



SEVESO

The escape of toxic substances at the ICMESA establishment on 10 July 1976 and the consequent potential dangers to health and the environment due to industrial activity.

VIIth Legislative Session

Parliamentary Commission of Enquiry on the Escape of Toxic Substances
on 10 July 1976 at the ICMESSA Establishment and the Consequent Potential
Dangers to Health and the Environment due to Industrial Activity.

(Act No. 357 of 16 June 1977)

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RUFFINO, Giancarlo, senator; SANTI, Mario, senator; TESINI, Aristide, deputy;
TRABUCCHI, Emilio, deputy; VENEGONI, Guido, deputy

Final Report

Rapporteur: Bruno ORSINI.

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Final Report

First Part

Establishment, structure and functions of the parliamentary Commission of Enquiry on the Escape of Toxic Substances on 10 July 1976 at the ICMESA Establishment and the Consequent Potential Dangers to Health and the Environment due to Industrial Activity.

Section I

Establishment of the Commission

1. The incident of 10 July 1976

An establishment was set up at the end of 1946 by the headquarters of ICMESA (Industrie Chimiche-Meda-Societa Azionaria) located in the area of Meda, in the province of Milan, for the manufacture of various products. In one of the buildings of this establishment, to be exact in shop B, a production process was carried on from 1969 to 10 July 1976, making use of a reactor vessel known as A101, for the manufacture of TCP (2,4,5-trichlorophenol), the raw material for the manufacture of other products, including hexachlorophene.

On Saturday 10 July 1976 the plant was closed around 5 a.m., approximately at the end of the weeks work. On the same day around 12.37 p.m. the safety plate of the reactor vessel A101 exploded.

The employees present in the factory (all engaged on maintenance and repair work) realized that something unusual had occurred, since they heard a loud whistling sound and saw - over a period of about 20 minutes - vapours escaping from the discharge pipe above shop B, which gave rise to the formation of a dense cloud of considerable altitude.

The shop foreman Carlo Galante, who happened to be in the immediate vicinity of the shop, proceeded immediately to the building, entered wearing a respirator and actuated manually the coolant water spraying equipment, thus blocking the escape of the gas.

The vapour cloud, containing a number of highly toxic compounds, including TCDD (2,3,7,8-tetrachloro-dibenzo-paradioxin) spread rapidly, polluting a large area. Serious harmful consequences were caused over the next few hours and days to persons, animals and crops.

The local administrative authorities, making use of their emergency powers granted at the time by the judicial authorities, took legal action against those who appeared, *prima facie*, to be responsible for this incident.

The scale of the disaster was exceptionally wide and made a very great impression, emphasizing once again in dramatic terms the subject of safeguarding human life and the environment from the risks due to industrial activities.

Only a few days after notification of the incident, the escape of toxic substances from the ICMESSA establishment was the subject of three bills presented to the Chamber of Deputies and two bills presented to the Senate of the Republic: these bills, although differing somewhat in their content, called for the immediate establishment of a parliamentary Commission of Enquiry on the causes, liability and consequences of this extremely serious incident.

2. Draft bills presented to the Chamber of Deputies.

The first bill was presented to the Chamber of Deputies on 27 July 1976 by Deputy Servello and others (Annex I). It proposed that the Commission, on conclusion of its enquiry, should recommend to the Government special measures to ensure the safeguarding of the population and the environment from any form of pollution resulting from the production of gas and other toxic elements.

The second bill was presented on 4 August on the initiative of Deputy Malagugini and others (Annex II). The accompanying report pointed out, in particular, that the incident at Seveso, "the extent and final implications of which were not yet known", could not be regarded as purely local relevance, but had assumed a national and international importance. The incident had in fact taken place in a factory belonging to a multinational undertaking - GIVAUDAN S.A. - which "in a purely incidental and unexpected

way - had produced a product - dioxin - previously used for military purposes - as a component of defoliants. At the end of their report, the sponsors of the bill proposed two aims for the parliamentary Commission which was to be set up: on the one hand to clarify fully the circumstances of the Serveso incident, covering all the measures taken and to be taken to deal with, and put right the consequences of the incident and also to formulate proposals for a new and more effective code of discipline for industrial activities comprising the manufacture of harmful materials and the use of dangerous processes.

Finally, on 9 August a third draft bill was presented by Deputy Aniasi and others (Annex III). The aim of this bill was to establish, by means of the immediate setting up of a Commission of Enquiry, whether it had been agreed or was agreed or could be tolerated, that production processes endangering safety should be carried out without suitable measures to prevent the occurrence of disasters, and to evaluate "whether there existed (in Italy) the essential technical and scientific research structures, capable of providing a general knowledge of chemical processes relating to certain types of work, reactions and all the possible consequences associated with the introduction of such processes on our territory".

3. Parliamentary action on the draft bills submitted to the Chamber

The three draft bills presented to the Chamber were referred to the Combined Commissions XII (Industry and Light Industry - Foreign Trade) and XIV (Hygiene and Public Health); examination of the bills was begun in the session of 28 October 1976.

In this session Deputy Cuminetti, rapporteur of Commission XII, while accepting the complete justification of the proposals under examination, suggested to the sponsors that the requirement could best be met by a fact-finding enquiry, which he believed to be "more in conformity with the aim". This argument was opposed at the session of 16 February 1977 by Deputy Giovanardi, rapporteur of Commission XIV, who considered that the structure of a fact-finding enquiry did not really enable Parliament to carry out a rigorous investigation of the causes and liability of an event, the consequences of which were proving to be evermore alarming, and to establish at the same time whether Italy had the necessary modern safety standards.

After a wide-ranging discussion, the combined Commissions came to a unanimous decision to formulate as soon as possible a draft bill, consisting of a combination of the three bills, to be submitted to the Chamber for approval.

This bill was prepared under the title "Parliamentary Commission of Enquiry on the Escape of Toxic Substances on 10 July 1976 at the ICMESA Establishment and the Consequent Potential Dangers to Health and the Environment due to Industrial Activity", approved by the said Commissions at their session on 24 March 1977, and submitted to the Office of the President of the Chamber in the name of all deputies and signed by Deputies Cuminetti and Giovanardi (Annex IV).

The bill was approved by the Chamber by secret ballot on 28 April 1977 without modification, the voting being 320 in favour, 32 against and 4 abstentions.

Those abstaining were the deputies of the proletarian democracy group and the radical group. The democratic proletarian deputies justified their abstention on the grounds of the failure of the Chamber to approve an amendment to Article 4, submitted by Deputy Gorla, which was aimed at ensuring the presence on the Parliamentary Commission of representatives of all these groups. The radical deputies justified their abstention on the grounds that the intended composition of the Parliamentary Commission was such as to allow the more numerous groups a clear predominance on the Commission.

4. Draft bills presented to the Senate

The first of the two draft bills, submitted to the Senate for the establishment of a Commission of Enquiry on the disaster caused by the toxic cloud released from the ICMESA establishment, was presented on 5 August 1976 on the initiative of Senator Luzzato Carpi and others (Annex V). The introductory report maintained that the directors of ICMESA had only decided to admit the extremely serious danger to which the population were

exposed, after the director of the Laboratory of Hygiene and Prophylaxis of Milan had discovered the appreciable quantitative dioxin content of the toxic cloud, that the competent authorities had taken note of the extreme reticence, strange silences and attempts to minimise the facts on the part of the directors and that all the information obtained had revealed a picture of disorganization and serious liability, which therefore necessitated the immediate establishment of a Parliamentary Commission of Enquiry "in order to cast light on the situation and to prevent any repetition of such tragic events".

The other draft bill was presented to the Senate on 8 October 1976 on the initiative of Senator Merzario and others (Annex VI). This bill proposed that the enquiry should be extended to cover the serious incident which had occurred in the meantime at Manfredonia (Foggia), where a highly toxic arsenic cloud was released from the ANIC establishment and also to the pollution caused by numerous industrial plants in the communes of Priolo and Melilli (Syracuse).

5. Parliamentary action on the draft bills presented to the Senate

Examination of the two draft bills, although they had been referred for joint examination by Commission X (Industry) and Commission XII (Hygiene and Health), was however deferred pending transmission to the Senate (on 2 May 1977) of the text approved by the Chamber of Deputies, which was again referred for examination by the aforesaid Commissions.

The joint discussion was begun at the session of 12 May 1977 with statements by Senator Vettori, rapporteur of Commission X, and Senator Minnocci, rapporteur of Commission XII.

Senator Vettori, taking up again the argument of Deputy Cuminetti, emphasized the desirability of a fact-finding enquiry, both in view of the inquisitorial nature of a parliamentary Commission of Enquiry and also in order to avoid interference with the

judicial proceedings in this matter and the measures already taken by various public organs and bodies. Senator Minnocci, on the other hand, maintained that only a Parliamentary Commission of Enquiry "would have the authority and prestige to supply the necessary energetic stimulus "which the seriousness of the incident required.

Senator Ruffino, while pointing out a number of technical imperfections in the text received from the Chamber of Deputies, considered that it was not desirable in view of the extreme urgency to send it back to the Chamber for revision. The urgency factor was stressed also by Senator Minnocci, the Undersecretary of State for Health Russo, and Senator Merzario who added, speaking on behalf of the Communist group, that the primary aim of a rapid establishment of the Parliamentary Commission of Enquiry rendered it desirable "to dispense with the extension of the enquiry to the circumstances at Priolo and Manfredonia".

This concluded the discussion and it was unanimously decided with the consent of the representative of the Government, to empower the Chairman of the Combined Commissions to ask the legislature for the immediate passage of the bill approved by the Chamber. This request was not however granted by the President of the Senate "since the rule of discussion in Assembly of bills for the establishment of Parliamentary Commissions of Enquiry, could not be the subject of any exceptions in view of their political relevance".

The debate in the Combined Commissions ended with the approval of the text submitted by the Chamber of Deputies. The relevant reports by Senators Vettori and Minnocci were announced to the Assembly in the Palazzo Madama on 24 May 1977 (Annex VII).

6. Approval of the Act setting up the Parliamentary Commission of Enquiry (Act No. 357 of 16 June 1977)

The discussion in Assembly took place at the session of the Senate on 8 June 1977.

The President of the Senate, Fanfani expressed reservations in regard to the formulation of Article 2 (c), adding that Article 3 had no connection with the aim of the enquiry or, if such connection existed, pointed out that the enquiry should be extended to cover the whole national territory of Italy.

After these statements, Senator Nencioni proposed suspension of the discussion for return of the bill to the Combined Commissions; this request was supported, although on different grounds, by Senators Noe, Balbo and Cifarelli.

Senator Romano, argued against this proposal. Although he accepted the bad formulation of Article 2 (c), the meaning of which was however clear, rejected the criticisms made of Article 3 in view of the fact that, if there was any delay in setting up the Parliamentary Commission of Enquiry on Serveso, it would not be possible to say what effect this might have on the "permanent and general problem underlying the incident at Serveso".

After a brief suspension of the session, the president announced that during the interval he had received an assurance from the Chamber of Deputies that the error in the text of Article 2 was a material error which would be corrected by an appropriate notification from the Office of the President of the Chamber. The President of the Senate announced also that the rapporteur had presented an agenda item dealing with the integration and clarification of Article 3.

Senator Noe submitted, in place of an amendment of Article 2, an agenda item, empowering the Commission "to examine measures which had been adopted or should be adopted in the future for decontamination of the affected zone".

The rapporteur Vettori, speaking also in the name of his corapporteur Minnocci, after recalling the parliamentary procedure in connection with the bill and emphasizing the

similarities and differences between the pollution at Seveso and that which had occurred at Manfredonia and in the industrial zone of Priolo/Melilli, stressed once again the urgent need for approval of the measure.

The Minister of Health, Dal Falco, after expressing the full support of the Government for the proposal to establish a Commission of Enquiry on the incidents at Seveso, notified the Senate of the actions taken for decontamination of the zones in question, giving a wide-ranging review of the measures taken at the local level and the assistance afforded in the field of health and decontamination measures. He also outlined the actions being taken with a view to the formulation of more up to date and effective regulations in regard to the chemical industry and dangerous substances and also in regard to intermediate products of industrial production and concluded with the hope that the Parliamentary Commission of Enquiry would provide useful elements and concrete proposals for more effective regulations and for the protection of human safety and the environment, and also for a better control of manufacturing activity, for the more suitable location of undertakings and for the storage and use of dangerous substances.

The Senate approved at this session, without amendment, and merely with correction of the material error to which attention has been drawn, the bill setting up the Parliamentary Commission of Enquiry (Annex VIII).

The Senate approved also the report presented by the rapporteur, in the following text which was accepted by the Government:

"The Senate,

Approving draft bill No. 665 and recognizing that this draft bill includes also draft bills Nos. 94 and 220;

In view of the wide terms of reference under Article 3 of the Commission of Enquiry to be set up and in view of the specific datelines in the subsequent Article 6 for completion of the work under these terms of reference, states that the elements of information collected and evaluated shall apply not only to the ICMESA establishment, but also to the cases of pollution which have been found to occur at Manfredonia and Priolo and Melilli;

The Senate also states that the experts, for whom provision is made in Article 4, are to be appointed by the Commission with the prior authorization of the Presidents of the two Houses of Parliament;

The Senate clarifies, finally, that Article 2 (c) is to be understood in the sense that the Commission is to ascertain what measures of control were implemented at all levels of the central and local authorities in relation to the installation of the factory, the safety aspect and the harmfulness of the production process, and that the Commission of Enquiry shall not interfere or conflict with, current proceedings in the judicial or administrative fields".

The Senate approved finally the agenda item submitted by Senator Noe, which was formulated as follows:

"The Senate,

Approving the draft bill No. 665, empowered the Parliamentary Commission of Enquiry to examine what measures had been taken or were planned to be taken for decontamination of the affected zones".

Section II

Composition, structure and activities of the Commission

1. Composition of the Commission

On 28 July 1977 the President of the Chamber of Deputies and the President of the Senate appointed the following to serve on the Commission of Enquiry: the deputies Agnelli Susanna (PRI), Aniasi (PSI), Balbo di Vinadio (PCI), Berlinguer Giovanni (PCI), Borromeo D'Adda (DM-Naz.) *, Borruso (DC), Chiovini Cecilia (PCI), Ferrari Marte (PSI), Marzotto Caotorta (DC), Morazzoni (DC), Orsini Bruno (DC), Raffaelli (PCI), Tesini Aristide (DC), Trabucchi (DC) and Venegoni (PCI); and the senators Ariosto (PSDI), Bellinzona (PCI), Benaglia (DC), Bombardieri (DC), Borghi (DC), Luzzato Carpi (PSI), Mazzoli (DC), Milani (PCI), Miraglia (PCI), Petrella (PCI), Pisano (Misto), Piscitello (PCI), Romano (Sin. Ind.), Ruffino (DC) and Santi (DC).

On the same date the Commission - under the provisional chairmanship of the Deputy Trabucchi - elected as chairman Bruno Orsini, as vice-chairmen Deputy Cecilia Chiovini and Senator Luzzato Carpi and as secretary Deputy Susanna Agnelli. The latter, however, resigned her functions as secretary at the session of 20 September 1977, on the grounds that her wide range of commitments did not permit her to discharge the functions of secretary. The Commission elected in her place at the session of 27 September, Senator Romano.

2. Method of work of the Commission

The Commission recognized in the discharge of its functions, above every other consideration, the importance of proceeding in such a way that the aims for which it was set up were fulfilled - in spite of the complexity and multiplicity of the information required to be obtained and the other terms of reference laid down - not only within the shortest possible time, but also and above all, so as to satisfy the

*Died on 17 April 1978, being replaced on 24 May by the Deputy Bonfiglio.

expectations of Parliament and the country and in particular those of the sections of the population directly affected by the tragic incident of 10 July 1976.

This overriding requirement, unanimously accepted by all political groups present in the Commission, made it possible to overcome rapidly the methodological difficulties inherent in the performance of so delicate a parliamentary enquiry, with a virtual unanimity of the decisions taken.

In this context, the Office of the Chairman not only performed the functions of stimulating the activities of the Commission and of coordination between the different working groups, but also organized the investigatory activities, being responsible in particular for obtaining the necessary documentation, for relations with the various authorities and for contacts with persons and public or private bodies, which were necessary for the work of the Commission.

This activity was assisted by a continuous positive evaluation on the part of the Commission. Whenever the Office of the Chairman was required to deal with problems of general importance affecting the Commission, the procedure adopted was to invite participation of representatives of the working groups. This made it possible to adopt stage by stage and in fully autonomous fashion, the methods of operation which were found in concrete cases to be most effective for the performance of the tasks assigned to the Commission, in the Act setting up the Commission. The statement of principle expressed by Chairman Orsini at the first session - that the Commission, being a form of extraordinary organ of Parliament, should enjoy the maximum autonomy in regard to the instruments required for the performance of its own activities - was agreed by all members of the Commission, received the full assent of the Office of the President of the Chamber of Deputies and inspired throughout the activities of the Commission. The resulting flexibility of method, made it possible to overcome the difficulties relating to shortcomings inherent in the legislative provisions and regulations regarding the organization of the work of the Commission of Enquiry and the procedure to be followed in the conduct of the enquiry itself. In practice, when

it became necessary to overcome difficulties in relation to customary methods of working, the Commission abandoned preconceived ideas and adopted the method of operation most suitable to the concrete situation, based on the overriding aim of the best possible achievement of the purposes for which the Commission was set up.

This method of work, which could only be followed by the voluntary agreement of all members of the Commission, contributed to the adoption of all measures to facilitate fulfilment of the terms of reference, including the abandonment of certain exceptions which were initially adopted.

3. Internal organization of the Commission

In organizing its own work and in order to ensure the most scrupulous observance of the mandate which it had received, the Commission found it necessary to set up right from the start four working groups which were given the task, with powers and limitations as set out below, of fact-finding, documentation and general study of the problems within the competence of the Commission itself.

The following working groups were set up. Group I was to be concerned with obtaining the information required under the three first subparagraphs of Article 2 of the Act setting up the Commission. Group II was to be concerned with establishing the damages inflicted on persons, on the environment and on the economy of the contaminated zone. Group III was to be concerned with obtaining the information required under the final subparagraph of the said Article (measures already taken or to be taken in the future for the compensation of citizens who had suffered damage and to obtain compensation from those responsible). Group IV, finally, was to be concerned with all the material covered by Article 3 of the said Act (collection of the evidence for evaluation of the potential risks deriving from industrial activity in the production process as a whole, with a view to formulating proposals for more effective regulations for the protection of the health of workers and the population

at large, to ensure a balanced natural environment and to provide adequate services for effective control).

The working groups were therefore authorized to undertake the necessary research and investigation with the same powers as the Commission itself, but with the obligation to refer to it in all cases where it should be necessary to adopt decisions, whether interlocutory or final, which were not merely instrumental in the exercise of the investigatory activity. The Commission would also be entitled to intervene, on its own initiative, in sectors within the competence of the individual working groups, to indicate methods of operation to be followed and to re-examine and evaluate the documentation acquired directly by the working group.

The composition of the working groups remained unchanged throughout the duration of the enquiry and was as follows:

<u>Group I</u>	Coordinator:	Chairman Orsini
	Members:	Agnelli, Balbo di Vinadio, Borghi, Borruso, Ferrari, Petrella, Raffaelli.
<u>Group II</u>	Coordinator:	Vice-chairman Chiovini
	Members:	Aniasi, Bellinzona, Berlinguer, Marzotto, Caotorta, Pisano, Ruffino, Trabucchi.
<u>Group III</u>	Coordinator:	Vice-chairman Luzzato Carpi
	Members:	Ariosto, Benaglia, Bombardieri, Borromeo D'Adda, Milani, Tesini, Venegoni.
<u>Group IV</u>	Coordinator:	Secretary Romano
	Members:	Mazzoli, Miraglia, Morazzoni, Piscitello, Santi.

