). From data given out in August 1994, when many Italian cities showed levels which were well above 200 $\mu g/m^3$ it can be said that ozone represents a very important pollutant in Italy, also because the data currently available probably underestimates the population's exposure. For example, in 1993 the sampling stations in the centre of Rome reported 16 excesses, compared to 106 excesses found in Colleferro (a small urban centre in the province of Rome). High values can be found in many urban areas and also in non-urban areas in the centre and south of Italy. In the report "Concern for Europe's Tomorrow" the WHO considered ozone pollution to be one of the priority problems for the European Mediterranean countries and estimated that at least 50% of the population is exposed to levels that are higher than the guideline of 200 $\mu g/m^3$, while a percentage of the population between 63 and 95% is exposed to concentrations higher than 150 $\mu g/m^3$.

The following table shows the short term effects of pollution on the state of health of exposed subjects.

Variation in the state of health in relation to some indicators of air quality

	For concentration values:		Estimated variation in mortality		use of hospital services	respiratory tract diseases
	mean $\mu g/m^3$	if ab. 24h $\Delta\mu g/m^3$	all cause	resp. syst.		
Total Particulate (TSP)	180		(+)	(+)	(++)	(+)
PM_{10} Particulate (breathable fraction $\phi 10\mu$)		+10	+1%	+3.4%	+1-2%	from +0.7 to +3.4%
SO_2	>150		+4%	11%	+10%**	
NO_2	>50 / 70	+20				+20%
Ozone	>200					(++)

(*) missing information does not mean absence of effects but no estimate available
(**) associated to exposure peaks per 100 $\mu g/m^3$
(+) = effects present but difficult to quantify

International literature has consistently shown an effect of environmental pollution on the aetiology of tumours, especially lung cancer. The impact in terms of population exposed and of attributable risk can be considerable. By applying the available estimates, residents of urban areas have an increased risk of between 9 and 33% of contracting lung cancer, regardless of whether they smoke or not. This estimate can be reasonably considered to be the upper excess risk limit for this pathology specifically due to environmental pollution.

Epidemiological studies in Italy, though not final, seem to indicate excess risk of cancers in various sites for different categories of workers who are exposed to vehicle exhaust emissions for various work purposes (drivers, traffic police, petrol pump attendants). As occupational exposure to such emissions is extremely widespread, various categories of workers could be affected.

Water

The availability and quality of information about water reflects the maze of responsibility among the bodies which govern the sector: the data is often fragmentary and is difficult to trace to each water basin or water supply service. The lack of coordination between the administrations, organisations and institutes responsible for the monitoring, drawing, treating, supplying and controlling of waste water is one of the biggest problems and is a priority for any improvements to be made. It is not only a question of information but also government and responsibility in the whole sector. There is some new legislation (e.g. law 183/1989) which is however difficult to enforce.

Water, even when it is used for recreational activity, should be seen as a resource, which can be purified and recycled and which is a possible carrier of harmful substances. It is very difficult to summarise the state of health of the water bodies in a short time without limiting the focus of attention on general denouncements of degradation. The organic biodegradable load, the availability of drinking water, the presence of chemicals and bacteria are described here as examples of the state of the sector.

Purification

The 5,279 existing water purifying plants in Italy can potentially purify water for more than 55 million people, or rather 96% of the Italian population, in line with other European countries. However, if we turn our attention from potential supply to actual supply provided the situation changes. The population actually served is a little more than 34 million inhabitants and the purifying capacity of the existing plants is only two-thirds used. North east Italy enjoys the highest levels, both in terms of potential service offered (110.6%) and of population actually served (77.9%), while the worst situation can be found on the Italian islands (27% of the population served compared to a potential of 58%) and in the south of Italy (53.1% of the population served compared to a potential of 83.4%). The regions with the greatest problems are Basilicata, Molise and Sicily. 193 purifying plants were built in Sicily between 1979 and 1989, of which 145 are not operational, thus the percentage of the population served is about 20%.

By using the installed potential, the quantity of organic material which is not purified and poured into water bodies and then into the sea can also be estimated. If the latter is considered in terms of BOD_5[1], phosphorus and nitrogen, it is estimated that 1,507, 59 and 238 thousands of tonnes respectively per year are poured into the Mediterranean. This estimate is

[1] BOD (Biochemical Oxygen Demand) is the quantity of oxygen required to oxidise the organic material present in water and is also used as a standard indicator of the level of pollution in wastewater.

based on the optimum operation of the purifying plants. The impact of this phenomenon on bathing water is evident.

Requirements of purifying plants for public drainage systems (1990)

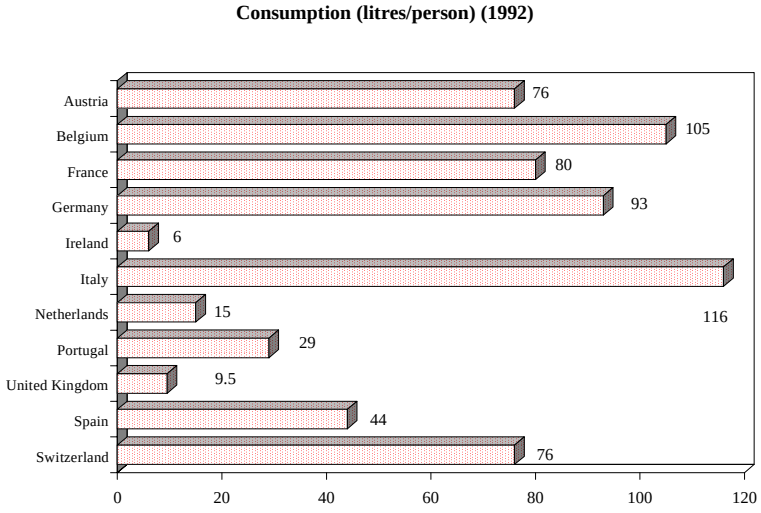
	Millions of equivalent inhabitants	
A. Required potentiality		
- urban potentiality	70.6	
- industrial discharges	58.6	
- total	129.2	
B. Potentiality currently installed		
- urban discharges	35.7	
- industrial discharges	21.8	
- total	57.5	
C. Remaining requirement forecast		
- urban discharges	34.9	
- industrial discharges	36.8	
- total	71.7	(55% of the total requested)