The only change occurred on 24 May 1978, when Deputy Bonfiglio was appointed a member of the Commission - and in consequence of working group III - taking the place of the late Giovanni Andrea Borromeo D'Adda.

4. Report of the Commission to the Presidents of the Chamber of Deputies and of the Senate

The Commission, in fulfilment of the obligation laid on it by Article 6 of the Act, notified - by means of two-monthly reports - the Presidents of the Chamber and of

the Senate, both of the progress of the report, of the activities of the working groups and also of the activities – apart from those relating to administrative control and coordination – of the Office of the Chairman.

The Chairman of the Commission, in accordance with the vote taken in the Senate approving on 8 June 1977 the agenda items submitted by Vettori – Minnocci, did not omit to request from the Presidents of the two houses of parliament, the authorization, granted to the Commission, to make use of the services of various experts.

The Chairman also informed the Presidents of the two Chambers, in accordance with parliamentary procedure, that it was necessary for the Commission to exercise its function outside the seat of Parliament (visit to Milan by working group III on 16 January 1978; visit to Berne on 13 March 1978 by the Chairman and his staff, accompanied by representatives of the working groups; visit of the Commission on 22 April 1978 to Seveso and other districts contaminated by the toxic cloud).

5. Investigatory activity of the Commission

The information requiring to be collected in accordance with Article 2 of the Act was of so wide a range and such complexity as to make it quite clear that the investigatory activity should if possible be carried out without too close an adhesion to juridical forms.

The Commission was encouraged in this view by decision No. 231 of 22 October 1975 of the Constitutional Court, and by Act No. 357 of 16 June 1977.

It is hardly necessary to recall, in fact, that the above decision stated that "the function of Parliamentary Commissions of Enquiry is not to judge, but merely to collect information and facts necessary for the exercise of the functions of the Chambers of Parliament"; such Commissions "are not expected to produce in their final reports any judicial findings"; they are thus left free "to select wide-ranging forms of action, which are more flexible and free of judicial formalities, so as to elicit a spontaneous

response from individuals and public officials called on to contribute to their work".

There was equally no doubt that Article 7 of Act No. 357 of 16 June 1977, which laid down that the Commission should undertake its investigation and detailed examination with the same powers and the same limitations as the judicial authority in the sense of Article 82 of the Constitution, had no wish to bind the Commission itself to a rigid judicial formalism. The word "examination", used by the legislator, should in fact be interpreted, in its widest significance, as indicating the possibility of this Commission also selecting "methods of action which were flexible and free of judicial formalism", referred to in the previous decision of the Constitutional Court.

The Commission built with the question of its procedural method at the session of 27 September 1977, during which the Commission heard two officials - Professor Giannico and Professor Pocchiari - appointed by the Ministry of Health, who were considered to be suitable persons to report on the most significant measures taken by the Ministry of Health. Since a simultaneous hearing was deemed by some members of the Commission to be impossible and by others to be confusing, the Chairman issued, on the analogy of judicial procedure, an opinion on the procedure to be adopted for such examinations, which was approved by the Commission.

The text of the opinion was as follows:

The Office of the Chairman, recalling previous procedure for the hearing of persons by Commissions of Enquiry, and bearing in mind the provisions of Decision No. 231 of 1975 by the Constitutional Court, points out that the Commission is free to undertake hearings in the most flexible manner and free of judicial formalism (as stated in the said decision), i.e. in a manner substantially identical with that followed by Parliamentary Commissions within the framework of the regulations of the Chamber of Deputies.

In cases where the Commission intends to hear the evidence of persons on specific circumstances or cases, it shall hear the evidence based on previously formulated investigatory headings, making use of the forms laid down for judicial procedures.

In regard to the problem of hearing the representatives of the Ministry of Health, the Office of the President, although recognizing that the simultaneous presence of the representatives of the bodies in question would not constitute a violation of the procedure referred to above, decides for reasons of expediency, to hear Professors Giannico and Pocchiari separately, as indicated to the Ministry of Health in Commission letter of 23 September ult.

Although the Commission adhered in principle to procedures similar to those of the judiciary, the Commission nevertheless undertook the hearing of witnesses, whom it deemed necessary to call, without the formalities laid down in judicial procedure for the hearing of witnesses and carried out its interrogation without the presence of advocates of technical advisers, without administering the legal oath and without a verbatim record of the evidence given. A shorthand record of these hearings was nevertheless kept and the relevant memoranda and documents produced. Taken overall, the procedure followed did not differ in principle from that of parliamentary Commissions when hearing persons in accordance with the respective regulations of the two Houses of Parliament.

The procedure followed for the hearings was for questions to be put first of all by the Office of the Chairman, followed by those of individual members of the Commission. At the same time the principle, already applicable to Commissions of the Chamber and Senate, was adopted of avoiding any discussion with the persons called before the Commission or in their presence.

Another question of a procedural nature arose during the session on 7 February 1978, when the Commission was hearing Engineer Herwig von Zwehl, Technical Director of ICMESA, and Dr. Paolo Paoletti, Director of Production of the establishment, against whom criminal proceedings were pending before the investigating magistrate of the Court of Monza.

Before hearing Engineer von Zwehl, the Chairman informed him that he had been called to give evidence before a Parliamentary Commission of Enquiry, the conclusions of which, to be submitted in the form of a report to Parliament, could not influence the course of the legal proceedings against him, in view of the clear and fundamental difference between the terms of reference of the Parliamentary Commission of Enquiry and the powers of the judicial authority.

In spite of the above statement, the witness submitted a memorandum in which, in view of the accusation made against him, he claimed the right to make no statement outside the courts, although he expressed the wish to collaborate with the Commission.

After Engineer von Zwehl had withdrawn, a long discussion was held within the Commission, on conclusion of which it was decided - in amplification of the statement made to the witness by the Chairman, to recall von Zwehl in order to pose a number of questions of importance in connection with the investigation.

Engineer von Zwehl was recalled and the initial request repeated; he immediately replied to this and to all subsequent questions.

A further question of a procedural nature came to the attention of the Commission as a result of a communication from attorney Giuseppe Prisco, briefed for the defence in Italy of the Swiss citizens Guy Waldvogel and Jeorg Sambeth, Director General and Technical Director respectively of GIVAUDAN S.A.. Attorney Prisco notified the Chairman of the Commission of the availability of his clients to provide any necessary clarification, provided however, that they could be examined in Switzerland, if necessary in the Italian Embassy at Berne.

At the session of 8 March 1978 the Chairman informed the Commission of the contents of this communication and stated that the Office of the Chairman, expanded by the addition of representatives of the working groups, had requested the Ministry of Foreign Affairs to arrange via diplomatic channels, for the hearing to take place on

13 March at the Italian Embassy in Berne, in view of the extra-territorial nature of the premises of the Embassy.

The Chairman discussed the hearing of these witnesses and decided that it should be undertaken by the Office of the Chairman, expanded by representatives of the working groups.

It should be pointed out that, in the course of the execution of this investigatory activity, the Chairman repeated to Mr. Waldvogel and Mr. Sambeth, the statement which was made during Commission hearings, to all those in the category of accused in the criminal proceedings before the investigating magistrate of the Court of Monza.

The witnesses Waldvogel and Sambeth made their statements without the presence of advocates or technical advisers.

It should be pointed out that all those, against whom criminal proceedings were pending, were only called to testify before the Commission after receiving an officially authenticated copy of the charges against them; this had the double purpose of preventing any application or contestation of the statements made before the investigating magistrate, and avoiding references or claims in regard to the hearing by the Commission. All persons, whose evidence it was necessary to hear, were invited to appear in writing. Only in cases of particular urgency or where it was necessary to determine the domicile of the witness, the invitation was issued by the police, use being made of the unit competent for the particular area.

The assistance was also requested of the financial supervisory service (Guardia di finanzi) for a specific investigatory task, the results of which are given in another part of the report.

6. Relations with the judicial authority

The Commission was necessarily brought into contact with the judicial authority as a result of the need for the Commission to acquire, under the seal of investigatory secrecy, an official copy of the deeds and documents relating to the criminal proceedings pending against Engineer von Zwehl, Technical Director of the ICMESA establishment and others, before the investigating magistrate of the Court of Monza.

This request - with the relevant grounds - for documentation on the legal proceedings, submitted in accordance with Articles 165 and 342 of the Code of Criminal Procedure, was received in a spirit open collaboration both by the Procurator General (public prosecutor) of the Court of Appeal of Milan, and also by the investigating magistrate, with both of whom representatives of the Office of the Chairman of the present Commission held a preliminary discussion - before the request was submitted in formal terms.

7. Documents acquired by the Commission

To complete the picture, details are given below of the documents requested by the Commission or communicated to the Commission in the course of the enquiry.

Documents provided by the Ministry of Labour and Social Security

Report of the Special Technical-administrative Commission set up on 9 August 1976, relating to the escape of toxic substances from the ICMESA establishment, with 45 annexes.

Report of the Director General on the working reports undertaken, before and after the escape of toxic gases from the ICMESA establishment, by the Ministry of Labour and Social Insurance, by the Provincial Inspectorate of Labour of Milan, by ENPI and ANCC, with 17 annexes.

Report dated 27 July 1977 submitted by the Provincial Inspectorate of Labour of Milan to the Minister of Labour and Social Security.

Reports drawn up by officials of the Provincial Inspectorate of Labour of Milan on inspections carried out in the ICMESA establishment in 1971, 1973 and thereafter in successive years up to 1975.

List of draft bills on safety and hygiene regulations covering the production and use of dangerous substances.

Documentation relating to the contamination occurring in the districts of Priolo, Melilli and Manfredonia.

Documents supplied by the Ministry of Health

Summary of the principal measures taken by the Ministry from 21 July 1976 to 23 July 1977, with 110 annexes.

Report of the Director General of the Public Health Services on the hygiene/health aspects of contamination with TCDD in the Seveso zone.

Descriptive Note and technical reports on dioxin drawn up in part by the Director General of the Higher Institute of Health, and in part by other experts.

Note covering various clarifications requested by the Commission and related annexes.

IARC Report on dioxin.

Documentation relating to the contamination occurring at Priolo, Melilli and Manfredonia.

Reports of meetings of the Technical-scientific Commission held at DPCM on 4 August 1976.

Updated report on the hygiene and sanitary aspects of TCDD contamination in the Seveso zone and related annexes.

Report of the Director General of the Public Health Service on remedial measures taken in the Seveso zone.

Bibliography on TCDD.

Documents supplied by the Ministry of Industry,
Light Industry and Trade

Report on problems connected with the incident of 10 July 1976.

Documents supplied by the Ministry of Public Works

Opinion (Vote No. 1861, issued on 29 November 1971, of Session VI of the Higher Council of Public Works) on the draft plan for the district of Meda.

Documents supplied by the Region of Lombardy

Report on programmes of operative measures in the affected zone.

Programme in six volumes of the measures taken in implementation of Article 1 of Regional Law No. 2 of 17 January 1977, and schemes relating to the project under subparagraph (a) of the said Article.

Review of the Italian press from July 1976 to July 1977, relating to the event at Seveso.

Document No. 9 relating to the ICMESA company.

Document No. 18 relating to the incident of 10 July 1976.

Report No. 2 on subparagraphs (a) and (e) of Article 2 of the Act setting up the Commission.

Report on remedial measures in zones A6, A7 and A8 of Seveso.

Technical Report drawn up by the Agrarian Inspectorate of Milan.

Resolutions adopted by the Regional Board and Regional Council.

Day-to-day record of the days immediately following the incident of 10 July 1976, with 34 annexes.

First investigation of the damage, in implementation of Article 1 of Legal Decree No. 542 of 10 August 1976.

All reports of meetings of the Health Commission.

Organization chart of the technical and political bodies operating in the contaminated zone.

Documents supplied by the provincial administration of Milan

Documents relating to: (a) the contamination caused by ICMESA, (b) the activities of the decontamination service of Seveso, (c) the activities of the provincial hygiene and prophylaxis laboratory of Milan, (d) warehouse infrastructure and preparations made in the storage area (with 5 annexes in graph form).

Documents supplied by the Extraordinary Commission for Seveso

List of damage reported by farmers, industry, light industry and commercial undertakings.

List of amounts requested and paid up to 31 May 1978.

Correspondence between the Region of Lombardy and the damage compensation office of GIVAUDAN.

List of schools fit for use in the contaminated areas.

Documentation relating to the state of progress of regional operational programmes.

Documents supplied by the Mayor of Seveso

Copies of Orders Nos. 377 and 736, issued by the magistrate of Desio, dated 3 July 1973 and 15 June 1976 respectively.

Municipal Order No. 26 issued between 30 July 1976 and 20 December 1977.

List of economic measures taken in the interests of the population of Seveso.

Resolution taken by the Municipal Board of Seveso dated 17 January 1978, relating to the situation following the incident of 10 July 1976.

Motion by the Communal Council of Seveso (15 February 1978).

Documents supplied by the Mayors
of Meda, Cesano Maderno and Desio

Various administrative reports and documents.

Documents supplied by the investigating magistrate
of the Court of Monza

Official copy of various documents relating to the criminal proceedings, pending against Herwig von Zwehl, Technical Director of the ICMESA establishment, and others (sheet No. 2097).

Documents supplied by the officer in charge
of the police station at Meda

Report on the way in which the officer in charge received information on the escape of toxic substances occurring in the ICMESA establishment.

Documents supplied by the National Research Council

Report of experiments carried out at Seveso under the analytical control of the Higher Institute of Health.

Documents supplied by the coordinating committee
of the three health consortia of Brianza-Seveso

Technical Report on the contamination.

Report on the medical supervision of workers of the ICMESA establishment after 10 July 1976.

Report on the measures laid down in operative programme No. 3 in the Regional Law of 17 January 1977.

Letter sent to the chairman of the committee by Professor Franco Bonetti in regard to the veterinary situation in the district of San Bernardo di Nova Milanese, dated 16 February 1978.

Documents supplied by the Provincial Hygiene and
Prophylaxis Laboratory of Milan

Report on the activities of the laboratory in connection with the problem of TCDD contamination.

Documents supplied by the "C. Besta"
Neurological Institute of Milan

Report on the results of an investigation carried out at Seveso to establish the causes and details of the occurrence of neurological disorders.

Documents supplied by the provincial medical officer
attached to Seveso

Report on the incident of 10 July 1976.

Document No. 21 relating to formal aspects of the functions of the provincial medical officer, his field of competence and his political/administrative and technical/scientific activities.

Documents supplied by the Ecological Group of Milan

Report No. 2 relating to the ecological situation in the Seveso zone.

Report on "Atmospheric contamination: the case of dioxin contamination at Seveso", prepared by the International Commission of the Group.

Documents supplied by the technical advisers involved in
the criminal proceedings against responsible officials of ICMESA

Up to date bibliography on the most salient toxicological aspects of dioxin.

Documents supplied by trade union associations of Lombardy

Various reports and documents.

Documents supplied by the Works Council of ICMESA

Various documents.

Documents supplied by the company ICMESA

Information report, with 22 annexes.

Documents supplied by the Prefect of Foggia

Documentation relating to the incident occurring on 26 September 1976 at Petrochemical Plant IV of ANIC at Manfredonia and the resulting contamination.

Documents supplied by the Prefect of Syracuse

Documentation relating to the contamination of the industrial zone of Priolo-Melilli.

The documents listed above were stored, from the date of their acquisition throughout the enquiry at the headquarters of the Commission in the Palazzo Raggi, in premises exclusively allocated for this purpose and guarded by personnel of the 18th Legion of the Guardia di finanza. This was necessary, since the documents themselves were copies of various documents, all of which had been copied under the seal of investigatory secrecy, relating to criminal proceedings pending against the director of ICMESA and others.

Only members of the Commission and officials attached to the Commission had access to these premises. No copies of these documents or of the stenographic records of the hearings were released, even if express requests were submitted.

8. Hearings

The Commission made full use of their powers to call and hear the evidence of all those who were, for official reasons, directly concerned with the problems associated with the contamination of the Seveso zone.

The following witnesses were in fact heard:

Professor Luigi Giannico, director general of the Public Health Service of the Ministry of Health.

Professor Francesco Pocchiari, director of the Higher Institute of Health.

Dr. Nicola Ricciardi-Tenore, director of the central medical health inspectorate and Chairman of the special technical-administrative Commission set up by the Ministerial Decree of 9 August 1976.

Dr. Ugo Tavernini, director general of reports of the Ministry of Labour and Social Security.

Dr. Claudio Caponetto, director general of general matters and personnel of the same Ministry.

Dr. Vito Brunetti, senior director of the general urban directorate of the Minister of Public Works.

Dr. Eugenio Carbone, director general of industrial production of the Ministry of Industry, Light Industry and Commerce.

Professor Cesare Golfari, President of the Region of Lombardy.

Mr. Vittorio Rivolta, health and social security adviser of the same Region.

Dr. Roberto Vitali, chairman of the provincial administration of Milan.

Engineer Carlo Cerabolini, director of the decontamination office of Seveso.

Dr. Aldo Cavallaro, director of the provincial chemical laboratory of Milan.

Dr. Nino Pisoni, ecological adviser of the Region of Lombardy.

Mr. Francesco Rocca, mayor of Seveso.

Professor Ilvano Desiderati, mayor of Desio.

Mr. Patrizio Malgrati, mayor of Meda.

Mr. Mario Vaghi, mayor of Cesano Maderno.

Attorney Antonio Spallino, Extraordinary Commissioner for Seveso.

Professor Augusto Giovanardi, Chairman of the special consultative Commission for the determination and coordination of remedial measures, set up in the Region of Lombardy.

Engineer Herwig von Zwehl, technical director of the ICMESA establishment.

Dr. Paolo Paoletti, production coordinator of the same establishment.

Dr. Giuseppe Reggiani, director of clinical research of the Hoffman La Roche group.

Representatives of regional and provincial trade union associations in Lombardy (Alberto Grancini, Antonio Nosedà, Sandro Venturoli, Leonardo Banfi, Walter Fossati, Felice Orsi and Carlo Ghezzi).

Representatives of the Works Council of ICMESA (Antonio Chiappini, Amedeo Argiuolo and Giorgio Zibra).

Employees and workers of ICMESA (Carlo Galante, Mario Corbisiero, Gabriele Gaviraghi, Annibale Basile, Elsa Galante and Antonio Dall'Orto).

Technical advisers concerned in the criminal proceedings against von Zwehl and others (Professor Antonio Fornari, Giuseppe Corsico, Maria Montagna, Luigi De Carli, Sergio Facchetti, Giuseppe Bianchetti, Piero Bellini, Linda Federico Goldberger, Engineer Franco Mozzana, Dr. Luisa Binecchio and Dr. Francesco Avato).

The various hearings were carried out, with the powers and under the conditions referred to above, by the Office of the Chairman and by the working groups.