Source: Studies requested by the Ministry of Environment, 1990

Shortage of water

A shortage of drinking water is a phenomenon that still concerns about 18 million people. In particular, 52% of the inhabitants of southern Italy and 43% of the island inhabitants encounter a least one episode per yearly quarter when there is an insufficient supply of water. 18% of Italian families (from 6% in the north-east to 30% in the islands) suffer from persistent irregularities in the supply of drinking water. The same availability of water does not guarantee its use for human consumption as its organoleptic characteristics (clarity, smell, colour and taste) can discourage its direct use. The alternative of bottled drinking water, although it is a market phenomenon - in Lombardy bottled drinking water is consumed at nine times the rate as in Calabria - can be an indirect indicator of the shortage or the bad quality of the resource. This consumption, which is out of proportion in Italy when compared to the rest of Europe, expresses an intention of protecting one’s health, from the evident economic implications.

Consumption of mineral water in some European countries in 1992



Source: GISEM-UNESEM, 1993

Contamination

Organohalogenated compounds and pesticides are briefly used here as examples of the chemical contamination of drinking water. Trihalomethanes, which are formed following the process of making water drinkable by adding chlorine, and synthetic chlorinated solvents derived from unsuitable disposal of refuse, both belong to the organohalogenated compounds group. Italian legislation foresees a maximum limit for these compounds of 30 µg per litre of drinking water, with the possibility of a waiver up to 50 µg/l. It is estimated that at least 5% of the Italian population make use of this waiver, as their available water exceeds the limit of 30 µg per litre. Some trihalomethanes are carcinogenic for animals and there is a possible risk for humans too. For this reason it cannot be excluded that some cases of cancer in Italy are a consequence of this type of exposure. The consequences for health of episodes of drinking water pollution, contained in time and space, need to be more thoroughly investigated.

Another important problem is the pollution of drinking water by herbicides. The Italian legislation (Presidential decree DPR 236/1988) has established a maximum concentration (of all herbicides) of 0.5 µg/l, although there is the possibility of a waiver in emergency situations. In 1994, the WHO established guide values for individual herbicides of at least one order of magnitude higher. At the end of the 1980s considerable excesses of limits foreseen by Italian law were noted (e.g. in Piedmont, in at least one third of the wells, the concentration of atrazine exceeded 1 µg/l - more than twice the limit foreseen for all types of herbicides together).In the north of Italy, up until 1991, at least two million people drank water which did not conform to the provisions made by Italian legislation (although lower than the guidelines fixed by the WHO).

Biological contamination can also be an important problem in bathing water as well as in drinking water when infiltration accidents occur in the water distribution networks. Even

though somewhat slow, a progressive improvement in the treatment of waste water is to be noted. Indeed, bathing water in Italy shows a progressive improvement. The comparison of data over the last few years is shown in the table.

Situation of Italian coastlines during the period 1992-94

	1992 %	*1993* %	*1994* %
Coast not fit for bathing			
for reasons other than pollution	9.6	10.0	11.0
for pollution reasons	8.5	7.3	7.5
not sampled sufficiently	2.2	1.0	1.2
Coast not controlled	24.4	22.0	17.7
Coast fit for bathing	55.3	59.7	62.6

Source: Ministry of Health, 1993

Surveillance of the incidence of infectious diseases following contamination of bathing water is not without its problems. In Italy occurrence of diseases due to bathing in unsuitable water is a reality but its quantification is difficult. Some indirect studies, based on the seasonal increase of health assistance in some holiday resorts, are available, which however rarely provide reliable information on the source of risk. This sector lacks rational and systematic programmes for epidemiological surveillance.

Food

Nutrition plays an important role in the level and distribution of the state of health of a country, both for the nutritional level and quality and because foodstuffs can be carriers of micro-organisms and harmful substances. The Report describes these risk factors in detail. Here instead we limit ourselves to mentioning the phenomena of microbiological contamination and the use of steroids and drugs in animal rearing.

In Italy, the number of toxic food infections is increasing, but determining the size of the phenomenon is complex. Statistics based on obligatory reporting of infections (by law) generally underestimate the true size. Toxic infections from salmonellae, which alone represent 81% of the total of episodes, have doubled in six years. The European average for this infection is 105 cases per 100,000 inhabitants against 34 in Italy (1991), but this difference is most probably linked to slack reporting of the infections. On the basis of a corrective calculation, it can be considered that in Italy each year there are 1 or 2 people per 1000 affected by food poisoning which must be reported. If the calculation includes the infections which, although requiring medical treatment do not need to be reported, an incidence of 9-18 cases per 1000 inhabitants can be reached. It cannot be ignored that the cost, directly on the health system and indirectly through loss of productivity, can be evaluated at around 1.0 - 1.8 million lire for each toxic infection (cautious estimate based on English and American studies).

The phenomenon of the presence of anabolic substances and veterinary drugs in meat is subject to growing controls by veterinary and health authorities. The number of controls has increased from about 4,000 in 1988 to 56,831 in 1991. Analyses with positive results, or rather cases of loads of meat which do not comply with the law have increased from about 0 to 1.7% of samples analysed (1991). This phenomenon mainly depends on the increase in the number of

substances which are the subject of researches in the samples. In particular, the search for Beta-Agonists has recently come into force. At the moment however, it is difficult to estimate the implications on health which are due the positive presence found during controls.

Radiation

Data on radiation in the living and working environments and on their effects on health are presented here according the traditional separation into ionising and non-ionising radiation. The latter is divided into ultraviolet (solar radiation) and that generated by electrical and/or magnetic fields.

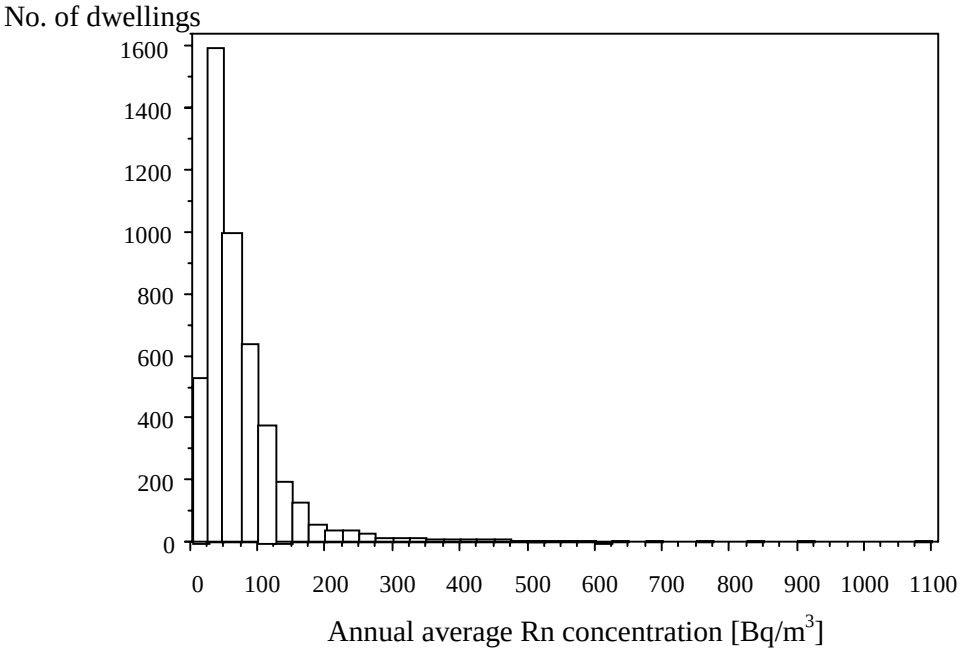
Ionising radiation

In Italy, the main source of exposure to ionising radiation associated with a risk for human health is radon in indoor environments.

Radon is a noble gas, with a proven carcinogenicity for humans, which can be freed inside indoor environments. This gas can be emanated by rocks, soil and natural building materials (such as tuff, pozzolano, lava, granite, schist, etc.) or some artificial materials. The radon emanated is rapidly dispersed in the open air, where it can be found in generally low concentrations, while it tends to concentrate itself in indoor environments.

The national distribution of the annual average concentration of radon is shown in the following figure.

Distribution of radon concentrations in a sample of Italian dwellings



Source: Bochicchio et al., 1994b

According to the recent investigation on the estimate of average concentrations of radon in Italian dwellings (1993), the average national value, obtained from the averages of each regions, weighted on the basis of the relative number of resident families, is 77 Bq/m^3. About 5% of dwellings have an annual average concentration of 200 Bq/m^3 and about 1% higher than 400 Bq/m^3. International organisations and a large part of national authorities agree on the need for intervening in cases of concentrations which exceed 400 Bq/m^3. If we assume that each dwelling corresponds to one family, the same percentages are valid for the Italian population. The national average concentration is significantly higher than the concentration recently (1993) accepted by the UNSCEAR committee as the world average, weighted on the population (40 Bq/m^3).

The reduction of exposure to high concentrations of radon in dwellings is a complex problem which requires various interventions. For this purpose the EU recommendations are useful, which suggest:

1. a reference level of 400 Bq/m^3 for existing buildings, above which certain provisions would be adopted to reduce the radon concentration;

2. a project level of 200 Bq/m^3 for new buildings (in Italy, because of the influence of building materials - e.g. tuff - it is necessary to limit the use of building materials, establishing a maximum value for their radioactive content).

The choice of the most appropriate remedies, as well as the problem of costs associated with it, needs further reflection and difficult decisions.

Non-ionising radiation generated by electromagnetic fields.

There are two types of electromagnetic radiation, low and high frequency. Radiation generated by power lines and by the main electrical equipment that work with network current belong to the first group, whereas the second group includes television transmission equipment, telecommunications equipment, radio control, microwaves etc.

While in the working environment all the types of exposure from non ionising radiation quoted here can be found, attention for the general population is mainly focused on low frequency fields, mostly due to living near to power lines or to the use of household electrical goods. About 1-2% of the whole country is close to important power lines. It is however extremely complex and currently impossible to calculate the resident population in Italy which could be exposed to fields which have an intensity higher than that recommended by international agencies. However, low frequency non-ionising radiation is filtered by building materials used in housing even when they are extremely close to power lines, thereby reducing exposure levels.

The pathology most commonly studied in association with exposure to electromagnetic fields is leukaemia in children. Available data coming from studies carried out in various countries are inconsistent and inconclusive, however. In the absence of Italian population studies, and therefore by applying risk coefficients observed in other countries to Italy, it can be estimated that out of the total Italian population no more than 1-2 cases per year of infant

leukaemia could be attributed to exposure to electromagnetic fields, if this association were to be confirmed by other studies.

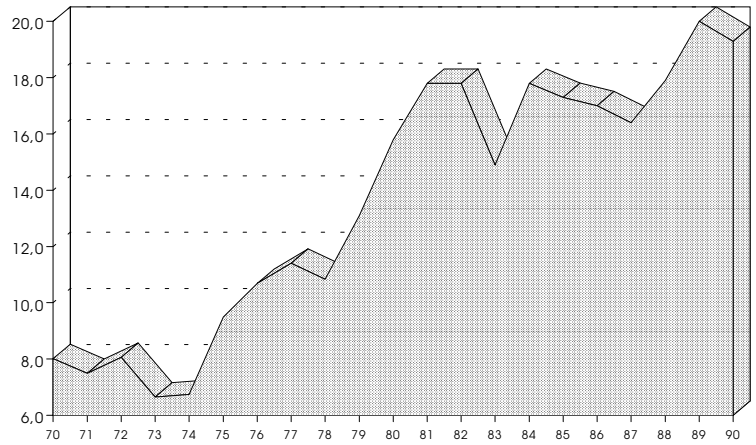
As far as high frequency magnetic fields are concerned, epidemiological evidence and exposure levels allow us to exclude the presence of significant risks for health.