While the Office of the President, expanded to include representatives of the working groups, visited Berne to hear the evidence of Messrs. Guy Waldvogel and Jeorg Sambeth, director general and technical director respectively of GIVAUDAN S.A.,

Working group II heard:

- (a) the data submitted by the Third Health Commission, set up in the region of Lombardy (Dr. Laura Conti, secretary, Minelli, Caccia, Meriggi and Petenzi, members),
- (b) the provincial medical officer allocated to Seveso, Dr. Zambrelli,
- (c) the data submitted by the coordinating committee of the health consortia of Brianza-Seveso 1-2-3 (Cavargna, Biella, Gorla, Laurizi, Bertoglio, Basile, Cairolì, Lissoni, Beretta, Ongetta, Drs. Longa and Fellin Professor Boeri and Dr. Filippini, neurological coordinators, Dr. Ideo, medical coordinator, Professor Remotti, obstetric coordinator, Professor Marni, paediatric coordinator, Professor Puccinelli, dermatological coordinator, Dr. Mocarelli, coordinator for laboratory analyses, Drs. Ghezzi and Cannatelli, coordinators for industrial medicine, Dr. Rossi, Dr. Alberti and Dr. Feltrin, medical coordinators for the three health consortia of the zone respectively,

Working group III heard:

the agricultural adviser of the Region of Lombardy, Dr. Vercese and the head of the agrarian inspectorate of Milan, Professor Zampieri,

Working group IV heard:

- (a) Professor Luciano Caglioti, department of chemistry of the University of Rome,
- (b) Professor Carlo Polvani, chairman of the working group of the Technical Commission of CNEN for the study of residual risks in connection with locations and emergency plans,
- (c) Engineer Giancarlo Tenaglia, directorate general of nuclear safety and health protection of the CNEN,
- (d) Professor Luigi Giannico, director general of the public health service of the Ministry of Health,
- (e) Dr. Mario Santi, head of the safety service of ENI, Dr. Emma Spreafico, office of legislative studies, Engineer Rosario Labozzetta, head of the specialist planning services, and Dr. Alfredo Casiglia, documentation service,

- (f) Professor Renato Wegner, director of the Institute of ergotechnics of the Technical College Milan,
- (g) Professor Paolo Schmidt, office for the coordination and control of environmental policy plans of Montedison,
- (h) Professor Aldo Visalberghi, Dr. Giorgio Panizzi, architect Sergio Bracco and architect Vieri Quilici of CNITE,
- (i) representatives of the combined confederations CGIL, CISL, UIL and FULC (Dr. Vigevani, Dr. Ilossi and Dr. Arnaud).

Working groups I and IV heard, if in joint session:

- (a) Engineer Ferdinando Pierini, director of the consumer section of ANCC of Milan,
- (b) accountant Vittoriano Costantini, director of the Milan Headquarters of ENPI,
- (c) Engineer Carmelo Miggiano, head of the Milan Fire Brigade,
- (d) Engineer Falco Siniscalco, technical adviser of CRIAL.

9. Deferment of the date for presentation of the final report to the Chamber and Senate (Act No. 12 of 24 January 1978)

The Act setting up the Commission provided for the completion of the work and presentation of the Final Report to the Chamber and Senate within six months of the setting up of the Commission.

At the session of 20 December 1977, the Commission came to the conclusion that the huge volume of documentation collected and the need for further investigation, rendered it impossible to complete the work within the period laid down in the Act setting up the Commission. It was therefore decided to request a deferment of six months.

This was implemented by the presentation of a bill, signed by the Chairman of the Commission and representatives of the political groups serving on the Commission, deputies Susanna Agnelli, Borromeo d'Adda, Borruso, Cecilia Chiovini and Marte Ferrari (Annex IX).

This bill was approved by Parliament without modification (Act No. 12 of 24 January 1978), as a result of which the date for presentation of the Final Report was deferred until 27 July 1978 (Annex X).

Second Part

Investigation of the causes and liability for the incident

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Section I

Investigations relating to the installation of the ICMESA industrial plant at Meda, its operational safety and the dangers inherent in the production process

1. Nature of the investigation

Article 1 of Act No. 357 of 16 June 1977, gave this Commission the terms of reference "to investigate and report to Parliament on the causes and liability for the escape of contaminating substances from a reactor vessel, installed in the ICMESA establishment, which occurred on 10 July 1976".

It is desirable to indicate here the criteria adopted by the present enquiry in connection with the investigation of the causes and liability for the incident in question.

It is immediately clear that the enquiry was carried out with different aims from those of the judicial investigation which - as stated above - is still proceeding before the Monza Court, in which the technical director of ICMESA and others, are accused under various heads in connection with the same incident, based on Articles 449 and 437 of the Penal Code (causing by criminal intent a disaster and criminal omission to take the necessary precautions against accidents at work).

The terms of reference of the Commission were to investigate the causes of the incident and to establish whether those responsible at ICMESA had complied with the regulations in regard to the precautions to be taken to prevent the occurrence - due to the harmfulness of the production process or to illegal actions, whether fraudulent or criminal - of circumstances liable to cause injury to the health of persons or damage to the environment and the economy; the Commission was also required to establish liability at all levels, both central and local. The competence of the courts, on the other hand, was to establish or exclude the criminal liability of persons accused in accordance with the law and, in appropriate cases, to demand the penalty for such actions.

The investigations of the Commission, in this aspect of the enquiry, dealt therefore with the following:

- (a) the risks involved in TCP production, the causes of the incident on 10 July 1976 and the technical liability of ICMESA,
- (b) the liability of ICMESA for violation of the health regulations and laws for the prevention of accidents at work and occupational diseases,
- (c) the liability of the public administration and supervisory organ.

2. History of the company ICMESA from 1921 to 1976, and distribution of shares as at 31 July 1976

The company ICMESA (Industrie Chimiche-Meda-Societa Azionaria) has its headquarters at Meda, in the present building located at Via Privata ICMESA, No. 21.

The history of the company may be summarized as follows:

By notarial deed drawn up by the notary Bonucci of Naples, on 15 October 1921, the limited partnership "Industrie Chimiche Meridionali K. Benger e C." was converted into a public company, taking the title "Industrie Chimiche K. Benger e C. S. A. ".

The headquarters was at that time situated at Naples and the company was engaged on manufacturing and selling synthetic aromatic products, intermediate products (for the pharmaceutical industry and for the organic colouring agent industry) and basic products for the chemical industry.

On 21 January 1924 the company again changed its name to "Industrie Chimiche Meridionali S. A. ICMESA" and on 24 March 1934 the headquarters was transferred to Via Pontaccio No. 14, Milan. It should be pointed out, that a report from the Guardia di finanza (financial supervisory service) to the public prosecutor of the Court of Monza, dated 29 September 1976, showed ICMESA to have been registered with the Chamber of Commerce of Milan under No. 197309 at the end of 30 September 1932.

According to the same report, the general assembly of shareholders decided in July 1947, since the establishment at Naples had been destroyed by bombardment, to complete the establishment at Meda (which was in course of construction), to change the title of the company to "ICMESA S.A. - Industrie Chimiche-Meda-Societa Azionaria", to extend the life of the company to 31 December 2000 and to increase the share capital from Il 4,000,000 to Il 48,000,000 by the issue of 88,000 new shares of nominal value Il 500.

On 21 June 1972, by notarial deed drawn up by Berenghe, the headquarters of the company was transferred from Milan to Meda and the share capital - which had in the meantime increased to Il 600,000,000 - was increased to Il 1,000,000,000, consisting of 1,000,000 of Il 1000. On 31 July 1976 the breakdown of the share holdings was as follows: 462,170 shares held by GIVAUDAN e C.S.A. (Geneva), 295,750 shares held by F. HOFFMANN LA ROCHE e C.S.A. (Basle), and 242,080 shares held by DREIROSEN AG. (Basle) (details will be found in Annex XI).

The history of the acquisition of the complete shareholding in ICMESA by the above company has been described by Mr. Waldvogel, director general of GIVAUDAN and chairman of the Board of Administration of ICMESA, in the following terms:

"GIVAUDAN was purchased by the company La Roche in 1964⁽¹⁾, having been previously a private company owned by the family Givaudan, founded by Leon Givaudan who had directed the development of the company for 70 years. ICMESA was for many years an important supplier of the company GIVAUDAN, the owners of which were linked and closely bound by friendship with the family Rezzonico, owners of ICMESA. The ICMESA establishments located at Naples were completely destroyed during the second world war, and the Rezzonico family, after the war, rebuilt the factory at Meda; the Givaudan family became shareholders in ICMESA before GIVAUDAN became the property of the company LA ROCHE. There were close links of friendship between the Rezzonico and

(1) This circumstance appeared to the Commission to be relevant for purposes of setting in perspective the problems to be dealt with in the fifth part of the present report.

and Givaudan families, and it thus occurred, since Mr. Rezzonico was already fairly old and had no family to whom he could entrust the management of the business, that ICMESA was acquired by GIVAUDAN, although it was known that considerable capital would have to be spent to modernize the plant. In 1970 in fact, the problem of waste water purification became urgent throughout the world and this necessitated considerable investment to provide ICMESA with the necessary infrastructure. There was however the advantage that the factory already possessed a thermal heating system which afforded the prospect of a measure of self-sufficiency in the energy field (statement by Mr. Waldvogel, IV/1).

3. Installation of the ICMESA industrial plant at Meda

On 13 December 1945 the civil engineering service notified the company ICMESA (and, for information, the mayor of Meda) of approval of the request put forward by the company on 29 November 1945 for authority to build in Meda an establishment for the manufacture of pharmaceutical products, the Allied Military Command having raised no objection, subject to the approval of the local authorities in application of local regulations.

On 28 December 1945, the communal administration of Meda approved the plans for the new building, noting that the ICMESA application had stated that the establishment was to consist of 17 principal buildings, but that only 7 were to be built at that time, namely 3 workshops, 1 heating and pumping plant, 1 general store, 1 office building housing also the porter, and 1 dwelling for employees.

The factory was then built during the next few months on the selected site, bounded by the territories of the communes of Meda and Seveso but within the area of authority of the former.

On 22 August 1946, the sanitary inspector of the hygiene and prophylaxis service of Seveso certified that the establishment met the requirements of the communal hygiene regulations and could therefore be declared habitable under the provisions of the single valid text of sanitary statutes.

Attention may be drawn to the rapidity with which the civil engineering service and the Commune of Meda, acting within their respective fields of competence, had authorized the construction of the establishment. At a time of grave economic crisis, the factor which probably took priority over all others was the prospect of installing in the commune of Meda - mainly engaged on light industry - an industrial plant which was likely to expand, according to the forecasts in the application submitted by ICMESA for approval of the project, since this would have given employment to almost 300 persons, i.e. the creation of a number of jobs of some significance in relation to the total population which amounted in 1946 to 10,309 inhabitants.

ICMESA had stated that the establishment was intended for "the manufacture of pharmaceutical products"; the sanitary inspector had certified, as stated above, that the plant was equipped so as to meet the communal hygiene regulations and there was no reason to anticipate any situation involving damage or danger to public health. No request was in fact submitted for the municipal board to classify the establishment in one of the categories laid down in Article 216 of the single valid text of the sanitary statutes, as laid down in Article 102 of Royal Decree No. 45 of 3 February 1901.

It appears obvious, however, that each successive change in the production process, which could have necessitated the registration of the establishment in one of the two categories laid down in the aforesaid Article 216, should have obliged the company ICMESA to notify the mayor "15 days before starting the new type of production".

This was never done. In successive years in fact, namely in 1953 and 1958, ICMESA merely applied to the local authorities of Meda for permission to expand the establishment by the construction of a further production shop and a building intended as a civil dwelling. In both cases the local authority raised no objection, no indications having been given of any change in the production process of the establishment, on the assumption that the conditions in the factory continued to comply with local and provincial laws and communal regulations on hygiene and housing policy. It appears, finally that on

4 May 1968 the local authorities of Meda approved the draft of a general modernization plan, to which certain changes were made by the Higher Council of Public Works at its sixth session, by decision No. 1861 of 29 November 1971. In April 1972, however, the Minister of Public Works instructed the mayor of Meda, that approval of the plan should be held pending, since certain changes were to be made in the regulations, including cancellation of Article 35 of the text of the operative technical regulations⁽²⁾. The cancellation of this article meant that the present and future presence of harmful industries was expressly excluded in combined industrial areas (IN zones), located close to the urban centre and intended for industrial buildings and related commercial activities. The area occupied by ICMSA was according to this included in the aforesaid IN zone.

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- (2) The text of Article 35 of the operative technical regulations in the general modernization plan of the Commune of Meda was formulated as follows:

"IN zone - Harmful industrial areas:

Industrial premises of any type may be located in the IN zone.

No residential installations may be located in this zone, apart from premises intended to be used by guards and night watchman.

In addition, a belt of trees, extending to at least 10.00 m is to be planted round the boundaries of the industrial area. In all other respects the provisions of the preceding Article 34 apply."

The Higher Council of Public Works pronounced as follows in decision No. 1861 of 29 November 1971:

"Article 35" IN zone - Harmful industrial areas". This article should be cancelled in view of the incompatibility, at the present time and in the future, of harmful industries close to the urban centre. The zone in question should comply with the provisions of Article 34.

By decision of 11 July 1972, the local council of Meda approved the requested modifications and by decision No. 2962 of 30 January 1973, which was made effective by the Commission of Control on Regional Administration, the regional board - which had in the meantime become competent for such matters, approved the general plan of adaptation for the commune of Meda. The ICMESA establishment, which was stated to be intended for the "manufacture of pharmaceutical products" was as a result located in an area in which the new general regulatory plan prohibited the installation of harmful industries.

The staff position during the first ten days of July 1976 was that the ICMESA establishment was employing 3 directors, 45 salaried employees and 112 workers, 2 of whom were on military service and 1 on leave of absence. The technical director of the establishment was Engineer Herwig von Zwehl and the technical production director was Dr. Paolo Paoletti.

The ICMESA establishment occupies at present an area of $52,875 \text{ m}^2$, in which are located the workshops used for the various production sectors. Production shop B occupies an area of 1100 m^2 . A plant for vanillin production was initially installed in this shop, but during the years 1969 - 1970 the plant was modified for the manufacture of TCP (2,4,5-trichlorophenol).

4. Trichlorophenol (TCP) production

Trichlorophenol production was started in 1969 - 1970, but full scale production was only reached in subsequent years, in particular in 1974 - 75, when - as the Commission was told by Mr. Waldvogel - "in view of shortages of some raw materials it became difficult to find products of the necessary quality in sufficient quantities". "For this reason - added Mr. Waldvogel - our technical division proposed a renewal of trichlorophenol production at the ICMESA plant, so as to provide compounds of the necessary quality for hexachlorophene production. I myself took part only in this final decision, the plant having been set up previously", (statement by Waldvogel, 11/2).

In regard to the production costs aspect, Waldvogel himself admitted that "it was worth producing trichlorophenol at ICMESA after the increase in prices which occurred in 1974" (VII/3).

The annual figures for trichlorophenol production may be obtained from the report of 29 July 1976 and the memorandum of 22 May 1978, prepared by the anti-adulteration section of the Milan police, based on documents produced by ICMESA and statements by members of the staff:

1970	6,361 kg
1971	33,000 kg
1972	40,350 kg
1973	No production due to lack of orders
1974	38,400
1975	105,346
1976	142,820 (sold up to 9 July 1976).

These figures were confirmed in the memorandum submitted to the Commission by Waldvogel on 2 July 1978, which included at annex a list of trichlorophenol production and sales.

The only difference relates to the year 1974, for which Waldvogel indicated no production, whereas the anti-adulteration section's report showed the figure of 38,400. This is however only an apparent discrepancy - and of little relevance to the aims of the enquiry - since, as was subsequently agreed by the anti-adulteration section itself, this quantity of TCP was in fact purified during 1974, having been produced during the preceding year.

It is also true that in 1975 ICMESA obtained a further 47,310 kg trichlorophenol as a result of purification of 53,440 kg of the compound acquired from GIVAUDAN.

Apart from trichlorophenol, ICMESA was also producing the following compounds:

(1) benzyl acetate, (2) phenylethyl acetate, (3) menthanyl acetate, (4) terpenyl acetate, (5) hydrochloric acid, (6) phenylacetic acid, (7) benzyl alcohol, (8) phenylpropyl alcohol, (9) cinnamic aldehyde, (10) methyl anthranilate, (11) benzoic aldehyde, (12) benzilidene acetone, (13) benzyl benzoate, (14) ethyl benzoate, (15) methyl benzoate, (16) benzyl cyanide, (17) citronellol, (18) benzyl chloride, (19) benzyl ether, (20) phenylacetamide, (21) ethyl phenylacetate, (22) phenylethyl phenylacetate, (23) isobutyl phenylacetate, (24) methyl phenylacetate,

(25) potassium phenylacetate, (26) 3-phenyl-5-chloroanthranil (or ICM 110), (27) para-hydroxybenzylidene acetone (or ICM 130), (28) nerolin, (29) benzylpropionate, (30) amyl salicylate, (31) benzyl salicylate, (32) methyl ethers of β -naphthol. Production of the compound listed under Nos. 5, 9, 11, 16 and 18 above, is included in the category of unhealthy industries of the first class, attached to Ministerial Decree of 12 February 1971.

The raw materials for trichlorophenol production were acquired by ICMESA either on the Italian or on the foreign market. The firm Montedison supplied monoethylene glycol and caustic soda, the firm ANIC monoethylene glycol, the firm Festerazzi xylene, and the firm Rhone Poulenc of Paris tetrachlorobenzene.

Trichlorophenol production at Meda was intended exclusively for GIVAUDAN VERNIER of Geneva and the GIVAUDAN CORPORATION of Clifton (USA); the following data demonstrate that the output of the Meda establishment was sufficient only for the requirements of GIVAUDAN. The Commission found in fact - both from the statements by Waldvogel (VIII/3 and X/6) and also from the central section of the financial supervisory service (report of 16 May 1978) - that in 1975 and 1976 the trichlorophenol output was relatively consistent and that ICMESA despatched the product to the above two companies alone, and in the following quantities:

GIVAUDAN VERNIER:	in 1975	63,140 kg
	in 1976	75,020 kg
GIVAUDAN CORPORATION:	in 1975	77,292 kg
	in 1976	67,800 kg.

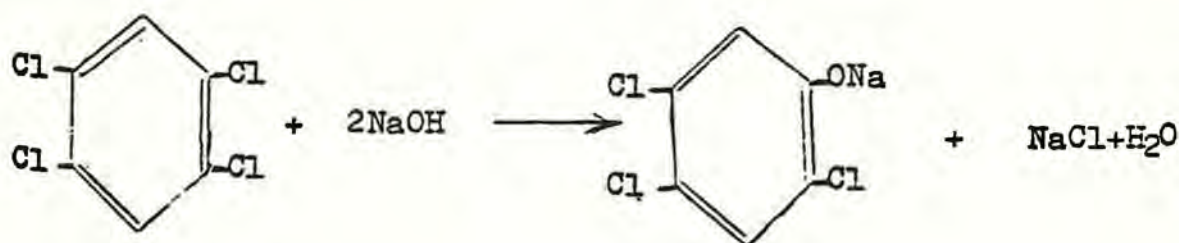
5. Method adopted by ICMESA for trichlorophenol production - Comparison with methods adopted elsewhere

TCP (2,4,5-trichlorophenol) is a compound which is mainly used for:

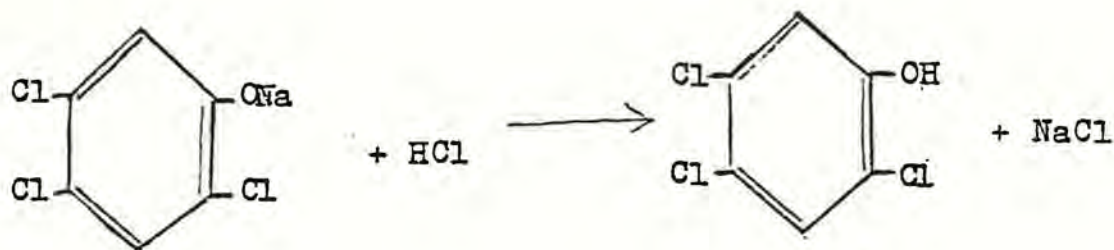
- (a) the preparation of 2,4,5-trichlorophenol acetic acid, the derivatives of which are used as herbicides,

- (b) the preparation of hexachlorophene, an antibacterial compound added to a number of cosmetic products.

The method used by ICMESA for TCP production is based in principle on a GIVAUDAN patent (US Patent No. 2,509,245, applied for on 20 March 1947), which involves the partial hydrolysis reaction between TCB (1,2,4,5-tetrachlorobenzene) and disodium hydroxide:



This results in the formation of sodium trichlorophenate, which is transformed by successive stages into TCP by treatment with hydrochloric acid (acidification):



The former of the two reactions proceeds in the heat in a suitable solvent, given in the patent as ethylene glycol, with the substitution (or addition) in industrial applications, of other compounds. According to the patent, the working temperature should be between 160° and 200°C, preferably between 170° and 180°C. In the

ICMESA establishment, the temperature did not exceed 185°C according to the statement by Dr. Paoletti, technical production coordinator (XVIII/1).

The industrial production process at ICMESA included the following stages:

- (1) the principal reaction between TCB and sodium hydroxide, which took place in a solvent mixture consisting of ethylene glycol and xylene,
- (2) distillation of the solvents,
- (3) an acidification reaction,
- (4) purification of the final product (TCP).

The scheduled working times for each of these phases were 8, 6, 1 and 8 hours, so that one full production cycle could be completed during the 24 hours of the day, carried out in three working shifts.

The production process, followed at ICMESA, varied from the original GIVAUDAN process in which, as emerges from the statements by Paoletti (XVIII/3) and Facchetti (XIV/2):

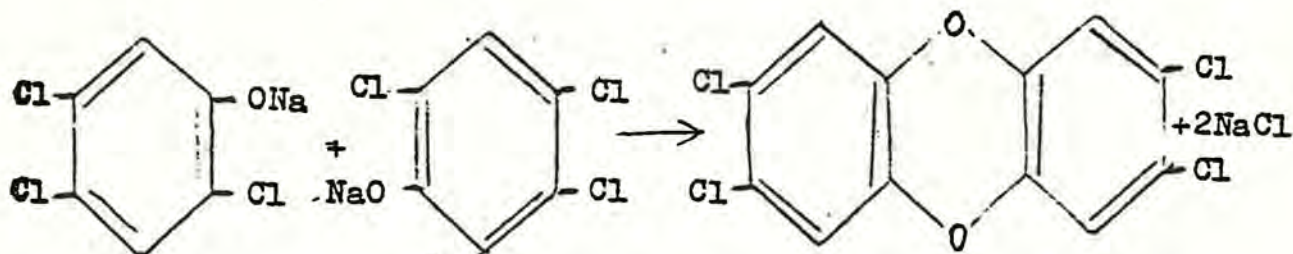
- (1) distillation of the solvent took place after and not before acidification,
- (2) the establishment of ratios for the compounds for separation (ethylene glycol, TCB and sodium hydroxide) different from those adopted in the Meda factory, in the sense of a higher ethylene glycol content.

It is clear from the final working sheet (annexes 7 and 8 to the report of the Special Technico-Administrative Commission, set up by the Ministry of Labour and Social Security) that the quantity of ethylene glycol used amounted in fact to about 45% (by weight) of the reaction mixture, whereas the original patent recommended, in order to obtain excellent results, a glycol content of about 70%, which should not in any case be less than 60% to avoid an unfavourable influence on the product yield and quality.

Other industrial manufacturers of TCP have adopted methods which differ essentially from those used at ICMESA, in the choice of solvents, in the ratios between the reagents,

the ratio between the reagents and solvents, and in the reaction temperature and pressure. The GIVAUDAN method has been followed, with some modifications, by COALITE in Great Britain, although alternative methods have been used for performance of the reaction in methyl alcohol under high pressure or in glycol at atmospheric pressure. One remarkable difference between the process used by ICMESA and the COALITE process, consists in the method of heating the hydrolytic reaction: at ICMESA heating was effected by steam at 12 atm and at COALITE by means of oil⁽³⁾. The relevance of the choice of solvent and of the modifications adopted by ICMESA to the subject of the present enquiry, will be illustrated later on.

It is however worth pointing out here that secondary reactions may occur during the TCP processing phases, one of which is a high-temperature reaction between two molecules of sodium trichlorophenate⁽⁴⁾ which, as a result of a process attributable to a mechanism involving a double nucleophilic substitution, gives rise to TCDD (2,3,7,8-tetrachlorodibenzo-p-dioxin), commonly known as dioxin:



The quantity of TCDD formed depends on the reaction temperature: no TCDD formation should occur below 153°C⁽⁵⁾, at 180°C less than 1 mg is obtained per kg TCP, whereas

(3) G. May, *British Journal of Industrial Medicine*, 1973 30 276.

(4) M. H. Milnes, *Nature*, 1971 232 395; G. W. Gribble, *Chemistry*, 1974 47 15.

(5) I. Jirasek, *Cesk. Dermatol.*, 1974 49 145.

heating for 2 h at 230 – 260°C may give rise to the formation of 1600 mg/kg⁽⁶⁾.

The greater part of the impurities, necessitating further processing, are eliminated from the final product (TCP) during the purification phase.

It is hardly probable that TCDD should not be present in TCP, at least in trace form, and in consequence in compounds derived from TCP.

This finding has given rise to widespread discussion – on the international level also – on the ratio of advantages to disadvantages in connection with TCP production.

TCDD is a white compound which melts at 300°C and decomposes around 800°C. It is virtually insoluble in water, sparingly soluble in fats, more easily soluble in hydrocarbons (e.g. benzene) and even more soluble in organic chloride solvents (e.g. dichlorobenzene). TCDD has an extremely high toxicity and will be dealt with in specific detail in a different part of the report (Fourth Part, Section I, paragraph 1).

(6) "IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man", 1977 15 54

Section II

Findings on the liability of ICMESA for failure to prevent the incident

1. Risks involved in TCP production in the ICMESA establishment. Knowledge of these risks by the directors and staff. Systems of control.

The major risk involved in TCP production is, as is well known, the possible formation of TCDD: this risk becomes progressively more acute, the less sophisticated the control system of parameters favouring TCDD formation, primarily the reaction temperature. Temperature control was particularly important in the process adopted ICMESA as a result of the presence - in the mixture for separation - of ethylene glycol and sodium hydroxide: the latter compound induces in fact, at a high temperature, the dehydrogenation of glycol to sodium glycolate and oxalate, giving rise to an exothermic reaction⁽⁷⁾.

In the opinion of the Commission, those responsible for the management of ICMESA were certainly aware of the risks involved in the adopted method of production: the undertaking was - de facto - a subsidiary of GIVAUDAN, which owned the majority shareholding. It was, furthermore, the technical decision of GIVAUDAN which decided to entrust ICMESA with the production of TCP required for the activities of the group and it was their responsibility to select the technical director of ICMESA. The technical director of GIVAUDAN (Mr. Waldvogel) stated to the Commission that the management of ICMESA was entrusted to Engineer von Zwehl, since "GIVAUDAN had no doubts whatever in regard to his capacity" (statement by Waldvogel, IV/3)).

It is also certain that Engineer von Zwehl, although enjoying a certain autonomy in the discharge of his responsibility, was bound to refer to the technical director and director general of GIVAUDAN, if technical problems or important matters relating to

(7) L. Canonica, *La Chimica e l'Industria*, 1977 59 87.

personnel arose (statement by Waldvogel, III/3). There is therefore no doubt that ICMESA was able to enjoy - and in fact enjoyed - the technical and scientific support and, in general, the accumulated knowledge of GIVAUDAN, which was undoubtedly of high quality.

It should therefore be borne in mind - as has been shown by the statements by the directors of ICMESA and on the basis of all the statements by GIVAUDAN itself - that the risks involved in TCP production at the ICMESA establishment, were well known to the responsible officers of the two companies⁽⁸⁾.

It is also not in dispute that ICMESA were aware of the presence of extremely harmful substances in their production residues. This is confirmed by the installation of an incinerator in the factory compound: this incinerator consisted of a furnace for the decomposition, by heating to a very high temperature, of residues including TCDD which is known⁽⁹⁾ to decompose around 800°C. This incinerator was designed to operate at at least 1000°C (statement by von Zwehl, VII/1).

(8) This is quite independent of the fact that samples of various TCP batches produced by ICMESA were sent systematically to the GIVAUDAN laboratories for analysis, covering the aspect of the hypothetical presence of TCDD in trace form. The statements by Waldvogel (IX/3, XV/2) and von Zwehl (VI/4) that the reason for these checks of the presence of TCDD - even in very small proportions - by GIVAUDAN was mainly of an economic nature, since on the international market TCP was required to meet certain specifications, such as the product manufactured by ICMESA and intended for hexachlorophene production.

(9) R. H. Stehl et al. *Advances in Chemistry Series*, 1973 120 119.

An incinerator of this type was installed in 1971 - 1972 (statement by Sambeth, XXIX/2), which was essentially a pilot plant (statement by Mozzana, XVIII/5). A further incinerator of larger dimensions which, "was required to have sufficient capacity for the combustion of all residues" was in the planning stage and, "construction was scheduled for 1977" (statement by Sambeth, XXX/1).

Combustion was carried out in the incinerator, in conjunction with other products, of the residues which had accumulated during the first period of TCP production (1970 - 1971).

No clear data have emerged on the working temperature of the incinerator plant: Engineer von Zwehl wrote in a memorandum on 17 February 1978, for example, that, "the temperature in the combustion incinerator was not measured, since this was a pilot plant, intended to provide practical information on the handling and destruction of all residues, with a view to the construction of a larger incinerating furnace". This is a truly surprising statement, since it is clear that, if the incinerator was operated at a temperature higher than that required for the conversion of TCP into TCDD, and lower than the decomposition temperature of the latter compound, the quantity of this undesirable compound would be increased rather than decreased.

The risks involved in TCP production were, on the other hand, unknown to the junior supervisory staffs at ICMESA, who were never informed either of the possibility of TCDD formation, or of its extreme toxicity. This emerges from the statements made to the Commission by the shop foreman Carlo Galante (III/4), by the worker Mario Corbisiero (VIII/5), by shop foreman Gabriele Gaviraghi (XIII/4) (who stated that he had not been informed of the dangers of TCDD, although he was employed on analysing the purity of the TCP produced), and from the statements made by workers responsible for checking the temperature of the reactor, operating the incinerator and removing and transporting production residues.

This failure to circulate information is all the more serious when it is remembered that, on various occasions, production residues were found to have escaped from collecting vessels or tubes (statement by Paoletti, XIX/3).

It has to be emphasized, finally, that the junior supervisory staffs at ICMESA were largely without the necessary basic preparation and were not in possession of the experience gained in other industries of the same type (statement by Corbisiero, VII/3, VIII/6). Engineer von Zwehl also stated (XIV/7) that the instruction in the factory consisted in having newly recruited operatives accompanied for three months by a more experienced operative. The Commission is well aware that it is practice impossible, in a plant in the chemical industry, to operate at a "zero risk level", but it is also well aware that this does not diminish but rather increases the responsibility of the undertaking in a case where it has been shown that - in spite of a knowledge of the serious risks, the necessary safety measures have not been taken.

Proof has been provided in the case of ICMESA both of the inadequacy of the measuring equipment for a number of fundamental parameters, and also of the absence of any automatic control system. Measurement of the acidity in the production phase, concerned with the transformation of sodium trichlorophenate into TCP, was in fact carried out manually, "by immersion of a rod with an indicator chart through a secondary inspection window, in the form of a system of discontinuous control, continuous control being only effected during the operating phase (Annex 37, page 9, of the report of the Zonal Council of Health). Any possible increase in temperature in the reactor vessel toward dangerous values, was normally controlled by manual cooling (statement by Sambeth, XXXVI/1; statement by Mozzana, XII/5; statement by Corbisiero, VIII/6; statement by Galante, II/6) by actuating a valve which introduced water into a coil (statement by Gaviraghi, XIII/1); everything depended on the promptness and efficacy of the intervention.

The management of ICMESA, in their statement, have maintained the validity of this method of manual cooling. Dr. Paoletti, in particular, has expressed his complete conviction of the guaranteed safety of this system of thermal regulation; he added that, "if this had ^{not} been regarded as insufficiently safe, some other measure would have been taken" (XXVI/2). Engineer von Zwehl, for his part, stated that, since, "the complete

plant was heated with steam at 12 atmospheres, the temperature could not exceed 180 - 183°C even in the event of a fault" (VI/2); he admitted, however, that if a request for an automatic control system had been submitted to GIVAUDAN, this request would have been accepted. This statement should however be received with reservations, since the technical director of GIVAUDAN himself stated that, "no theoretical work predicted and no experiments had reported an exothermic reaction" and that, "increases in temperature were visible on a thermometer and the temperature could in fact be reduced, and in this way controlled, by the addition of water" (statement by Sambeth, XXXV/2). The view put forward by Mr. Sambeth was not an isolated one and could not be regarded as a purely personal opinion, but indicated the general thinking of the directors of GIVAUDAN, especially since the director general of the company, Waldvogel, stated that, although he was not directly concerned in problems of a chemical nature, "no possibility of an exothermic reaction with a system of this type had been reported in the literature" and that, although he could not give an opinion on the selection of an automatic control system, the operatives knew that, "the temperature should not exceed a certain limit and that they were required to open the necessary taps" (XIII/2).

The director general of GIVAUDAN, Waldvogel, also maintained that, "in an undertaking like ICMESA and in any other undertaking belonging to the company, principal emphasis was placed on the quality of the operatives, on their level of training and on their initiative; the automation of every installation in order to prevent every possibility was out of the question" (XIII/6). Sambeth, the technical director of GIVAUDAN, also stated: "I do not think that merely changing the cooling mechanism could be regarded as a solution of the problem" (XLII/2).

The logic of this attitude, in the opinion of the Commission, increases the liability of ICMESA: if a manual control of the temperature is regarded as sufficient alone, it is absolutely necessary to guarantee the continuous presence of personnel capable of exercising such control.

Sambeth himself has admitted in this connection that, if the incident had occurred on a different date and at a different time, the presence and intervention of the staff – who would have actuated the cooling system manually, would have prevented the temperature reaching dangerous levels (XLIII/1).

It also emerges from the statements made (statement by Paoletti, XIX/6) that the ICMESA plant was not fitted with automatic alarm and cut-out devices. It is clear that, if such systems had been installed, they would have come into operation in the event of any variation from "normal conditions" in the working of the system as a whole. It does not follow that, even if such devices had been installed, they would have been actuated in a situation where the shop was not manned, as occurred at the time of the incident.

The relative promptness of the intervention by the shop foreman Galante, who first noticed the incident, may in fact be regarded as purely fortuitous, as he happened to be present in the neighbourhood of the plant at the time of the incident. The fact that Galante, having heard the whistle was able to go to the site, was an abnormal circumstance (statement by Galante, II/6), which thus enabled an even more serious disaster to be prevented (statement by Gaviraghi, XIII/2, and Corbisiero, IX/2).

2. Causes of the incident of 10 July 1976

When examining the causes of the incident which occurred on 10 July 1976 (bursting of the safety plate of the A101 reactor vessel, engaged on TCP production, and the consequent venting into the atmosphere of toxic compounds, including TCDD), it has also to be noted that the management of ICMESA and of GIVAUDAN have agreed in maintaining the absolute impossibility of such an incident, quoting the negative results of experiments, carried out subsequently, under widely varying conditions, with the aim of reproducing the incident in the laboratory (statement by Sambeth, XXXV/2, and Waldvogel, XIV/3).

Nevertheless, various other incidents, connected with TCP production and giving rise to the formation of TCDD, have been widely described in the scientific literature between 1971 and 1974, and the Commission regards it as highly improbable that the technical management of ICMESA and of GIVAUDAN were unaware of this. Members of the management, in other statements made to the Commission (statement by Sambeth, XX/2); by von Zwhel, X/3; by Paoletti, XVII/3), have moreover stated that they were aware, even before the incident of 10 July 1976, of the paper written by Milnes⁽¹⁰⁾. These authors reported as early as 1971 that, in a mixture of caustic soda and ethylene glycol, an exothermic reaction - attributable to the decomposition of the sodium ethoxylate ($\text{NaOCH}_2\cdot\text{CH}_2\text{OH}$) - may occur suddenly at around 230°C , proceeding rapidly and in uncontrolled fashion to about 410°C , with the simultaneous release of large quantities of gaseous products.

In the case of ICMESA, the Commission learned from one of the witnesses (statement by Bianchetti, XV/2) that the temperature of the A101 reactor at the time of the incident - without, as stated above, any form of control - was around $450 - 500^\circ\text{C}$: this means that the temperature had already exceeded, and by no small margin, the safety threshold (of the order of 180°C), thus creating conditions suitable for the formation of an appreciable quantity of TCDD, either by evaporation of the solvent or by the uncontrolled formation of other compounds.

(10) See M. H. Milnes. Nature, 1971 232 395; G. May. British Journal of Industrial Medicine, 1973 30 276; C.D. Carter et al. Science, 1975 188 738; L. Jirasek et al. Cesk. Dermatol., 1973 48 306 and 1974 49 145.

It should be emphasized that the two former articles give a very full description of the incident occurring at Bolsover (in Britain) in a factory producing TCP by the method adopted by GIVAUDAN, but which involved, at least in regard to the succession of working phases, a lower risk probability.

It is necessary to take into account also the following further facts, which certainly contributed to the causation of the incident and which appear significant also in regard to the allocation of liability:

(a) The interruption of the daily production cycle

Saturday, 10 July 1976, in building B of the ICMESA establishment the work cycle was interrupted around 5 a.m., without taking into account the particular phase of the cycle.

At this moment - i.e. after the halting of the stirrer of the A101 reactor and the initiation of natural cooling of the mixture - solvent distillation under vacuum was just starting (statement by Bianchetti, XIV/3); this circumstance, liable to increase the probability of risk, was not unknown to the technical management of ICMESA, which had in fact ordered the starting of the final weekly work cycle at 4 p.m. on Friday 9 July (statement by von Zwehl, XIII/1), with a 10 hour delay by comparison with normal conditions, and were certainly aware on the basis of the chronological schedule of the situation obtaining at the time of interruption of the work cycle. Method of distillation adopted. The GIVAUDAN patent provides for solvent distillation to take place after acidification of the trichlorophenate to trichlorophenol; in the ICMESA establishment the opposite procedure was adopted (statement by Facchetti, XIV/2). If this inversion of the process had not been adopted, the prolonged contact between ethylene glycol and sodium hydroxide under hot conditions would have been avoided (a contact which, as has been stated above, involves appreciable risk factors) and in consequence the distillation of the solvent would not have occurred in a basic medium. To this has to be added the fact that, in the procedure adopted at the ICMESA establishment, the gradual removal of solvent (which was collected by the recuperator) necessarily involved a continuous decrease in the thermal equilibrium, thus promoting the very risk conditions described in the quoted paper by Milnes. Attention should be drawn finally to the modification in the molar ratios of the initial concentrations between

TCB, sodium hydroxide and ethylene glycol. These ratios in the GIVAUDAN patent were around 1:2:11.5, whereas in the production process at ICMESA they had become 1:3:5.5 (statement by Bianchetti, XIII/4, and annexes 8 and 9 of the Report of the Technico-Administrative Commission, set up by the Ministry of Labour).

All these changes taken together involved, on the one hand, an appreciable reduction in costs (statement by Bianchetti, XII/3, and Mozzana, XX/5), accompanied on the other hand by an increased risk of TCDD formation and of an exothermic reaction involving the ethylene glycol.