It should be mentioned that health problems associated with electromagnetic fields are, according to current knowledge, linked to the perception of risk rather than to its actual extent (at least for the general population). The priority in this sector should be a complete and accurate communication of the real risk and to create dialogue between researchers, communicators, authorities and the population.

UV Radiation

UV rays cause concern because of their carcinogenic effect on human skin and because of their causal association (interacting with the phototype) with melanomas and carcinomas. Skin melanomas before the age of 64 represent the largest part of fatal skin cancers and their incidence is increasing in Italy, as in other countries. To attribute this trend solely to more precise diagnoses is hardly plausible and does not explain the difference between different age groups:in Italy, between 1951 and 1986, in both women and men, the average annual increase was between 3-4% among the age group 20-44, against 1-2% in the group 45-64 years of age. This corresponds to similar observations in other Southern European countries. Tumours registries in Italy too suggest a more pronounced increase in incidence among the younger age groups, particularly among women. Severe sunburn during childhood is a risk factor for melanoma.

Mortality from skin melanoma in Italy between 1970 and 1990 (standardised rates per 1,000,000 - 1987)



The changes in attitude of Italians, especially the young, towards the sun in the last few decades, could partly explain the increase in mortality from this cause. The effect of artificial suntanning is difficult to prove, but it is likely that excess exposure to UV rays in this way

contributes to the risk of melanoma. Other harmful effects of UV rays are plausible, especially in the aetiology of a cataract. Currently it is not possible to quantify the importance of this association in Italy.

In spite of the proven effects on health of excessive exposure to UV radiation, little has been done in the field of public information. The necessity for a suitable policy for this argument is even more essential if we consider the possibility that risks could be limited by means of changing individual behaviour.

Some widespread factors of environmental risk

Benzene

Benzene is a monocyclic aromatic compound which is found in the environment both naturally and as a consequence of human activity. Emissions from petrol-run motor vehicles and from industrial processes are the main sources of benzene in the environment. In indoor environments, tobacco smoke contributes significantly to exposure to benzene.

The main way to intake benzene is the air and exposure to benzene is higher in urban areas than in rural areas. Benzene is carcinogenic and exposure should be reduced as much as possible. A wider use of lead-free fuels could cause an increase in benzene emissions if there is not a parallel reduction of the concentration of benzene in fuels.

Estimating the average levels of exposure is difficult due to the differences which exist between the various monitoring systems, the methods and periods (seasons, months, hours of the day etc.) used for sampling. However, using available data, the average level of benzene in the air for several types of site and conditions has been estimated. The values obtained for urban areas with a low-medium traffic density, medium density, city centres with high density traffic and heavily polluted areas are respectively, 16, 22, 30, and 35 $\mu g/m^3$. Large seasonal variations were found, up to a factor of 5-10 for the relationship between winter and summer average levels. If the differences in benzene levels indoors and outdoors and some typical classes of humans exposed (people who are outside for a limited period 3-6 hours each day, people who work in the open air for half the day or the whole day) are borne in mind, the actual corresponding exposure has been estimated at 71,75 and 85% of the above indicated levels.

With regards to data on levels of exposure during working activities, average values for bus station workers (5-40 $\mu g/m^3$, measured in “breathing areas”) and for motorway petrol pump attendants (190-250 $\mu g/m^3$, measured over an average of eight hours during the hottest months of the year) are available.

Acute exposure to high concentrations of benzene causes a depression of the central nervous system and continuing exposure to toxic levels can cause damage to the spinal chord. There is a connection between benzene and leukaemia and benzene has been classified by the IARC as Group 1 for humans (sufficient evidence in humans). Given this level of danger, no threshold of safety can be given for its concentration in the air.

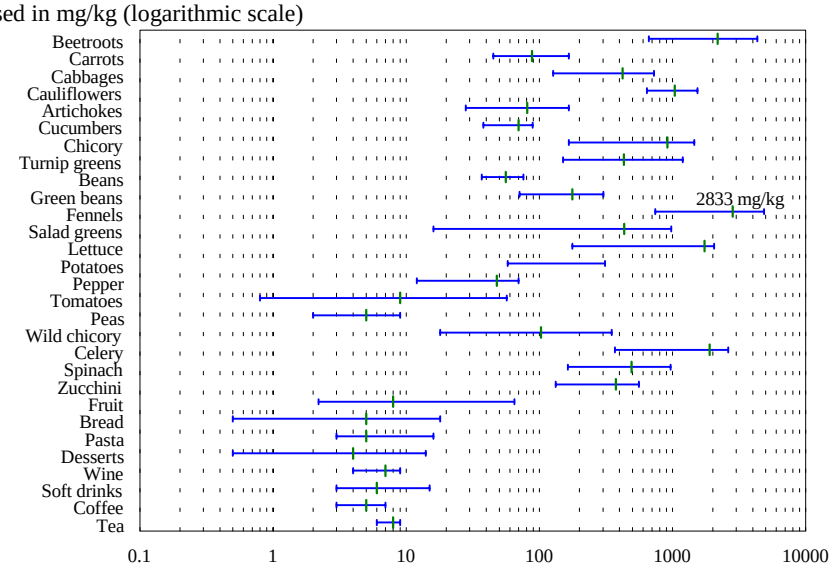
Nitrates are naturally present in the ground, the water, plants and meat, and in low doses in the air. Nitrate levels in the ground and water can rise due to anthropic activity, e.g. using fertilisers containing nitrogen. The concentration of nitrates in water can vary greatly. The WHO guide value, as well as the current Italian legislation, place the limit value for drinking water at 50 mg/l.