(c) Setting of the safety plate

It has been stated above that the incident occurred as a result of the escape of gaseous compounds, the pressure of which caused the breaking of the safety plate on top of the reactor vessel. Investigation revealed that this safety plate was set at a pressure of about 3.5 atm; attention should be drawn to the implications of setting the bursting of the safety plate only at high pressure and temperature values, since if the safety plate had been set to burst at lower values, this would have occurred at a less advanced stage in the reaction, with less harmful effects.

The Commission found, however, that the bursting plate was installed and set at the above value not so much to perform the function of "an emergency mechanism in case of an explosion inside the plant", but merely to permit the transfer of the product from one container to another (a transfer which was effected by means of compressed air) and to safeguard the equipment in the first part of the process "should the reaction not have proceeded correctly and a proportion of the compound forced backwards, blocking the refrigerating plant" (statement by Mozzana, XVI/1; Paoletti, XX/1; Sambeth, XXXII/2). The technical director of ICMESA himself stated that the plate was installed, "to safeguard the plant in case of incorrect handling of the compressed air during the transfer of sodium trichlorophenate from one reactor to the other" (statement by von Zwehl, VII/4).

(d) Failure to install the required "destruction plant"

The consequences of the incident, and in particular those affecting the external environment in the vicinity of the factory, could have been avoided, or at least contained, if the plant had been equipped with a system for the collection and destruction of any compounds which might possibly escape - as in fact occurred in the concrete case.

Systems or equipment of this type could certainly not have appeared to the management of ICMESA as a novelty of a doubtful or risky experimental nature, since they had been installed even before 1976 in other establishments in the chemical industry producing trichlorophenol, such as Dow Chemical and Coalite⁽¹¹⁾.

Furthermore, the Fike Metal Products Corporation itself, which supplied the bursting plate to ICMESA, stated in illustration of the technical characteristics on page 207 that, "bursting discs may be preferred in the case of fluids of great value and high toxicity, where the loss of such fluids should be avoided. In this case a second receiver tank is required to recover the discharged fluid".

The management of ICMESA have stated that no destruction system was provided, since they were certain that an exothermic reaction could not occur in their establishment (statement by Sambeth, XXXIII/2; von Zwehl, VIII/3). However, the incident which occurred on 10 July 1976 gives the lie to this statement.

One fact is therefore beyond dispute, namely that ICMESA contravened Article 3, first paragraph, of D.P.R., No. 322 of 15 April 1971, which lays down in this connection that, "all plant in industrial establishments, which may contribute to the contamination of the atmosphere, are to be fitted with destruction equipment corresponding to the requirements of the present regulations"⁽¹²⁾.

(11) R.L. Rawls and D.A. O'Sullivan, Chemical and Engineering News, 1976 27.

(12) See Section III, paragraph (d).

Section III

Findings in regard to the liability of ICMESA for the contravention of health acts and acts relating to obligatory insurance against industrial accidents and occupational diseases

1. Failure by ICMESA to notify industrial activities in relation to TCP production and failure to implement the mandatory requirements

The Commission was required to report its findings on the question of whether ICMESA, in contravention of the currently valid legal regulations, took steps to notify the competent authorities that in 1970 the establishment at Meda would initiate TCP production. The relevant findings are as follows:

- (a) Article 216 of the text of the health act (Royal Decree No. 1265 of 27 July 1934) states that, "manufacturing processes producing vapours, gases or exhalations, liable to injure health or otherwise endanger the safety of local inhabitants, are to be notified in a list divided into two classes. The first class includes those to be installed in the country and at a distance from dwellings; the second class requires special precautions for the protection of the neighbourhood"⁽¹³⁾.

The fifth paragraph of the same article provides however that, "an industry or manufacturing process included in the former class may be permitted to operate in an inhabited zone, provided that the undertaking is able to demonstrate that, by the introduction of new methods or special precautions, the exercise of its activities does not endanger the health of persons in the neighbourhood".

(13) This list was subsequently modified with the development of industrial production.

The relevant list for purposes of the present Enquiry is that issued in the Ministerial Decree of 12 February 1971, which expressly includes, among operations liable to injure health or endanger safety, those involving the production, use and storage of cyanides and cyanogen, chlorine, phenol and trichlorophenol compounds.

It follows from all this that ICMESA, when wishing to undertake trichlorophenol production - a production process which would per se have involved inclusion of the establishment in factories on the above list - was bound (by virtue of the sixth paragraph of the said Article) to notify the mayor of Meda in writing 15 days before starting production.

The enquiry has revealed, however, that trichlorophenol production was started in 1970 without any prior notification whatever of the mayor of Meda.

- (b) Article 12 of the single text of the Act on Obligatory Insurance against accidents at work and occupational diseases (D.P.R. No. 1124 of 30 June 1965) obliges employers in the industrial sector to notify INAIL of the nature of the work at least 5 days before the starting of such work, indicating the production activities which are liable to cause occupational diseases. The relevant diseases are listed in a table (Annex No. 4 to the single text) and include - at serials 15 and 22 respectively - those caused by glycols and phenols.

The enquiry has revealed, on the other hand, that ICMESA stated at the time of drawing up the insurance report (1947) that the establishment at Meda was to be concerned with the manufacture of chemical and pharmaceutical products; no changes in the degree of risk and no changes in the degree of risk and no variations in the manufacturing activity have been subsequently reported.

It should also be pointed out that, on the basis of reports of accidents affecting ICMESA employees and in consequence health checks, INAIL has never received information justifying a reclassification of the risk.

- (c) The National Collective Labour Contract for those employed in the chemical and chemical-pharmaceutical industry (31 October 1972) makes provision for the establishment of the "Register of environmental data", the "Register of biostatistical data", the

"Personal risk card" and the "Personal health card". The enquiry has revealed that these systems of information had not been implemented in the ICMESA establishment as at 10 July 1976.

Furthermore, ICMESA failed to set up the labour environment committee, provided for in Article 9 of the aforesaid Act No. 300 of 20 May 1970, the terms of reference of which include participation in the determination of harmful conditions and in the promotion of research and implementation of measures for the protection of the health and physical well-being of workers.

A service for the prophylactic and periodical visiting of workers was in operation in the establishment (memorandum of 26 June 1975 from ICMESA to the Zonal Health Committee) but, according to members of the Works Council (report of the Commission set up by decree of the Minister of Labour and Social Security of 9 August 1976, page 81), this service did not fully satisfy the requirements of the junior supervisory staffs.

The above report also stated (page 81) that it was normal practice for ICMESA employees to accompany the Inspector of Labour on his visits to individual departments, indicating to him at the same time their own requirements, but that they had never been able to bring the Inspector up to date on the work carried out in building B, since the management of the establishment had always refused to provide any information on the production processes being carried out in that building and on the consequent specific risks.

This confirms that the management of ICMESA had in fact prevented its employees in making any adequate evaluation of the risks associated with TCP production.

- (d) As stated above, Article 3 of the regulation for implementation of the legal provisions against atmospheric pollution in the industrial sector (Act No. 615 of 13 July 1966; D.P.R. No. 322 of 15 April 1971) lays down that, "all plant forming part of industrial establishments, which are liable to contribute to atmospheric pollution, are to be fitted with destruction plants which meet the requirements of the present regulations".

Article 10, second paragraph, of the same regulation, allows for the following transitional regime: "Industrial establishments... which do not possess destruction plants, are to present to the communal authority, within six months of the coming into force of the present regulation, a report containing qualitative and quantitative data on maximum emissions from the undertaking, and also, for each industrial plant, the time required for interruption of the process and for restarting of the operating regime".

The Commission submitted the required report on plant liable to cause atmospheric pollution only on 7 March 1972, when required to do so by the mayor of Meda. Furthermore, in this report - which the mayor forwarded, as he was legally required to do, to the Regional Committee Against Atmospheric Pollution of Lombardy (CRIAL) - ICMESA did not refer explicitly to trichlorophenol production, but confined itself to notifying the existence of an incineration plant for organic residues and residues of phenol production.

- (e) Examination of the relations between ICMESA and the provincial administration, the competent authority in respect of atmospheric and water pollution (D.P.R. No. 987 of 10 June 1955; Act No. 615 of 13 July 1966; Act No. 319 of 10 May 1976) shows that notice was served on ICMESA on 27 June 1957 to cease discharging industrial wastes into the public drainage system, but that nevertheless the situation continued to give cause for alarm. The communication of 18 October, in which the provincial hygiene and prophylaxis laboratory notified the results of the analysis of wastes from the Meda establishment, states in fact: "Abundant nauseous odours, penetrating and persistent, covering an area of a few hundred metres, accompany the person and clothing of the visitor for several days and represent a continuous and constant danger to the aquiferous layers and to the river Taro itself which flows past at a distance of a few dozen metres".

Various other warnings were addressed to the company, either by the provincial administration or by the civil engineering service, and one contravention was dealt with by means of an administrative penalty.

In January 1972, finally, ICMESA submitted to the provincial administration and the other competent authorities, a report on its plans for a plant for the biological purification of activated sludges and work on the incineration of phenolic waters, produced in accordance with the requirements under subparagraph (d). A memorandum, sent by the hygiene and prophylaxis laboratory to the chairman of the Provincial Board of Milan, stated that ICMESA was believed "to have adopted also all necessary steps to prevent atmospheric pollution".

The incident on 10 July 1976 proved, however, that no such measures had been adopted.

2. Failure by ICMESA to request the periodical inspections laid down for industrial plant

The Commission has found that ICMESA also failed, between 1970 and 1976, to fulfil its obligation to request periodical inspections of industrial plant and, more particularly, of the A101 reactor, intended for trichlorophenol production.

The detailed findings are as follows:

- (a) The National Association for Combustion Control (ANCC), set up by Royal Decree-Law No. 1331 of 9 July 1926, exercises supervisory control over pressure vessels and combustion, either by means of a first fact-finding visit including a summary and general inspection of the apparatus or plant (to be followed by visits at two year intervals), or by physical and chemical analyses of the combustion products, or by output and consumption tests. Article 2, first paragraph, subparagraph (b) of the regulation approved by Royal Decree No. 824 of 12 May 1927, lays down that steam vessels are to be understood to mean "vessels exposed to the action of gas or vapours, or of both together, evolving inside the vessels as a result of the action of heat and chemical factors, wherever a pressure in excess of atmospheric pressure is exerted in the processing chamber or on the surrounding walls".

The apparatus, for which periodical inspection was required by the ANCC, included therefore the A101 reactor (built by the firm SIAI LERICI of Comano), the litre capacity of which 13.875 was marked by the symbol "770919 MI".

It is evident from the card relating to ICMESA, prepared by the technical inspector of the ANCC in accordance with the provisions of the aforementioned Article 69 of the regulation, that inspections of the above reactor were carried out on the following dates:

11 January 1971:	internal inspection
17 November 1972:	hydraulic test
22 November 1972:	functional test.

It is evident from the report made on 17 November 1972 that no hydraulic test was carried out, but only an examination of the external parts of the reactor, since the responsible official of ICMESA had informed the technical inspector of ANCC that the internal chamber - i.e. the chamber in which the exothermic reaction occurred on 10 July 1976 - would only be used at atmospheric pressure.

This statement was not true, however, since both during the transfer of the product from reactor A101 to reactor A110, and during the eight washing operations carried out in the two reactors, compressed air was introduced into the vessel containing the product to a sufficient extent for the internal pressure in the reactor to reach 1.5 atm, with the presence of a vacuum in the other reactor. It has also been shown that during the production cycle of crude TCP (24 hour cycle) the internal chamber of the A101 reactor was exposed for about 1 hour and 40 minutes, to a pressure in excess of atmospheric pressure.

It is clear from what has been stated above that ICMESA, by failing to reveal to the technical inspector of ANCC the actual phases of the work, created conditions liable to mislead the inspector and in particular, as will be shown below, failed to report the installation of a bursting plate, which was situated furthermore in a part of the plant not inspected and was not included in the designs submitted by ICMESA.

- (b) Article 2 of Act No. 966 of 26 July 1965 lays down that the head of the provincial fire brigade is to carry out inspections and control checks of fires in areas of the undertaking, which are subject as a result of their characteristics to the provisions of Article 36 of D.P.R. 547 of 27 April 1955.

Such visits and control inspections include also the prevention of accidents at work and are carried out not on the initiative of the fire service, but at the request of the firms concerned.

The provincial fire officer carries out such checks as appear necessary and, if the plant appears to comply with technical safety regulations, issues the firm concerned with a "fire prevention certificate", having a validity restricted to the period between inspections, which depends on the type of economic activity being exercised.

The obligations of the undertaking are not however exhausted by the submission of the initial request: the undertaking is in fact bound to request further visits and control checks - in the sense of Article 4 of Act No. 966 of 26 July 1965 - whenever modifications have been made to the work cycle or to the structure, even if restricted to some areas only, and such modifications alter the safety conditions established previously.

As stated above, ICMESA restarted TCP production in 1974 - after a 12 month suspension of production - using for this purpose shop B, and applied (but without giving details of the characteristics of the substance being produced) for renewal of the "fire prevention certificate". The fire brigade undertook the required inspection, but did not issue the certificate, since a number of deficiencies were found in the documentation attached to the application. In a letter of 13 February 1975, the head of the fire brigade in fact notified the mayor of Meda - and for information ICMESA itself - that issue of the renewal fire prevention certificate was subject to the submission of up to date plans of the individual buildings, accompanied by a technical report indicating, among other things, the work cycles being carried out, the chemicophysical characteristics of the substances used and their quantitative ratios, the aim of this being to lay down the necessary safety regulations for the establishment.

In spite of this, it is now known that ICMESA restarted trichlorophenol production in 1974, which was continued up to 10 July 1976 without having obtained the necessary fire prevention certificate.

- (c) The provincial inspectorate of labour is responsible for supervising the application of social legislation "in industrial and commercial undertakings, in offices, in agriculture and in general wherever wage-earning and salaried employees are employed".

To ensure that the actions of the inspectorate are up to date and effective, Article 48 of D.P.R. No. 303 of 19 March 1956 lays down that "those intending to construct, extend or adapt a building or a location for industrial activities, where more than three operatives are liable to be employed, is bound to notify this intention to the inspectorate of labour by registered letter or equivalent means".

At the time of adaptation of the plant in shop B for trichlorophenol production, therefore, ICMESA should have notified the inspectorate of labour in Milan of this fact, attaching to the notification, a description of the purpose of the work and the principal details of the work cycle, the characteristics of the plant in question, and the required general designs (Article 48, second paragraph). This requirement was again not fulfilled by ICMESA.

The Commission is not unaware that the wording of the said Article 48 is to some extent restrictive, and that, adhering to this wording, it would be possible in this case to acquit ICMESA of their obligations under the preceding paragraph, since the trichlorophenol production did not require the construction, extension or adaptation of buildings or locations, but merely a different utilization of the equipment already in use. The Commission is of the opinion, however, that such an interpretation is not compatible with the provision of the third paragraph of the said Article 48, which states that the inspectorate of labour may request further information and lay down modifications to be made to the plans of locations, plants and methods of work, where it deems necessary, a power which is obviously incompatible with the restrictive interpretation referred to above.

It is clear from this that ICMESA, by failing to notify the inspectorate of labour of the modification of the use made of the original plant, had contravened the provisions of Article 48 of D.P.R. No. 3 of 19 March 1956.

Section IV

Findings in regard to the liability of the public administration and of the supervisory and control authorities

Act No. 357 of 16 June 1977, setting up the Commission, included in its terms of reference to establish "the liability at the central or local level", in connection with the installation of the ICMESA establishment, of those responsible for supervising the establishment and inspecting the plant.

The Commission therefore heard evidence during its enquiry in connection with the public administration and the supervisory and control authorities, to determine whether actions had been carried out in conformity with the statutory powers assigned to them, and whether their functions had been discharged with efficiency, reciprocal coordination, and a due sense of urgency.

The findings are set out below in relation to the communal administration of Meda, the provincial administration of Milan, the provincial inspectorate of labour, the Regional Committee Against Atmospheric Pollution (CRIAL), the head of the fire brigade, the National Association for Combustion Control (ANCC), the National Accident Prevention Service (ENPI) and the National Insurance Institute for the Victims of Accidents at Work (INAIL).

1. Liability of the public administrative services

A Liability of the communal administration of Meda

The actions of the communal administration of Meda in connection with ICMESA will be considered under two heads:

- (a) the measures taken in regard to the pollution originating from the establishment in question,
- (b) the building permission granted to ICMESA in the years 1974 and 1975 (previous permits have been considered already).

In connection with (a), it is to be noted that on 18 October 1969, the director of the Provincial Hygiene and Prophylaxis Laboratory of Milan, sent a report to the mayor of Meda and to the health officer of Meda and Seveso, drawing attention to the water and atmospheric pollution caused by discharges from the ICMESA establishment.

This report included in particular the following words, "the situation over the discharges. . (has) brought to light new, more serious and more complex pollution due to ICMESA operations, which have been taken into account up to now, not relating only to liquid effluents and in consequence of a primary and immediate nature, but extending further and involving all the disadvantages which may result from the discharge, into water courses outside the establishment, of solid, mucillaginous and liquid substances of a various and indeterminate nature, and to the combustion in the open, in simple and uncontrolled form, of products of different types. . . Such operations, accompanied by a wide range of nauseous odours of an intensive and persistent nature, covering an area of a few hundred metres, adhere tenaciously to the person and clothing of visitors on certain days, representing in fact a continuous and constant danger to the aquiferous layer and to the river Taro itself, which runs past at a distance of a few dozen metres".

In conclusion, the report in question stated that the following measures were necessary:

- "(a) to require the destruction, in a suitable and correct manner, of existing solid residues and the immediate cessation of further discharges or of their combustion in the open air, even if this involved the temporary closing of the establishment;
- (b) to require a primary purification of the process waters emerging from individual production plants, followed by their passage into a collection vessel and compensator; final and integral purification in a suitable neutralization, oxygenation and decolouration plant and the destruction of the organic waste; the elimination of processing residues by rational and agreed procedures".

The health officer, for his part, informed the mayor of Meda on 18 December 1969, "in view of the seriousness of the situation", of the desirability of taking steps by virtue of Article 217 of the single text of the health regulations, requiring ICMESA to adopt effective, stable and continuous measures to eliminate (or at least reduce to a tolerable minimum) the substantial nuisances which had been detected".

The necessary order was issued on 29 December 1969, requiring the implementation of the measures requested by the director of the hygiene and prophylaxis laboratory, but ICMESA failed to comply.

The mayor reported the facts to the magistrate of Desio, but did not avail himself of his powers of intervention conferred by Article 217 of the single text of the health regulations, even after the court proceedings had been completed without the achievement of any concrete effects in regard to the elimination of the "nuisances which had been detected".

The results of the enquiry under head (b) were as follows:

On 24 March 1973, ICMESA submitted to the mayor of Meda a direct request for a permit for a purification plant for industrial waste waters. The application was accompanied by a plan of the plant (DAGH plan) and a description of the purificatory processes, culminating in the combustion of the sludges, to be effected in a methane incinerator at a temperature between 200° and 800°C; the incinerator would produce an output of ashes and a gas phase, to be dispersed in a scrubbing tower.

It is not irrelevant in this connection to point out that the mayor of Meda also sent to CRIAL on 9 March 1972, a report from ICMESA on the atmospheric pollution caused by plants of the establishment, and that, in a letter of 3 August 1972, addressed to the mayor, CRIAL should supplement their report with further data. Referring to the incinerator mentioned in the report, the CRIAL experts pointed out in fact that nothing was stated in the report, "in regard to other operations which were certainly being carried out, necessitating the DAGH plan for an incineration plant for organic residues and residues of the phenol operating cycle".

This letter drew the attention of the mayor, therefore, to the fact that ICMESA found it necessary to destroy phenol products. It is well known that industries producing phenols and chlorophenols are included in the first category of unhealthy industries, as listed in Ministerial Decree No. 114 of 12 February 1971.

The mayor of Meda, after it had been brought to his attention that phenol compounds were being produced in one of the ICMESA shops, should therefore, in accordance with the provisions of the first paragraph of Article 217 of the single text of the health acts, have implemented the regulations for the prevention of the damage and danger liable to arise from this type of production.

The comment may be made that the mayor of Meda, in addition to implementing the above regulations - taking into account the provisions of Article 26 of the general regulatory plan - should not have authorized the building of the water purification plant and the corresponding enclosure (authorization was in fact made on 16 January 1974), until ICMESA had fulfilled the imposed requirements.

It has to be borne in mind, however that the purification plant in question was not intended solely for the destruction of residues arising from phenol production, but also for organic residues in general and for the treatment of the industrial waste waters produced by ICMESA. In view of this circumstance, which was particularly urgent and in accordance with existing legislation for the protection of the water and atmosphere from contamination, the Commission does not regard the granting of the authorization as inherently illegitimate, in the light of the above considerations.

Subsequently on 13 May 1975, ICMESA applied directly to the mayor of Meda for a permit for the installation in its own establishment, within shop D, of a new plant for the manufacture of a product known as ICM 110.

This plant was to include, among other items, a burner for the destruction of hydrocyanic acid.

The mayor granted this permit on 15 October 1975 which, in the view of the Commission, should never have been done. It may be pointed out in fact that the grounds given for this include an inaccurate reference to an opinion alleged to have been issued by CRIAL on 6 August 1975 (the date should have been 26 August 1975). No such opinion was in fact issued on that date by CRIAL, which merely sent the mayor the technical report to be discussed - and possibly approved - in September. This report stated: "It is considered that the proposal could be accepted on the following conditions: (1)... (2) the company should under no circumstances be able to operate the plant releasing HCN after 31 May 1976, without having completed the new destruction plant".

The reservations expressed by the CRIAL experts, should have led the mayor not to issue the licence applied for by ICMESA.

The list of insalubrious industries of the first category, referred to in the Ministerial Decree of 12 February 1971, includes under serial 12 those engaged on operations with hydrocyanic acid; issue of the building permit was therefore outside the provisions of Article 26 of the general regulating plan of the communal area of Meda, which permitted, in the IM zone, the installation of industries with the express exclusion of harmful industries. There were therefore no conditions which could justify the issue of a building permit for a plant intended in the future for harmful operations.

B Liability of the provincial administration of Milan

The aforementioned report from the director of the Hygiene and Prophylaxis Laboratory of Milan, dated 18 October 1969, was sent, in addition to the mayor of Meda, to the president of the provincial administration of Milan. Only in a letter dated 18 April 1972 did the provincial administration invite ICMESA to, "provide information on the operative plan (and the times of implementation) for actuation of the purification operations", with a warning that, if no reply were received within one month, the administration would take coercive measures, pursuant to Article 227 of the single text of the health acts.

Nevertheless, although the causes of pollution remained in existence, the provincial administration failed to implement the coercive measures, even though the said administration - when requesting from CRIAL on 29 March 1972 an opinion on the incinerating plant which ICMESA intended to construct - showed that it was aware that this plant would be used also for the incineration of residues of phenol operations.

It is true that the provincial adviser on ecology, hygiene and health sent to the public prosecutor of the court of Monza on 5 September 1975, a copy of another report, dated 2 December 1974, from the provincial hygiene and prophylaxis laboratory, for such action as was deemed necessary, but it is also true that the provincial administration failed to take advantage of all the powers with which it was vested under existing regulations in connection with water and atmospheric pollution.

2. Liability of the supervisory and control authorities

A Liability of the provincial inspectorate of labour

It has been pointed out above that ICMESA failed to notify the provincial inspectorate of labour of the bringing into operation in the Meda establishment from 1970 onwards of the A101 reactor, and that in none of the numerous inspections, carried out by the chemical division of the inspectorate of labour, was this omission reported and the consequent contravention of the regulations in D.P.R. No. 547 of 27 April 1955 (Prevention of accidents at work) and of D.P.R. No. 303 of 19 March 1956 (Industrial hygiene).

It may be added that the argument is put forward in the report of the Special Technico-Administrative Commission, set up by the Minister of Labour by Ministerial Decree of 9 August 1976, that this limited and specific omission on the part of the inspectorate of labour was due not only to the failure of ICMESA to notify the modification of the plant, but also to the fact that no requests or complaints were submitted by the local administration, by the junior supervisory staffs engaged on production, or by residents in the immediate vicinity of the establishment. It still remains true, however, that the inspectorate of labour did not fully discharge in this case the functions allocated to it, and failed to obtain, during repeated internal inspections of the ICMESA establishment, a knowledge of the type of production being carried out and of the existence of conditions which would prevent the occurrence of damage.

B Liability of the Regional Commission Against Atmospheric Pollution of Lombardy (CRIAL)

As stated above, ICMESA sent to the mayor of the district of Meda on 7 March 1972 a technical report on industrial plant which could give rise to atmospheric pollution.

CRIAL, to whom the said report was duly transmitted, informed the mayor of Meda on 3 August 1972, with a copy for information to the health officer of Seveso, that the report submitted by ICMESA should be supplemented by the data requested by its own group of experts, who had found that the said report did not provide information on operations which had to be being carried out, taking into account the evidence of the DAGH plan for an incinerator plant for organic residues and residues of phenol production.

ICMESA replied to the request for supplementation of the report only on 28 March 1975, stating that plans were being made for a sludge incinerating plant by means of a burner (which would be an integral part of the plant) and that it was intended for the combustion of phenol waters originating from trichlorophenol production. ICMESA thus referred for the first time, although in passing, to trichlorophenol production.

It follows from this that CRIAL had allowed the practice to continue for 32 months, even though its experts had expressed reservations in regard to the completeness of the report submitted by ICMESA.

It is reasonable to say that defective office organization within CRIAL enabled ICMESA to avoid for so long a period, submitting the information required; it has also to be pointed out that, even after this very tardy reply, CRIAL failed to implement the provisions of the fourth paragraph of Article 10 of D.P.R. No. 322 of 15 April 1971.

C Liability of the Milan Fire Brigade

The head of the Milan Fire Brigade, called to give evidence before the Commission, stated that the certificate of fire prevention, issued to ICMESA, expired on 31 July 1971 and no request for renewal was received up to 1974. He also indicated why no renewal of the certificate was allowed and stated finally that, after the expiry of the said certificate, ICMESA was never asked to apply for renewal of the certificate.

In the opinion of the Commission, this latter circumstance is in no way worthy of censure; nor can any liability be attributed to the fire brigade for having failed to check whether activities were being carried on in the Meda establishment, which would necessitate a fire prevention certificate.

Article 2 of Act No. 966 of 26 July 1966 states in fact that control checks for the prevention of fires, and the examination of the plans for new plant or modifications to existing plant, are not carried out on the initiative of the fire brigade, but on application by the interested parties (private individuals or legal entities) submitted to

the provincial fire brigade competent for the area.

It has to be pointed out, however, that if the fire brigade had informed the provincial prefect of the failure to apply for a renewal of the fire prevention certificate (between 1971 and 1974) or of the fact that renewal of the certificate was not granted during the subsequent period, the authorities could have ordered suspension of the permit to operate, pending implementation of the obligations under the final paragraph of Article 2 of Act No. 966 of 26 July 1965.

In justification of his omission to do so, the head of the Milan Fire Brigade informed the Commission that, with present staff shortages, the fire brigade was only in a position to exercise control over particularly dangerous activities and that it was absolutely impossible to take further measures.

This argument does not however appear to carry great weight. Such notifications to the provincial prefect - which certainly do not require complex and time-consuming activity - are an indispensable element in the application of the regulations of the aforesaid legislation.

D Liability of the National Association for Combustion Control (ANCC)

It has already been stated that on 17 November 1972, in place of a hydraulic test on the A101 reactor, the responsible staff of ICMESA stated to the ANCC technical inspector that the internal chamber of the apparatus in question - i.e. that in which an exothermic reaction occurred on 10 July 1976 - would only be used at atmospheric pressure.

It has also been pointed out that this statement was not true, since during the transfer of product from reactor A101 to reactor A110, and during the eight washing operations in the two reactors, compressed air was introduced into the vessel containing the product in sufficient quantities to raise the pressure inside the vessel to 1.5 atm, while at the same time a vacuum was created in the other reactor. This meant that the internal chamber of the A101 reactor was exposed for 1 hour and 40 minutes during the production cycle of crude TCP (24 hours) to a pressure in excess of atmospheric pressure.

The director of the user section of the ANCC stated that an internal inspection of the plant was carried out on 11 January 1971, a hydraulic test at a pressure of 17 atmospheres on 17 November 1972, on the cavity side (roof), a hot test on 20 November 1972, the periodical internal inspection on 4 August 1973, the periodical hot test on 28 August 1974, the periodical internal inspection on 18 August 1975 and that the subsequent inspection, including a hot test, would have been carried out during August 1976 (statement by Pierini, XI/3).

The fact remains however, as has been shown above, the technical inspectors of the ANCC were unaware of the nature of the operating process and it follows that the method of inspection was dictated by those who were concerned with concealing the actual use of the equipment being inspected. In reply to this suggestion, the director of the user section of the ANCC stated that, under the law, the technical inspectors of the Association did not have the power to establish the nature of the production process, since - on grounds of industrial secrecy - this could only be known to the inspectorate of labour.

The arguments put forward here were very complex, since there is a conflict between industrial secrecy, which applies to all the various components of the product and the corresponding phases of the operation, and the method of utilization of the plant under pressure, which can and should be indicated to the technical inspectors of the ANCC.

The management of ICMESA stated to the Commission that, to prevent any danger associated with this phase of the operation or with an increase in the pressure, and the various technical disadvantages of an exothermal reaction (the possibility of which was however excluded), it had been decided to install - in a pipe located at the upper end of the distillation column - a bursting plate. This bursting plate, according to the relevant documentation, was constructed by the firm FIKE METAL PRODUCTS CORPORATION of Missouri (USA) on the basis of an order dated 4 March 1970, in which the date of despatch was given as between 40 and 50 working days.

It follows from this that in November 1972, when the ANCC technical inspector carried out the two tests, the bursting disc had very probably already been installed.

The director of the user section of the ANCC stated however: "the bursting plate was not in position, otherwise our technical inspector would have seen it. The modification was probably made after the inspections carried out in 1974".

(Statement by Pierini, XI/3).

This statement does not appear probable, but there is no means of checking it. The Commission cannot therefore express an opinion on the diligence with which the technical inspectors of the ANCC checked the plant at the ICMESA establishment from November 1972 onwards.

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The Commission has found that, in regard to the material which is the subject of the Enquiry, no liability attaches to ENPI and INAIL.

The National Association for Accident Prevention (ENPI) is concerned with technical studies, dissemination of information and planning. Admittedly the Ministry of Labour and Social Security may - by virtue of D.P.R. No. 547 of 27 April 1955 - allocate to ENPI further powers, such as checking and controlling the state of safety of certain installations and equipment, but these powers have up to now only been allocated in the Ministerial Decrees of 12 September 1956 and 22 February 1965 (inspecting and controlling fire escapes, moving parts on vehicles, suspension bridges, hydroextractors, hoisting equipment and installations and devices against atmospheric discharges). No provision was therefore made for ENPI to exercise supervision or control over the ICMESA plant and in consequence over the reactor intended for TCP production.

In regard to INAIL, it is sufficient to note that ICMESA stated to the Institute in question, when drawing up the insurance report in 1947, that the Meda establishment would be engaged on the manufacture of chemical and pharmaceutical products and that this statement was never modified. The original classification of the risks therefore remained unchanged: it was not within the competence of INAIL to undertake any direct

activity to establish possible changes in the manufacturing activity of ICMESA. The Institute is in fact in the position of the injured party, since ICMESA, by failing to notify TCP production, has prevented any evaluation of the increased risk associated with this production and in consequence the provision of adequate insurance contributions.

3. Final considerations

The shortcomings in the administrative and technical services in connection with the Seveso incident, have induced the Commission to formulate a few general conclusions.

It is evident in the first place that the fragmentary system of regulations results in a large number of bodies, each of which is charged with particular functions. The practical effect of this situation is that each body tends to have a field of vision circumscribed by its own particular sector of competence, without any overall consideration being given to the safety aspect. This field of vision is in point of fact even further restricted, where the administrative or technical authority conceives its own role in purely formal terms and restricts its activities to the preparation of documents (communications to other authorities, notifications etc), which are not conducive to an adequate or substantial safeguarding of the public interest, but merely to the formal fulfilment of specific obligations which, at the most, relieve or are intended to relieve, the authority of the burden of responsibility.

In the present case the Enquiry has shown that, not infrequently, the practice followed has emphasized rather than overcoming, the negative aspects in the existing system of regulations and structures.

This conclusion is reinforced by the insufficient coordination between the different bodies, even though institutional provision is made for contact between them.

These findings relate - obviously - to the structures as they appear in concrete form today: the Commission cannot refrain from referring, as a further negative element, to the lack of organization and in consequence to the inadequate level of training (basic and advanced) of the staffs.

The Commission wishes to emphasize that this final aspect, in particular, gives rise to a sort of complex inadequacy of the public service in relation to the industrial world, always technologically more competent, which it is required to supervise. This leads to a situation in which safety is left, to a large extent, to the sense of responsibility of the undertakings.

There is no doubt that the spirit of cooperation between the public services and operators in the private field, is one of the indispensable conditions for the achievement of an adequate system of safety, but it is equally obvious that a serious and no less urgent requirement is for the community, in the interests of its own safety, to have available fully adequate technical and administrative instruments - from the regulations, structural and technical points of view - to discharge their progressively more difficult and indispensable functions.

The Commission, finally, has not found any direct liability on the part of the central authorities. Nevertheless, the Commission feels bound to observe that the inadequate result, due also to legislative shortcomings, necessitates control and coordination between the central authorities, the local authorities and those who are responsible on a sectoral level for individual functions in connection with the matter under examination.

The Seveso incident underlines the important fact that the specificity of the breakdown of functions of the bodies responsible for safety should not stand in the way of the high degree of coordination and synthesis which is obviously essential for the correct functioning of a really efficient system.

Third Part

Findings in regard to the notification of the incident
and the initial measures taken by the local and central authorities

Section I

Formation of the toxic cloud and initial measures taken by the local and central authorities

This part of the report will examine the behaviour of ICMESA and its representatives following the incident on 10 July 1976; an evaluation will be made of the initial measures adopted by local bodies and public organs responsible for the control of harmful and dangerous production processes; an examination will also be made of the urgency and efficacy of such measures, aimed at restricting as far as possible the damage resulting from the incident; details will be given of the activities of those organs responsible for establishing any criminal liability for the circumstances in question.

1. Behaviour of the management of ICMESA following the incident

As has already been stated, the incident occurred around 12.37 p.m. on Saturday 10 July 1976. The shift foreman, Carlo Galante, who took steps to prevent the escape of the gas, reported the incident by telephone to Dr. Barni (statement by Galante, 11/6), who was standing in for Dr. Paoletti, at that time on holiday (statement by Paoletti, XXVII/4). Nothing is known of any steps taken by the management of ICMESA until the following day, Sunday 11 July, when Dr. Paoletti got into contact with Engineer Herwig von Zwehl, technical director of the establishment (who was also absent from the factory at the time of the incident), who gave orders for samples to be taken of foliage which had turned yellow as a result of contact with the toxic cloud and to take these to the Givaudan laboratory in Switzerland for immediate analysis (as was in fact done by Paoletti, who left the same evening for Geneva). Engineer von Zwehl also instructed Dr. Paoletti to notify the health officer of Meda.

The senior officer of police at Meda reported to the magistrate of Desio on 11 July 1976, that at 5.45 p.m. on that day, Drs. Paoletti and Gaetano Barni, official representatives of ICMESA, had appeared at the police station to report, "that as a result of an escape of trichlorophenol vapour from a reactor, a cloud of herbicide had been released, which had caused damage to the surrounding crops". It emerges

however, from this telephone record, that immediately thereafter a number of policemen accompanied by the mayor Meda, the head of the technical office and the aforesaid doctors Paoletti and Barni, notified the health officer of Meda and other "persons concerned" of the incident.

It emerges clearly from this that the management of ICMESA:

- (a) allowed a good 27 hours to pass before informing the mayor of Meda and the police of the incident,
- (b) failed to notify directly any of the authorities which could have taken emergency measures,
- (c) when reporting the circumstances to the mayor and to the police, failed to make any reference (even hypothetical) to the escape of dioxin and to the serious nature of the consequences, but merely reported the formation of a "cloud of herbicide".

It is evident from this that the management of ICMESA attempted to minimize the incident and its consequences. This is confirmed also by the letter sent to the Seveso office of health and hygiene (and for information to the health officer of Seveso and Meda), and from the telegram sent to the provincial inspectorate of labour: the former letter, sent on 12 July, stated that ICMESA had notified local inhabitants not to consume vegetables, in view of the danger of poisoning, resulting from the evaporation of herbicidal compounds; the second letter, sent on 17 July, requested the intervention of the provincial inspectorate of labour, without however giving the detailed grounds for this, or providing specific information indicating the dramatic nature of the incident.

It should also be noted that in spite of the incident and the seriousness of the situation, ICMESA did not interrupt the activity of its production divisions. This induced the works council to proclaim a strike, and on 18 July, the divisions in question were closed by order of the mayor (Order No. 3).

It also emerged from the enquiry that at 2.15 p.m. on 11 July, Dr. Sambeth, technical director of GIVAUDAN, after receiving information of the incident which had occurred at Meda, suggested - "after a few minutes - the possibility of TCDD production".

Dr. Sambeth stated in fact to the Commission, "We had heard of incidents of the same type and I had thought of the possibility... however, I thought at the time, and I still continue to think, that there was a very high dioxin content in the area of the bursting plate and a lower concentration elsewhere. I could not believe, at that moment, that the dioxin would have been capable of spreading in a very much wider zone" (XXXIX/1).

There is no doubt whatever that the directors of GIVAUDAN were immediately aware of the seriousness of the incident, but nevertheless, failed to provide direct information of this to the competent Italian Authorities. They persisted in this omission even after on 14 July the analyses, carried out in the laboratory at Dübendorf (Zurich) had demonstrated the presence of TCDD in material collected from the environment of ICMESA, and after this had been confirmed by subsequent analyses on the following days in their own laboratory (statement by Sambeth, XXXVII/2).

The Commission finds this behaviour a serious matter and cannot accept the possibility that it was motivated by a concern to avoid panic: the seriousness of the incident should rather have required the directors of ICMESA and GIVAUDAN to warn the Italian authorities without delay of the real situation and the danger of the spreading in the area of the cloud of poison, to enable the authorities to take the most suitable measures to reduce the harmful effects of the incident as soon as possible.

The fact remains that, even after learning that the analyses in the Dübendorf laboratory provided proof of the diffusion of TCDD, the directors of ICMESA and GIVAUDAN failed to notify this most serious circumstance to the Italian authorities (statement by Sambeth, XXXVII/2).

Only on 18 July, when the director of the Provincial Chemical Laboratory of Milan suggested to the technical management of ICMESA the possibility of TCDD being present in the cloud of poison, was it announced that the director of the chemical laboratory of GIVAUDAN was coming to Italy. The director arrived in fact on 19 July - i.e. nine days after the incident, eight days after the well-founded suspicion by Sambeth, and five days after the results of the analysis were available - and only at this stage, and through its own channels, ICMESA and GIVAUDAN decided to admit the extreme seriousness of the situation.