Ingested nitrates can easily be transformed into nitrites. These can react with secondary or tertiary amines and amides (normally derived from food and from other sources), forming nitrosamines/amides. Although tests carried out on many animal species have shown that several nitrosamines are carcinogenic, there is no direct evidence that they are carcinogenic for humans. Many epidemiological studies have been conducted to investigate the possible carcinogenic effect of nitrates in drinking water, but the evidence is not conclusive.

In general the main source of exposure to nitrates is through food. About 80% of total nitrates ingested daily derive from vegetables; the remaining part derives directly from water. The acceptable daily dose of nitrates has been fixed by the FAO/WHO at 300 mg/day for an adult, for the purpose of preventing effects on haemoglobin. An evaluation of nitrate levels found in food in Italy is shown in the figure.

Nitrate levels in various foods (average and range). 1985

Values expressed in mg/kg (logarithmic scale)



Source: Cocchioni et al., 1985

In 1986, the average daily intake per person through food was found to be 106.4 mg/day which, added to the 10 mg/day introduced via water, gives a complete intake of 116.4 mg/day. However, if a person uses water with a high content of nitrates (as for instance, the water of some distribution networks in the Marche region, where nitrate levels of 100 mg/l have been found) the daily intake almost reaches the acceptable dose. Some estimates of daily

dietary intake of nitrates in Italy have indicated values higher that those of other European countries.

In the areas of Italy where nitrate levels in water do not exceed 50 mg/l, exceeding the daily acceptable dose is highly unlikely. However, the situation in Italy is not reassuring. It is in fact estimated that in 1992 about 650,000 inhabitants, in 116 boroughs that are supplied by the Vesuvius distribution network, consumed water, with the permission of a waiver, with nitrate levels higher than 50 mg/l. Other data of previous exposure can be seen in the following table.

Nitrates in drinking water resources in Italy (1988)

Piedmont	58 boroughs (28 in the province of Alessandria) with levels >50 mg/l, up to 90 mg/l in the province of Vercelli.
Lombardy	39 boroughs (19 in the province of Milan, 10 in the province of Brescia) with drinking water supplies at levels >50 mg/l, up to 144 mg/l.
Veneto	The province of Verona is particularly concerned with 35 boroughs with levels >50 mg/l up to 75 mg/l.
Emilia Romagna	All the areas in the 'conoidi' area, except Ferrara, are affected.
Marche	30 boroughs in the mid-coastal areas; levels >50 mg/l in the province of Pesaro.
Molise	Little data available concerning private wells in the province of Campobasso: levels up to 200 mg/l.
Campania*	Out of 43 wells examined from the Lufrano aquifer (which 'feeds' the Naples distribution network), 33 had levels >50 mg/l. Max. levels of 80 and 100 mg/l in two important boroughs in the province of Naples.
Sardinia**	Levels >45 mg/l were found in several aquifer in the province of Cagliari (20.9% of the 588 samples examined).

* Data 1986-87
** Data published in 1983

Source: Funari, 1989

According to an estimate, which does not however take into consideration the consumption of mineral water that could reduce the exposure levels, there could be about 1 person in 1000 who risks exceeding the daily acceptable dose in Italy.

Lead

Lead is naturally present, almost totally in an inorganic form, in the Earth's crust and is the most common heavy metal. The main sources of lead emissions into the environment are lead-based paints (for indoors) mostly used in the past in buildings, motor exhausts which use fuels containing lead and some industrial activities. Lead persists in the environment and is generally transported by air. The soil can be seriously contaminated by lead and contributes significantly to human exposure. For example. concentrations of lead between 2,000 and 3,000 mg/kg are not uncommon in road dust where there is intense traffic.

Lead accumulates in the human organism and has a generalised toxic action with anaemia, effects on the nervous system, on the kidneys, on the reproductive and immune systems, as well as having cardiovascular, hepatic, endocrinologic and gastrointestinal effects. In long-term low dose exposure conditions, typical of the general population, the most serious

effects are those on the nervous system and on the blood. In children lead has been associated with a *continuum* of effects on the nervous system which range from a slowing down of the nervous impulse to behavioural problems and small reductions in the cognitive capacity up to the point of mental retardation, acute encephalopathy and death.

The average intake of lead for a city inhabitant is around 6-8 μg/day, whereas through drinking water the daily intake can range from 10-20 μg to 1 mg or more. Food contributes in a greater way to the intake of lead and it is estimated that the average daily intake ranges from less than 100 to more than 500 μg/day.

The Italian population's exposure to lead has generally decreased following some laws which have prohibited the use of lead in food containers and have reduced the lead concentration in petrol. However, in urban areas with a high traffic density (Rome) the average annual concentration in the air is higher than the legal limit and is 2.2 $\mu g/m^3$. Studies carried out in various areas of the country through the evaluation of the content of lead in the blood, which reflects both the long term and short term total exposure, have shown a reduction of this indicator by 25-50%. The highest values have been found among the adult and child population living close to industrial plants in Lombardy, Emilia Romagna, Umbria (Deruta), and Sardinia (Portoscuso) and in areas with very high traffic density (Perugia).

In spite of improvements in Italy with regards to lead exposure, it is necessary to reduce emissions and the consequent exposure further, as even low concentrations in the air and in food can have adverse effects on the population.

Noise pollution

The systematic and standardised measuring of noise levels in Italy is a recent occurrence (1983), although data exist from as early as 1968. The samples carried out in the last few years (1983-1992) have involved 96 cities, 11 of which have more than 300,000 inhabitants, 58 have 50,000-300,000 inhabitants and 27 have fewer than 50,000 inhabitants.

So-called "environmental" noise - that which occurs in the home or in places such as schools, hospitals, hotels, mainly caused by road, rail or air traffic - gives rise to communications disturbances, rest and sleeping disturbances as well as being annoying. Over long periods of time these effects have an effect on a person's well-being. The level of 65 dBA has been identified as that which causes noticeable annoyance to most people.