2. Actions of the judicial police

The Meda police (carabinieri) - acting on their own initiative as agents on the judicial police - had in the meantime submitted to the magistrate of Desio further information on the incident which, with the passage of time, appeared progressively more serious and suggestive of the commission of an offence. In detailed terms, the police reported by telephone at 12.55 p.m. on 15 July, that the cloud had formed as the result of the bursting of the safety plate of a reactor, which had been left untended during the cooling phase, and that this had occurred as the result of an exothermic chemical reaction; that a first on-the-spot examination had been made by Dr. Francesco Uberti, medical officer attached to the hygiene and prophylaxis group of Seveso, who had stated, "that the cloud of vapour originated from the reactor, located in shop B of the ICMESA establishment, reaching a height of 40 m and spreading rapidly in a south-easterly direction" and that, "the cloud in question was not liable to cause injury to persons"; that investigations carried out up to that time had shown that persons in the zone surrounding the establishment had not suffered any harm, but that damage had been caused to plants and vegetables grown in two farms in Seveso and Meda, amounting to an approximate value of 100,000 lire. A further telephone message - on 16 July - reported that on the evening of 15 July the mayors of Meda and Seveso, having appreciated in conjunction with the provincial medical officer and Dr. Azzimonti of the hygiene division of the regional health advisers office, the seriousness of the numerous cases of poisoning occurring among the population of the two areas on the afternoon of the same day, had decided to close off the zone by means of a fence with boards indicating contamination; it was also reported that samples had been taken - by technical staff of ICMESA - from the area of the reactor and sent for analysis to the GIVAUDAN chemical laboratory at Dübendorf.

On 17 July the Meda police also sent to the magistrate of Desio a detailed report which, in addition to confirming the situation described above, stated that on the evening of 15 July Dr. Uberti had observed in a number of persons, especially among children, allergic symptoms (diffuse urticaria, conjunctivitis and oedema of the face) and eczematous manifestations, which had necessitated the administration of detoxicant and antiallergic preparations. Dr. Uberti had also reported the death of a number of

farm animals and the local authorities in Meda and Seveso had ordered the destruction by fire of both animals and crops. The same report also stated that on 16 July thirteen children from Seveso, between the ages of two and nine years, and a fifteen year old boy, had been admitted to the "Felice Villa" hospital at Mariano Comense, suffering from "toxic dermatitis due to a compound in vapour form belonging to the trichlorophenol group" and that a further four children, more serious cases, had been admitted to the Niguarda hospital in Milan.

In a further telephone message on 19 July, the police informed the magistrate of Desio of the admission to the "Speciles" hospital at Mariano Comense, of four further children from Seveso and one female child from Mariano Comense, also suffering from "toxic dermatitis due to a compound in vapour form belonging to the trichlorophenol group". The report also stated that an outpatient control was being carried out of other children in Meda and Seveso.

Numerous reports were submitted on subsequent days by various organs of the police (in particular by the investigatory group of Monza, from the Seregno police station, from the Desio company and from the N.A.S. police group attached to the Ministry of Health); these reports were sent to the public prosecutor at Monza.

Attention should be drawn at this point to a report by the investigatory group of Monza dated 26 July, in which it is stated that Dr. Uberti - while awaiting the results of the analyses in the GIVAUDAN laboratory - requested on 16 July, the mayors of the communes affected by the toxic cloud to authorize the use of teams of workers from ICMESA, with the necessary equipment, to undertake the incineration of contaminated material (vegetable, plant and animal products) in the areas in question; although this request was accepted, the measure was not implemented "owing to the refusal of ICMESA to provide operatives". The same report also stated that Dr. Ghetti, medical officer of health of Meda and Seveso, and Dr. Cavallaro, director of the provincial hygiene and prophylaxis laboratory, on their return from Switzerland, where they had been to ascertain the results of analyses of samples taken

in the contaminated zone, had taken part in a meeting held in the mayor's office at Seveso, where they had brought to the notice of the authorities the results of the analysis and indicated the dangers due to the compound contained in the cloud of poison.

3. Initial measures by the local and central authorities

Examination of the measures taken by the local and central authorities after the incident enabled an assessment to be made of the urgency, suitability and efficacy of these measures, so as to check whether they were adequate to control the harmful consequences of the contamination.

Detailed consideration will be given in this connection to the measures taken between 15 and 24 July 1976, by the mayors and local councils of Meda, Seveso, Cesano Maderno and Desio, by the hygiene services of Meda and Seveso, by the provisional medical service, by the director of the provincial chemical laboratory, by the provincial inspectorate of labour, the directorate of the provincial hygiene and prophylaxis laboratory, the prefect of Milan, the provincial council of health, the regional health adviser and the Ministry of Health.

The series of measures were in fact initiated only on 15 July, no measures of any kind having been taken between the afternoon of 10 July and the evening of 14 July: these five days of inactivity in the Seveso tragedy have been justly called "the days of silence". There was in fact no awareness of the seriousness of the incident until the 14 July, when the first cases of farm animal mortality were reported in the village of S. Pietro, which bounded the ICMESA establishment.

From that time on the sequence of activities of the administrative and technical services between 15 and 24 July were broadly as follows:

15 July: The mayors of Meda and Seveso announced the contamination with toxic substances of the zone of S. Pietro, which was marked off by means of stakes with noticeboards, prohibiting contact with or consumption of, vegetable products. The medical officer of health - Dr. Ghetti for both Meda and Seveso - reported to the provincial medical officer, the regional health adviser, the police and the mayors,

a number of cases of poisoning. The mayor and Dr. Uberti met in the evening in the town of Seveso to examine the situation in conjunction with the mayor of Meda and the management of ICMESA, although the latter refused to accept, even as a hypothesis, the presence of TCDD in the contaminating material.

16 July: The medical officer of health of Seveso and Meda sent a number of samples of vegetable products to the provincial hygiene and prophylaxis laboratory for analysis.

17 July: The mayors of Seveso and Meda ordered the destruction by burning of plants, crops and vegetable products from the contaminated zone and also the carcasses of dead beasts. The director of the provincial chemical laboratory, Dr. Cavallaro, summoned by the medical officer of health for Seveso and Meda, inspected the contaminated zone and took a number of samples of contaminated products (Dr. Cavallaro stated to the Commission that, immediately after inspecting the locality, he consulted the most recent scientific literature from which he learned that "the condensation of sodium trichlorophenolate may give rise, as a result of an abnormal reaction, to the formation of dioxin" (XIV/5).

18 July: The mayor of Meda ordered the closing of the production shops of the ICMESA establishment.

By order of the magistrate of Desio, seals were applied to the doors giving entry to shop B of the establishment.

19 July: The provincial medical officer and Dr. Azzimonti of the hygiene division of the office of the regional health adviser, made an on-the-spot inspection of the ICMESA establishment and, immediately thereafter, the provincial medical officer requested the intervention of the provincial inspectorate of labour, to whom he reported the result of his inspection by telephone. The mayor of Seveso issued an order prohibiting the ingestion of products originating from animals in the contaminated zone and the mayor of Meda ordered the closing of the firm ENCOL (Confezioni) (Packaging).

Dr. Vaterlaus, director of the chemical laboratory of GIVAUDAN arrived in Italy and admitted "the presence of dioxin and brought with him the relevant literature" (statement by Cavallaro XVI/6).

20 July: Dr. Riboldi, head of the chemical division of the provincial inspectorate of labour, visited Meda to undertake a direct examination, but found all the doors giving access to shop B had been closed and sealed. However, Dr. Riboldi had a meeting with representatives of the company, with the works council and with representatives of the trade unions, to obtain information on the course of the incident and to determine what forms of permit the firm should have had in its possession on the basis of the existing regulations. On conclusion of the interview, Dr. Riboldi informed the directors of ICMESA of the contravention of Articles 36, 40, 328 and 374 of D.P.R. No. 547 of 27 April 1955 (Regulations for the Prevention of Accidents at Work). The provincial medical officer at the same time requested by telegram CRIAL (the Regional Committee Against Atmospheric Pollution of Lombardy) to undertake immediate investigations and to take the necessary technical measures; a telegram was sent to all doctors in the zone, requiring them to report all cases of gastro-intestinal disorders and cutaneous irritation; a report was also sent to the regional adviser of health on the on-the-spot inspection carried out on the previous day.

The mayor of Meda issued an order prohibiting the consumption of products of animal origin originating from the contaminated zone.

On the evening of the same day, Drs. Cavallaro and Ghetti were present at Zürich at the analyses carried out in the GIVAUDAN laboratory. This analysis confirmed the presence of tetrachlorodibenzo-para-dioxin (TCDD) among the compounds present in the toxic cloud (statement by Cavallaro, XVII/1). The mayor of Seveso - after receiving this information - notified by telephone the regional health adviser for the Lombardy region, Dr. Rivolta, and arranged a meeting for the following day.

21 July: A meeting was held in the municipal offices of Seveso, attended by the mayor, the regional health adviser Rivolta and the health authorities, in which the positive results of the analysis for TCDD, obtained in the GIVAUDAN laboratory at Dübendorf, were reported. At the end of this meeting, the mayor prohibited movement along C. Porta and T. Grossi streets, and the regional health adviser Rivolta sent a report to the chairman of the Regional Board and the Prefect of Milan, setting out the seriousness of the situation. The provincial medical officer sent telegrams to the Ministry of Health, the Higher Institute of Health and to the Prefect of Milan with information on the situation, and also summoned by telephone Professor Puccinelli, clinical dermatologist of the University of Milan. The office of the regional health adviser set up the first Commission of Experts (Professors Dioguardi, Mantegazza and Chiappino). The Ministry of Health - having been notified of the extreme seriousness of the incident, requested by telegram further information from the Region of Lombardy and offered the services of the Higher Institute of Health for any collaboration that might be required. In the meantime, in the districts of Cesano Maderno and Desio, which were also contaminated but to a less serious extent, similar measures were taken to those adopted by the mayors of Seveso and Meda (orders restricting movement in the contaminated zone, orders relating to behaviour for the protection of health etc).

22 July: A census was started of the animals in the contaminated zone. The mayor of Seveso requested the provincial administration to accept eighty children in school camps away from the area: the request was accepted and the children were sent to Cannobio. The regional adviser for health arranged for the opening in Seveso of an outpatient department with medical staff provided by the dermatological clinic of the University of Milan, to undertake clinical examination of all remaining persons who had been exposed to the risk of contamination.

The Regional Council met and, in the course of its session, in response to questions raised by a number of councillors, the health adviser provided initial information on the situation and on the measures which had been taken.

The Ministry of Health provided the Region of Lombardy with fundamental data from the international literature on TCDD and sent Professors Polizzi, Melograni and Sampaolo, technical officials of the ministry, to the contaminated zone. In the meantime, the extent of the area affected, the severity of the contamination, the progressive increase in the number of pathological conditions affecting human beings and the intensive animal mortality induced the provincial medical officer of Milan, in agreement with the local health authorities, to request the Prefect to convene as a matter of urgency the Provincial Council of Health.

23 July: The Provincial Council of Health met in extraordinary session, attended by experts from the Ministry of Health, the Higher Institute of Health, the University of Milan and the "Mario Negri" Institute. On conclusion of the meeting, the measures taken by the regional health adviser were confirmed, in particular: (1) the instructions to the Institute of Plant Pathology to check vegetation, so as to establish the boundaries of the zone affected by the toxic cloud; (2) to instruct the regional veterinary service, in conjunction with the Brescia Institute of Animal Prophylaxis, to examine the animals which had died; (3) to set up a clinical centre at Seveso under the direction of Dr. Ghetti, medical officer of health, as a clearing station for persons with pathological conditions; (4) to instruct the hygiene and prophylaxis laboratory to carry out the necessary examinations, so as to provide exact knowledge of the chemical aspects of the contamination. The Ministry of Health arranged for the despatch to the contaminated zone of a complete team of research workers from the gas chromatography section of the Higher Institute of Health.

24 July: A meeting of officials and technical advisers from the Region of Lombardy, the Ministry of Health and the Higher Institute of Health, was held under the chairmanship of the regional health adviser and attended by Dr. Vaterlaus representing GIVAUDAN, at the headquarters of the Regional Board. The results were announced at this meeting of the laboratory analyses, carried out between 23 and 24 July, by the

Higher Institute of Health and the provincial hygiene and prophylaxis laboratory of Milan, making use of equipment from the pharmacology institute of the University of Milan, which had yielded positive results in regard to the presence of TCDD. At this meeting Dr. Vaterlaus confirmed that the analyses in the GIVAUDAN laboratory at Dübendorf had established the presence of TCDD in an appreciable quantity.

The zone of major contamination was defined (starting from the ICMESA establishment and extending southwards over an area of about 15 hectares to a depth of about 750 m); it was decided to evacuate the population, to prohibit access and to fence off the area. This created in fact zone A.

During 26 July 225 persons (170 from Seveso and 55 from Meda) were evacuated by the local authority in cooperation with the armed forces.

The results of further laboratory examinations caused the regional health authority to extend zone A on the following days and to increase the depth of the zone to about 1600 m.

The difficult question of the demarcation of zone A had not been finally dealt with even then: laboratory analyses necessitated a further increase in the depth to 2200 m, without reaching in the south the railway line between Seregno and Saronno. This decision involved also the evacuation of residents within the contaminated zone.

Zone A, evacuated and fenced off, occupied overall an area of 108 hectares and the evacuated population numbered in August more than 730 persons.

Further laboratory research enabled the contaminated zone to be defined with greater precision: a zone of lesser contamination was established in the area of Cesano Maderno and Desio, amounting to 269.4 hectares, and designated zone B.

The regional health authority ordered on 2 August the daily evacuation of children under twelve and of pregnant women up to the third month, and the adoption of strict measures, affecting in particular food and water supplies.

A third zone (R or the "zone of caution"), which was either uncontaminated or with contamination values below $5 \mu\text{g}/\text{m}^2$, was set up round zones A and B with an area of 1430 hectares.

Complete mapping of the zone was carried out in an initial draft on 10 August 1976 by the Technical and Scientific Commission (set up by D.P.C.M. No. 206 of 5 August 1976) and finally approved by the Regional Council of Lombardy on 7 October 1976.

4. Urgency and efficacy of the initial measures

The first fact to emerge clearly from the above account is the delay with which the public authorities realized that an enormous area to the south of ICMESA had been contaminated with TCDD, and in consequence by the most highly toxic synthetic compound known.

It was only on the evening of 23/24 July in fact, a little less than two weeks after the incident, that laboratory analyses, positive in respect of TCDD, became available in Italy, even though, as stated above, the presence of this compound was reported on 19 July (statement by Cavallaro, XVI/6).

This was certainly due, during the initial phase, to the extreme reticence of GIVAUDAN and also probably to the fact that the equipment available was not fully adequate to provide rapid results in this fairly difficult analysis of a type as unusual as that relating to the present case.

The second relevant fact is the absence of any significant steps before 15 July: this was undoubtedly due to ignorance of the production process of ICMESA and the consequent risks. This of course relates closely to the liability arising prior to the disaster, a subject which has been fully treated in the second part of this report.

This not inadvertent ignorance of the real production process at ICMESA meant that workers in the factory itself, the inhabitants of the zone affected by the toxic cloud and also the administrators initially regarded the incident as a normal escape of gas and vapours from the establishment, which was not an exceptional event.

When the public services, admittedly in a fairly vague, cautious and reticent manner, were informed of the cause of the formation of the cloud and of the fact that this cloud contained herbicides, people hurried to the police station to take initial measures.

As the mayors and medical officers of health realized the seriousness of the incident, they agreed the emergency measures to be taken. These activities were not isolated, but were supported by, and integrated with, the measures taken by the provincial, regional and central authorities, referred to above.

It cannot be said that this multiple form of support was entirely adequate, but it is not possible, in the view of the Commission, to establish the liability of individuals or bodies. The position is rather that the large number of bodies - created by the current legislation - involved in partly superimposed activities, caused a waste of energy and produced a form of cooperation which was not consistent with the urgent requirements, even though the necessary special legislative measures were taken, including those affecting the operational structures.

The measures taken after 24 July, when the scale of the incident became known with all its dramatic urgency, have been widely discussed in Italy and abroad.

Nevertheless, the Commission believes that the demarcation into zones, even though carried out in several phases, was a timely measure, taken overall: on 10 August, a little more than two weeks after the laboratory analyses, the Technical and Scientific Commission was able to define the essential extent of the contaminated zone.

No blame can be attached to the decision to evacuate zone A.

The question remains open of the degree of risk to which the 4754 inhabitants of zone B were exposed, a zone in which the mean value of TCDD contamination was $3 \mu\text{g}/\text{m}^2$. Although there is no doubt of the correctness of the prophylactic measures taken in zone B to reduce the risk and contamination factors, some people believed at the time, as is well known, that evacuation of the population would have been desirable.

The Commission does not have the criteria to agree with or dissent from the relevant decisions taken by the competent health authorities and by the Regional Council of Lombardy.

Consideration will be given to the measures taken by the local and central authorities in subsequent phases in the fourth and fifth parts of the present report.

5. Actions of the judicial authorities

The actions of the judicial authorities were initiated by the report – referred to above – sent by the Meda police to the magistrate of Desio. The magistrate in fact, having summoned Herwig von Zwehl, Gabriele Gaviraghi, Paolo Paoletti and Antonio Aiello – all employees in different capacities of the company ICMESA – since he wished to consider criminal proceedings against them, "in connection with the diffusion of toxic substances on 10 July 1976 and the symptoms of disease occurring as a result", issued on 21 July warrants for the arrest of Herwig von Zwehl and Paolo Paoletti, technical manager and production manager respectively of the ICMESA establishment.

The warrants of arrest were executed on the same day by the police of Desio. After the customary interrogation, the magistrate ruled that von Zwehl and Paoletti should remain in arrest, "in the house of the former adjacent to the ICMESA establishment, with freedom of movement within the house and the establishment, but always under supervision". The magistrate then placed the arrested persons at the disposal of the public prosecutor of the court of Monza, which was competent to try the offences in question.

On 30 July the public prosecutor requested the examining magistrate to undertake a formal investigation to issue a warrant for the arrest of both the persons concerned, to confiscate the technical and administrative documentation at ICMESA and to obtain any other document relating to the company, which might possibly be available with the administrative authorities.

The examining magistrate, in implementation of these instructions, ordered the confiscation of the relevant documents and issued on 2 August warrants for the arrest of von Zwehl and Paoletti for offences under Article 449 in conjunction with Article 434 of the Penal Code. On the same day the examining magistrate, having received the defence offered by the accused persons, modified the order of house arrest issued by the magistrate of Desio and ordered the immediate transfer of von Zwehl and Paoletti to the municipal prison of Desio.

The same examining magistrate, instructed by the public prosecutor, issued on 10 August a new order for the arrest of the aforementioned von Zwehl and Paoletti, and also of Giovanni Radice, head of the engineering department of ICMESA, and undertook on 20 August the formal interrogation, informing the accused of their offences under Articles 113, 449, 437, second paragraph, of the Penal Code, and in the case of von Zwehl in addition contravention of Article 216 of Royal Decree No. 1265 of 27 July 1934.