Italian legislation has established the same limits for mobile noise sources as those from the WHO and the OECD: 55 dBA during the night (from 22.00 to 6.00) and 65 dBA during the day (from 6.00 to 22.00).

Data gathered in Italy show that the legal limits are amply exceeded. The collection of samplings of noise levels from road traffic in 96 Italian cities between 1983 and 1992 is shown here in the following table.

Percentage distribution of noise levels from road traffic in 96 Italian cities ($L_{Aeq,m}$) according to the number of inhabitants and the reference time intervals (1983-92)

N. of inhabitants	*Time*	*<55.0*	*55.0-59.5*	*60.0-64.5*	*65.0-69.5*	*70.0-74.5*	*≥75*	*%>65 dBA (d) %>55 dBA (n)*
<50,0000	6-22	7.4	7.4	18.5	**14.8**	**22.2**	**29.7**	**66.5**
	22-6	0	**0**	**20.0**	**60.0**	**0**	**20.0**	**100.0**
50,000-300,000	6-22	0	0	3.4	**20.7**	**56.9**	**19.0**	**96.4**
	22-6	2.3	**14.0**	**32.6**	**46.5**	**2.3**	**2.3**	**97.7**
>300,000	6-22	0	0	0	**9.1**	**36.4**	**54.5**	**100.0**
	22-6	0	**0**	**36.4**	**36.4**	**27.2**	**0**	**100.0**
ITALY	6-22	2.1	2.1	7.3	**17.7**	**44.8**	**26.0**	**88.5**
	22-6	1.7	**10.2**	**32.2**	**45.7**	**6.8**	**3.4**	**98.3**

On a geographical basis the break-down by region confirms what has already been indicated: the percentage of exceeding the daytime limit is more than 90% in 14 regions out of 20, with an average national level of 71 dBA. The situation worsens further during the night, when the average level of noise is 65 dBA (10 BA higher than the limit) and all the regions exceed the limit.

A certain improvement was noted during the five-year period 1987-1992. The percentage of the urban population exposed to daytime noise levels which are higher than the legal limit is estimated at 79.4%, whereas the percentage rises to 88.8% for night time noise. It has been evaluated that corresponding to the road surfaces of Italian cities with more than 300,000 inhabitants, 69.2% of the population suffers noise emissions higher than 70 dBA. This level is indicated as a threshold above which psychosomatic effects can occur.

Waste

The production of solid waste is a phenomenon connected to the level of economic development. As we know, the disposal of waste is the problem of this sector and is a part of the "environmental argument" in the world. In 1991 about 62.7 million tonnes of waste (32% urban, 68% special[2] - 13% of urban origin and 55% industrial origin[3]) were produced in Italy. The production of urban waste in Italy is on a par with other European countries and is lower than that of North America.

[2] Residues from industrial processes and agricultural, craft, commercial and service activities which are not assimilable in quantity or quality to urban waste; hospital waste that can not be assimilated to urban waste; demolition, construction and digging material, broken or obsolete equipment; motor vehicles, trailers and the like which are no longer useable and their parts; residues from waste treatment and depuration of effluents.

[3] These are estimates with a significance for comparisons. To evaluate their reliability it should be considered for example that scrapped cars are inclued among special wastes, which are evaluated by the weight of the crushed vehicle.

In Italy solid urban waste (SUW) is mostly disposed of in waste dumps. In 1991 89.8% of SUW was destined for dumps, 6.3% for incinerators and 3.9% for treatment. The potential of authorised plants for the disposal of solid urban waste and assimilable waste was 73% of total need in 1991 and, still today, some regions (Lombardy, Latium, Campania, Apulia and Sicily) have insufficient means. The production of waste increases by about 3-5% per year, while separate collection of glass, paper, plastic and aluminium is limited to some areas and, with the part exception of glass, is generally less frequent than in other European Union countries.

Generally, the population's perception of possible risks associated with the presence of waste in the environment is particularly high. This contrasts with the available results of epidemiological studies, mainly carried out in North America, which do not confirm these risks. However, the infiltration of percolate from waste dumps to the ground and down into the aquifers, the possible consequent deterioration of water quality, as well as the transportation of pollutants far from their origin, can constitute problems for public health, the extent of which cannot be evaluated at present. The negative effect on the general state of well-being which is associated with the presence of uncollected waste in the environment should also not be ignored.

It should be noted that modern technologies for waste disposal, both through dumping and incineration, reduce the environmental impact of waste to a minimum (as well as that on the population). In Italy however, 51% of incineration plants are inefficient in containing emissions, and 42% of SUW is disposed of in plants which are not technologically suitable. An attempt at estimating, albeit very broadly, the number of the population concerned can be made based on the results of a survey carried out on behalf of the Ministry of Environment. According to this study, the highest number of plants which do not conform with the law currently in force (because the emission limits of incinerators are not respected, or because there are not sufficient guarantees for the protection of the base and the walls of the dump, or the percolate and biogases are not captured) are found in the regions with the most dense populations. These plants are operational without authorisation, or with authorisation from the Mayor (art. 12 of the Presidential decree DPR 915/82). The regions with the highest number of inhabitants potentially at risk of exposure are in order: Campania, Apulia, Sicily, Veneto, Abruzzo, Molise, and Latium.

Areas with a high risk of environmental crisis

The Italian Ministry of Environment, by means of a Presidential Decree (DPR 8.7.1986 n. 349) identified 16 areas in Italy that run a high risk of environmental crisis. Later other areas were declared, among which Casale Monferrato. The areas were determined on the basis of evaluations of an environmental nature. In the analysis summarised here the desire was to verify if it were possible to identify effects on health linked to the environmental risk by reading mortality data.

The interpretative limits (and potentialities) associated with the use of solely mortality data for epidemiological analyses are not mentioned here. These problems are amply illustrated in the Report. We consider it suitable, however, to underline the fact that, for the purpose of evaluating possible health-environment associations, special attention was paid to the study of all causes mortality, as a general indicator of the state of health of the population, to mortality from all types of cancer and from specific cancer sites and to mortality from respiratory diseases apart from tumours. For this group of causes it is possible to hypothesise the presence of environmental and occupational risk factors, on the basis of what we already know from scientific literature.

The areas were divided into point source and complex areas (made up of more than six oroughs), in relation to the consideration or not - in their definition - of supposed sources of environmental pollution within a limited and well-defined geographical area.

Below are the mortality data of the resident population of the 16 original areas during the period 1980-87 and some disease data for Casale Monferrato.

Point source areas

There are 9 point source areas mentioned in this section: Massa-Carrara, Manfredonia, Taranto, Brindisi, Crotone, Augusta-Priolo, Gela, Portoscuso, and Casale Monferrato. The data for all causes mortality, all types of cancer mortality and respiratory diseases mortality for the first seven are presented in Table A. For these causes of death, for each sex, the following are listed:

a. the number of deaths observed
b. the number of deaths expected on the basis of specific rates of mortality for age groups in the region where the area is situated (province in the cases of Manfredonia and Crotone)
c. the absolute difference between the two values (a-b)
d. a graph of mortality expressed as SMR[4]*, which represents the difference between mortality and the expected value*

[4] SMR (standardized mortality ratio): if equal to 100 it indicates that there is no difference in mortality compared to that expected, while values higher or lower than 100 indicate excesses or defects, respectively, of mortality in the population observed, compared to the reference population.

Massa-Carrara (133,000 inhabitants)

For men, but not for women, all causes mortality is higher than the rest of Tuscany and also than adjacent Liguria. 125 more deaths associated with residing in the area can be observed. The large groups of causes of death which most contribute to this excess are tumours, cardiocirculatory diseases and respiratory diseases. The most important types of cancer observed are lung cancer and larynx cancer (SMR 211.45 expected deaths and 94 observed). The fact that women are not affected by these excesses makes the accusation of pollution in the general environment caused by the chemical industry unlikely. A role played by exposure in the working environment is more likely. Ad hoc studies in the area have shown excesses of mortality from lung cancer among employees at a coke plant and an excess, although statistically not significant, of mesothelioma of the pleura among port workers. The increase - in both sexes - of death by cirrhosis of the liver and by liver cancer suggest environmental exposure outside work (to chemical or infectious agents) or of a behavioural origin. Credibility of an association between chronic liver diseases and pollution of the general environment is limited due to the lack of similar episodes which have been documented in literature.

Manfredonia (98,000 inhabitants)

All the differences between observed and expected are negative and, therefore, are difficult to look into more thoroughly. The petro-chemical plant (where there was an accident in 1976 which resulted in a leak of arsenic), the extraction industry and the mineral processing industries do not seem to have a direct influence on mortality, as far as available statistics allow us to see. However, taking into consideration latency time, which is necessary for finding the effects which can be put down to the exposure to arsenic following the 1976 accident, one would like to see a epidemiological surveillance programme operating in the area and on the population involved.

Taranto (279,000 inhabitants)

Excess deaths (statistically important in males, with about 80 deaths more per year than expected) is primarily due to an excess of tumours (especially lungs pleura and bladder). The excess of mesothelioma of the pleura and partly that of lung cancer is traceable to exposure to asbestos (building sites, cement works etc.) The excess of pleura cancer in women (17 cases observed vs 5 expected) could suggest exposure to asbestos outside working environments (pollution of the domestic environment and/or the general environment).

The excess of non-Hodgkin lymphoma and of multiple myeloma (looking at the two sexes together the ratio observed/expected is 42/28.3) and the excess deaths from bladder cancer bring us to hypothesise a role played by occupational exposure, respectively linked to agricultural activity and the chemical industry. The increase in pathologies of the liver is more difficult to interpret. In a collective evaluation of the habitat, the marked excess of accidental deaths in both sexes (about 12 cases more per year than the regional average) should not be ignored.

Brindisi (131,000 inhabitants)

35 excess deaths among men and 16 among women per year are associated with living in the area. The main contributions to the excess come from mortality from cancer and - in women - from respiratory diseases. The area has many petrochemical, chemical, iron and manufacturing industries, an electrical energy plant and shipping activities. Occupational exposure could explain a part of the deaths from lung and bladder tumours, but the increase suggests a role played by air pollution. A role played by environmental exposure is not very likely in explaining the mortality excess due to prostate cancer in men and breast cancer in women.

Crotone (59,00 inhabitants)

Each year 34 male deaths and 14 female deaths are associated with living in the area. The main illnesses which contribute to the excess are tumours, circulatory diseases and - in women - respiratory diseases. Industry is intense and heterogenic, and causes emissions into the general environment, which could explain the excess of deaths by respiratory diseases in women. The excess of lung cancer in men suggests a role played by occupational exposure (maybe in part due to exposure to sulphuric acid in zinc production : more than half compensated occupational illnesses in the area are for illnesses from sulphur dioxide and sulphuric acid). The increase in deaths from cirrhosis and liver cancer in men could partly be traced to occupational exposure (zinc production). On the other hand, the excess of cirrhosis in women suggests exposure of an infectious type or is linked to the consumption of alcohol. In brief, the picture of mortality found in the Crotone area is made up of excesses due to various types of tumour pathologies and others, which can be caused by occupational and environmental exposure.

Augusta-Priolo (223,000 inhabitants)

Each year, the death of about 27 men is associated with living in the area. The discrepancy - in terms of all causes mortality - between the two sexes seems to exclude the role of risk factors in the general environment. The area is the site of industrial concentration. The most important contribution to the excess of deaths is given by deaths from malignant tumours. A professional aetiology is plausible for lung and bladder tumours, but less so for those of the colon-rectum (increased among both sexes) and the prostate.

Gela (105,000 inhabitants)

Each year the deaths of about 22 men and 33 women are associated with living in the area. The main contributors to the excess are deaths by circulatory diseases. The increase in all causes mortality and in death from cardiovascular disease is compatible with an aetiology linked to environmental pollution, especially to exposure to SO_2 and aerodispersed particulate. The area is characterised by extraction and mineral processing activities and chemical industries (petrochemical), which emit various types of pollutants. Among men, deaths from larynx cancer have increased (for which a professional aetiology is plausible). The excess of deaths from cirrhosis and from non-Hodgkin lymphoma are difficult to interpret, but exposure

to chemical products in an industrial environment and antiparasitic substances in agriculture cannot be excluded .

Portoscuso (305,000 inhabitants) - not in table

As well as the extraction of coal, the area has many industries for aluminium, zinc, lead, cadmium, sulphuric acid, electricity, carpentry, inert substances etc. The area has been industrialised progressively and intensively in the last few decades. All causes mortality is high in Carbonia and Gonnesa in both sexes. Due to the high number of workers who commute to work from other areas, further investigations are necessary to evaluate the excess of tumours observed in some boroughs. Anyhow, from data currently available, it is believed that the effects on health are more likely to be due professional exposure than to environmental exposure. Among the stable population (born and died in the area), compared to the national average, an increase in all causes mortality has been found in men up to the age of 35, but not in women. In the older age groups, mortality decreases compared to the national average. Excess deaths from lung cancer (13 in Sant'Antioco, 6 in Gonnesa, 6 in Carloforte) have been found. Deaths from chronic bronchitis have increased among both sexes (relative risk 2.5 in Gonnesa and 1.7 in Sant'Antioco) (+ 13% among men and + 18% among women).

Casale Monferrrato (city population 50,000 Local Health Authority (USL) Piedmont 76 98,000 - not in table.

Up until 1985 the main Italian producer of asbestos cement was active (which also used crocidolite). Emissions were controlled in a limited way and it is likely that even now, waste from production is the source of pollution in the general environment.

This area was declared at high risk only recently. No analyses on the scale of those carried out in other areas dealt with by the Report have yet been carried out on mortality. However, the population belonging to USL Piedmont 76 has been given the service of epidemiological surveillance since 1980 for newly diagnosed cases of mesothelioma of the pleura, which occurred hystologically. Mesotheliomas are highly fatal tumours, not associated with smoking, for which the only known risk factor is asbestos. On average among the of USL 76, 10 new cases of mesothelioma of the pleura are diagnosed each year (as well as some cases of peritoneal mesotelioma), of which no more than a third are in employees of the company. It is therefore plausible to hypothesise that asbestos plays a role in polluting the general environment. Both sexes suffer equally from the disease caused by this carcinogen present in the general environment.

Surveillance of mortality among ex-employees of the company is also in force, which annually finds 10 excess deaths (mostly due to lung and pleura cancers and other respiratory pathologies) compared to the estimate for the general population of Piedmont.

Complex areas

The areas concerned are Val Bormida, Lambro-Olona-Seveso, Conoidi, Po Delta; Naples and its province, Sarno. Compared to the point source areas, the research for a relationship between environmental causes and state of health indicators is more difficult. In

many of these areas, the risks deriving from environmental degradation are mixed with those associated with social disadvantage, living conditions, and the habitat in general. In some cases, the risk coming from environmental exposure is partly "compensated" by rural areas own protective effects.

The inferences deriving from mortality data are in this case, to be considered even more so as generators of hypotheses to confirm by more thorough geographical analyses and analytical studies which allow individual exposure data to be taken into consideration.

However, the total data relating to all causes mortality, cancer mortality and respiratory diseases mortality are presented here (tables B1 and B2). In table C mortality rates for males and females are compared with regional averages.

As examples of the results described in the report, the analysis of three areas with different characteristics are presented here.

Val Bormida (59,000 inhabitants)

This is a geographically complex area, between two regions (Liguria and Piedmont) and with a small population (59,000 inhabitants). Apart from the traditional geographical analyses a spatial analysis has been carried out (table "Val Bormida" in the Appendix) studying mortality for each borough along the banks of the river Bormida.

For the whole area, all cause mortality, tumour mortality and respiratory diseases mortality are lower than those which can be observed both in Piedmont and Liguria. This result is confirmed by the geographical analysis which shows a two-phase trend in mortality along the river Bormida, with values that are always lower or equal to those expected for mortality in each borough. Although the geographical analysis needs deeper investigation, the current survey, consistent with what has already emerged in previous studies, tends to exclude increases in mortality which can be traced to environmental causes.

Naples and province (3,039,000 inhabitants)

Each year 1050 more deaths among men and 760 deaths among women are observed, an increase of 11% and 7% respectively. This increase is more noticeable for cancer and respiratory diseases in both sexes and is more accentuated in the city of Naples compared to the rest of the province. The types of cancer which have increased are, among others, lung cancer, pleura cancer, and bladder cancer in both sexes.

The data indicate a noticeable worsening in the state of health. The simultaneous increase in mortality among men and women from cancer and respiratory diseases supports the theory, though with all the interpretative limits pointed out several times, of an aetiologic role played by both occupational exposure and environmental exposure.

Sarno (390,000 inhabitants)

Each year 55 more deaths among men and 51 more deaths among women are observed, meaning an increase of about 4% for both sexes. No increases have been observed for cancers, except for liver cancer among women, while a marked increase in mortality from respiratory diseases in both sexes has been noted. A geographical analysis carried out to study the spatial distribution of cases of lung cancer, of which an excess was reported in the tanning area of Solofra, indicated the existence of a positive gradient from the sea towards inland for this cause of death, with slight excesses in the Sarno area, but not in the tanning area. The increase in mortality from respiratory diseases, without an increase in mortality from lung cancer or other pathologies associated with smoking, is an important and unexpected observation which suggests a more thorough investigation of the role played by occupational and environmental factors.

APPENDIX

The following have contributed to the report "Environment and Health in Italy":

Study group for the epidemiology of high environmental risk areas

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