On 21 August the examining magistrate, after issuing an order to appear before him, interrogated Fabrizio Malgrati, mayor of Meda and Giuseppe Ghetti, medical officer of health of the areas of Meda and Seveso, informing them of their offences under Article 328 of the Penal Code and in addition in the case of Malgrati under Article 361 of the Penal Code. Finally on 24 August the magistrate issued an order to appear before him, which however remained without effect, in respect of Jeorg Sambeth and Guy Waldvogel, director general and technical director respectively of GIVAUDAN S.A., and served formal notice of offences under Articles 113, 449, 437, second paragraph, of the Penal Code and Article 361, final paragraph, of D.P.R. No. 547 of 27 April 1955.

The accused persons in detention were granted provisional liberty.

Since it was obviously necessary to ascertain by means of an expert investigation the causes of the incident and the nature and extent of the damage caused to persons, animals, plant life and the natural environment in general, the examining magistrate arranged for three separate expert examinations.

The result of only one of the expert examinations has yet been submitted, the remaining two being in course of execution.

The investigation by the examining magistrate still appears far from complete due to the complexity of the facts for investigation and it is therefore impossible, even on a hypothetical basis, to predict when the proceedings before the court of the first instance will take place.

Fourth Part

Effects of the incident on the health, on the natural environment
and on economic activities

Section I

Toxicity of TCDD

1. Effects on experimental animals

TCDD is the most toxic of the dibenzo-para-dioxin chlorides. The results reported in the literature of tests on experimental animals (which received single or repeated oral doses of TCDD) are summarized in Table 1, which shows that the LD₅₀⁽¹⁴⁾ of TCDD in the guinea-pig is about 0.6 µg/kg body weight.

- (14) The LD₅₀ (50% lethal dose) is a quantitative expression indicating the acute toxicity of a substance, which represents the estimated value of the quantity capable of inducing death in 50% of the animals to which it is administered. The LD₅₀ is expressed in units of weight or volume of substance per kg body weight of the animal to which it is administered.

Table 1 LD₅₀ of TCDD in various animal species

Animal species	LD ₅₀ (ug/kg)	Reference
Guinea-pig, male	0.6	B.A. Schwetz et al. Environment Health Perspectives, Experimental Issue, 1973 (5) 87.
Rat, male	22	Idem
female	45	Idem
Rabbit, male	115	Idem
female	115	Idem
Mouse, male	114	J.G. Vos et al. Toxicology and Applied Pharmacology, 1973 29 229.

The extremely high toxicity is evident from a comparison with the LD₅₀ values in Table 2, provided for the Commission by the Higher Institute of Health.

The values in the table indicate only the relative toxicity. It is to be noted that the table is based on data for different species, different methods of administration and different survival times. Administration was effected intra-peritoneally except for (a), where the LD₅₀ was obtained by oral administration in the guinea-pig, and (b) where the LD₅₀ was determined by intravenous injection in the cat.

Table 2 Relative toxicity of a number of poisons

Substance	Molecular weight	Minimum lethal dose moles/kg
Botulinus toxin	9×10^5	3.3×10^{-17}
Tetanus toxin	1×10^5	1×10^{-15}
Diphtheria toxin	7.2×10^4	4.2×10^{-12}
TCDD ^a	322	3.1×10^{-9}
Saxi toxin	372	2.4×10^{-8}
Tetrado toxin	319	2.5×10^{-8}
Bufo toxin ^b	757	5.2×10^{-7}
Curare	696	7.2×10^{-7}
Strychnine	334	1.5×10^{-6}
Muscarine ^b	210	5.2×10^{-6}
Di-iso fluorophosphate	184	1.6×10^{-5}
Sodium cyanide	49	2.0×10^{-4}

The administration of TCDD to experimental animals produces toxic effects, which vary in qualitative and quantitative terms according to the species of animal, as shown in Table 3.

The toxic syndrome may be divided into eight categories:

(1) Chloracne

TCDD is highly active in causing dermatoses and inducing acne on the ears of rabbits. Chloracne, which may appear weeks after exposure, is the most typical form of TCDD poisoning in man like hyperkeratosis and cystic dilation of the sebaceous glands, it has been observed in monkeys, rabbits and in some strains of mouse.

Table 3 Toxic effects of TCDD

	Guinea-pig	Mouse	Monkey
Thymus, involution	+++	+++	+++
Spleen, reduction (white pulp)	+	+	+
Medulla, hypoplasia	++	±	+
Liver, megalocytosis/degeneration	—	+++	—
Bile duct, hyperplasia	±	±	+++
Testicles, degeneration	+++	++	not determined
Renal pelvis, hyperplasia	++	—	+
Urinary bladder, hyperplasia	++	—	—
Adrenal gland, atrophy of the cortex	++	—	—
Haemorrhage, intestinal	+	+	—
adrenal	++	—	—
Ascites	—	++	+
Cutaneous lesions	—	—	+++
Tumours*			+

* An increase in the tumour rate was observed in the rat also.

(2) Hepatotoxicity

The degree of involvement of the liver depends on the dose absorbed and the severity of the pathological changes, which varies according to the species. Necrosis of the liver cells, produced by TCDD, is the probable cause of death in rats, whereas necrosis and hepatic insufficiency are minimal in the mouse and in the guinea-pig. The principal organs attacked by TCDD in rabbits, rats, guinea-pigs and mice appear to be the liver and the thymus. In the monkey, on the other hand, involvement of the liver is minimal. An accumulation of hepatic porphyrin and/or cutaneous porphyrin has been observed in chickens, rats and mice.

(3) Hypoplasia of the lymphatic tissues

Involvement of the cortical cells of the thymus has been observed in mice, rats and guinea-pigs. Particular symptoms, which have been observed, are atrophy of the thymus and exhaustion of the lymphatic organs. The most significant results, both in mice and in guinea-pigs treated with sublethal doses of TCDD, related to the lymphatic system: TCDD causes a suppression of the cell-mediated immunity, especially in young animals. Low doses of TCDD, which do not produce within a short period manifest clinical or pathological changes, are capable of lowering the efficacy of the immune defences: 1 µg/kg body weight, administered orally to mice once weekly for four weeks, prior to inoculation with Salmonella, increased the mortality and reduced the interval between inoculation and death. Mice, rats and guinea-pigs after treatment with TCDD exhibited lymphopenia and thrombocytopenia.

(4) General debilitation and progressive decline

Death occurred after 2-6 weeks in experimental animals aged 1-2 years, and after about 1 year in monkeys. The following additional symptoms were observed: mobilization of peripheral fat accumulations, increased triglyceride levels in the blood and fatty degeneration of the liver.

(5) Embryotoxicity and teratogenicity in the mouse

TCDD is embryotoxic and teratogenic in the mouse both in single doses or in cumulative repeated doses amounting to 1-10 µg/kg body weight, causing an increased incidence of split palate and abnormalities of the kidneys, as is evident from Table 4.

Table 4 Evaluation of the reported teratogenic and embryotoxic effects of TCDD in rats and mice

Species	Strain	Embryotoxic or teratogenic effect	Dose (ug/kg body weight)		Period of administration (days)	Method of administration	References
			Minimum exptal. value (a)	ED ₅₀ (b)			
Rat		Intestinal haemorrhage	0.125	0.52		oral	G.L. Sparzschu et al. Food Cosmet Toxicol 1971 9 405. K.D. Courtney and J.A. Moore, Toxicol. Appl. Pharmacol. 1971 20 396
	CD	Renal abnormality	0.5	>1	6-15	s.c.	
Mouse	CD-1	Split palate	1% 3	>3	6-15	s.c.	Idem
		Renal abnormality	1	1-3	6-15	s.c.	
	DBA/2J	Split palate	3	>3	6-15	s.c.	Idem
		Renal abnormality	3	>3	6-15	s.c.	
	C57BL/6J	Split palate	3	>3	6-15	s.c.	Idem
		Renal abnormality	3	<3	6-15	s.c.	
	NMRI	Split palate	3	6.5	6-15	oral	D. Neubert and I. Dillman, Naunyn-Schmiedeberg's Arch. Exp. Path. Pharmacol 1972 272 243. D. Neubert et al. Environmental Health Perspectives, 1973 5 567
			9	<9	9-13	oral	
			15	40	13	oral	
			5	15	11	oral	

(a) This indicates the minimum dose giving rise to a teratogenic or embryotoxic effect at the time of birth. Since on occasion only one dose was administered, this represents necessarily the minimum dose capable of producing an effect.

(b) ED₅₀ = Dose required to produce an embryotoxic effect in 50% of the animals.

Embryolethal effects were observed in rats under the experimental conditions, in conjunction with renal abnormalities, intestinal haemorrhages and general oedema in the foetuses. Studies have also been made of the effects of prenatal exposure on the post-natal functions. One of the post-natal effects due to exposure of the mother was renal hydronephrosis, occurring in small mice which were breast-fed by an animal, to which TCDD had been administered during pregnancy or at the time of birth. Prenatal and post-natal renal abnormalities had a common aetiology and the incidence and severity of the hydronephrosis depended on the dose and the period of exposure of the organ. In a reproduction trial covering three generations, carried out on non-related albino rats, 0.1 µg/kg TCDD daily resulted in a lower pregnancy rate and a higher mortality among the young, whereas daily doses of 0.001 µg/kg produced no detectable effects on the parameters under study.

(6) Chick oedema disease

Chick oedema disease, a characteristic subcutaneous oedema of the hydropericardium with ascites, necrosis of the liver and death was described in 1957, following the accidental administration of toxic fats in the feed of rearing chickens. Ascites has also been observed in mice. Daily doses of 10 or 100 µg/kg body weight TCDD have caused a positive reaction in the biological test for chick oedema disease. Similar effects have been observed in monkeys, pigs, dogs, guinea-pigs and rats.

(7) Carcinogenic effects

The data available in the literature on the tumour-forming effects of TCDD are insufficient for a statistically valid finding, since studies on this aspect have only been undertaken recently. Nevertheless, the results on rhesus monkeys and recent research on the rat (which revealed a high percentage of malignant tumours of various types, following the administration in the daily diet of 0.25 ng TCDD/kg body weight daily for 18 months) indicate that dioxin has a pronounced carcinogenic activity.

Table 5 Episodes involving exposure of human beings to TCDD

Date	Firm	Country	No. of persons suffering injury	Cause of incident
1949	Monsanto	USA	117	Overheating leading to explosion
1952/3	Boehringer	Federal Republic of Germany	37	Exposure during the production process.
1953	Badische Anilin und Soda Fabrik AG (BASF)	Federal Republic of Germany	55	Overheating leading to explosion
Between 1953 and 1971	Rhone Poulenc	France	97 (including 17 in an explosion in 1956 and 21 in a further explosion in 1966)	Explosion during the production process.
1956	Hooker	USA	Staff of the firm	Overheating
1960	Diamond Sham-Roch	USA	Figure unknown	Overheating
1963	Philips Duphar	Netherlands	30	Overheating leading to explosion
1964	Spolana	Czechoslovakia	72	Exposure during the production process.
1964	Dow Chemical	USA	30	Explosion during the production process.
1963	Coalite and Chemical Products	UK	79	Overheating leading to explosion.
1970(1)	Bayer	Federal Republic of Germany	5	Exposure during the production process.
1972/3	Chemie/Linz	Austria	50	Exposure during the production process.
Before 1976	Thompson Hayward	USA		Overheating leading to explosion
1976	ICMESA (GIVAUDAN)	Italy		Overheating.

(8) Other effects

The following symptoms have also been observed after the administration of TCDD in one or more species of laboratory animals: medullary hypoplasia, degeneration of the testicles, hyperplasia of the urinary bladder and renal pelvis, and intestinal and adrenal hæmorrhages.

2. Effects on man, described in the scientific literature prior to the incident of 10 July 1976

Table 5 lists the toxic effects in man due to TCDD after:

- (a) occupational exposure during the industrial synthesis of 2,4,5-trichlorophenol,
- (b) exposure in establishments and local environments as a result of incidents occurring during TCP synthesis,
- (c) exposure to herbicides and other materials containing TCDD.

The exposed persons suffered a wide range of lesions and symptoms as shown in Table 6.

Table 6 Toxic effects of TCDD in man

1.	Dermatological
1.1	chloracne
1.2	porphyria cutanea tarda
1.3	hyperpigmentation and hirsutism
2.	Internal
2.1	liver damage
2.2	increased blood levels of the hepatic enzymes
2.3	metabolic changes affecting fats and carbohydrates
2.4	cardiovascular changes
2.5	changes in the urinary tract
2.6	respiratory changes
2.7	pancreatic changes
3.	Neurological
3.1	polyneuropathy
3.2	weakness of the lower limbs
3.3	sensory damage (vision, hearing, smell, taste)
4.	Psychiatric
4.1	neurasthenic and depressive syndromes

Chloracne, which is one of the most constant and predominant characteristics of exposure to TCDD, has been described as a refractory acne, involving cysts, pimples and pustules, with a possible cicatrization of the skin, starting in most cases on the face and extending subsequently to other parts of the body. Many patients exhibit conjunctivitis of the eyelids and irritation of other mucous membranes. Chloracne sometimes precedes erythema and oedema of the skin. The latent period between exposure and the appearance of manifest symptoms of chloracne varies from a few weeks to several months.

The following effects have also been observed in man: hyperlipaemia, muscular weakness and pain (with pathological changes in the nerve conduction) and neuropsychiatric syndromes.

In 1949 an incident occurred during TCP production in a United States nitro factory (in West Virginia)⁽¹⁵⁾. The first symptoms occurred in a number of workers after a few hours, but in the majority of those affected, only three months or more after the incident. A survey made five years later indicated that 117 persons had exhibited symptoms which could be attributed to contact with the compound as a result of the incident; a further 111 persons, employed in the factory, were affected in a milder way. The wives of many operatives exhibited symptoms similar to those of their husbands: acne, hepatic dysfunction, nervous irritability and fatigue.

One year after the incident at Boehringer in the Federal Republic of Germany in 1953, in which 37 workers were affected, a further incident occurred in Germany at the BASF plant at Ludwigshafen, engaged on TCP, in which 55 operatives exhibited symptoms of chloracne⁽¹⁶⁾. Twenty-one of these exhibited pathological symptoms affecting in particular the liver, kidneys and spleen; symptoms affecting the cardiovascular, respiratory and nerve systems and the visual function, were less frequent. Symptoms of chloracne were also observed among the families of the operatives. In a subsequent study⁽¹⁷⁾ it was found that 22 of the workers, who had been exposed to TCDD during the incident in 1953, were still working in the factory five years later: 2 of these were still suffering from acne of the face and scrotum, 1 from

(15) R.R. Suskind, I.A.R.C., Meeting, Lyons, Gennaio 1978.

(16) A. Hay, *Nature*, 1976 262 636.

(17) I.A.R.C. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, 1977 15 83.

paralysis of the left leg and 1 from permanent deafness; the remainder were healthy, the only residual symptoms being the scars of the chloracne. Fifteen persons had died in the meantime, 7 due to cardiovascular disease (including 2 due to myocardial infarct and 1 to mitral stenosis), 4 due to cancer, 2 to suicide, 1 to necrotic pancreatitis and 1 to hæmorrhage of the esophagus.

The 16 men who had been placed on retirement were still enjoying good health. No miscarriages or adverse effect on procreation was recorded among the wives of workers in the factory.

Further reports from German sources, appearing between 1957 and 1961, related to persons employed in the herbicide industries of the Federal Republic of Germany. These involved primarily dermatological symptoms (cysts, pimples and pustules with possible cicatrization) in the area of the temples and cheeks, spreading to the neck, nape of the neck, thorax and groins^(18, 19, 20). A number of cases of conjunctivitis of the eyelids were also observed; further symptoms were anorexia and weight loss, abdominal pains, headaches, asthenia of the lower limbs and hepatic dysfunction, plus a complex of psychological changes, involving a reduction in the vitality, libido, judgement, resistance to fatigue, emotional stability and learning capacity.

Cases of chloracne, manifested by the occurrence of sebaceous cysts and dry, brown-coloured pimples obstructing the sebaceous pores over large areas of the skin, were reported between 1956 and 1958 by two French dermatologists on the basis of clinical observations on 17 operatives working in a TCP factory in the region of Grenoble^{(21), (22), (23)}.

(18) R.H. Schulze, Arch. Klin. Exp. Dermatol., 1957 206 589.

(19) J. Kimmig and K.H. Schulze, Dermatologia, 1957 115 540.

(20) H. Bauer et al., Arch. Gewerbepath. Gewerbehyg., 1961 18 538.

(21) P. Dugois and L. Colomb, Bull. Soc. Franc. Derm. Syph., 1956 63 262.

(22) P. Dugois and L. Colomb, J. Med. Lyon, 1957 38 899.

(23) P. Dugois, J. Marechal and L. Colomb, Arch. Mal. Prof., 1958 19 626.

The same group of dermatologists reported similar findings in 1968, following an explosion which occurred during TCP production⁽²⁴⁾. The symptoms were broadly similar to those observed ten years earlier. It was possible in the latter case, however, to observe the effects due to a brief contact with a larger quantity of the compound. It was possible in fact to observe the initial phase of the dermatic conditions occurring during the first few days, involving erythematous-oedematous lesions with prurigo, probably due to the direct external effect of the chemical compound. Subsequently, during the first three weeks, follicular lesions were observed of the same type and with the same localization as those due to elaeoconiosis. After a further two or three weeks these lesions gradually turned into the primary keratinous lesions of chloracne. According to these authors, the logical explanation is that the toxic product, which has been introduced into and stored in the organism, is eliminated through the skin over a period of a few months, causing the characteristic lesions of chloracne, but no proof has been provided of this hypothesis.

Five cases of chloracne were reported in 1962 following an incident in the area of Milan, in an establishment manufacturing TCP⁽²⁵⁾.

Fifty persons were involved in 1963 as a result of an explosion occurring at Philips Duphar in the Netherlands, and ten of these were still suffering the effects in 1976; four persons died within two years of the incident (although the connection between the dioxin poisoning and death could not be adequately proved)⁽²⁶⁾.

In a paper published in 1964 a number of American dermatologists reported the results obtained in a study on twenty-nine workers in a factory producing herbicides from chlorophenol derivatives⁽²⁷⁾. Apart from the characteristic symptoms of chloracne, they observed hyperpigmentation, hirsutism, brittleness of the skin and vesicular eruptions over the exposed cutaneous zones. Porphyrria cutanea tarda was observed in eleven of the twenty-nine workers and hepatic dysfunction in two workers. These authors assumed a correlation between the chloracne and the porphyria cutanea tarda and a connection between this disease and the compounds present in the factory.

(24) P. Dugois et al., Bull. Soc. Franc. Derm. Syph., 1968 75 260.

(25) M.F. Hofmann and C.L. Meneghini, G. Ital. Derm., 1962 103 427.

(26) A. Hay, Nature, 1976 262 636.

(27) J. Bleiberg et al., Archives of Dermatology, 1964 89 793.

This study was renewed by another group of workers in 1971⁽²⁸⁾, who examined members of the work force of the same factory and extended the range of the research to 73 persons: they observed less serious pathological symptoms than those reported in the previous case. High serum cholesterol and lactic acid dehydrogenase was found in a number of cases (10 - 30%) and the leucocyte count was below 5000/mm³ in 7 persons.

After a serious incident at Bolsover (United Kingdom) in 1968, 79 persons exhibited symptoms of chloracne during a period of seven months after the incident⁽²⁹⁾. In 11 of the 14 persons, who were present in the factory at the time of the explosion, a number of the results of functional liver tests differed from normal, but returned to normal limits within ten days.

In 1970 an article was published by two Soviet research workers⁽³⁰⁾, referring to the effects produced on 128 workers in a plant engaged on herbicide production with a TCP derivative.

These workers exhibited, with varying degrees of intensity, lesions of the follicular apparatus of the skin and irritations of the mucous membrane of the upper respiratory tract. In the zones of maximum concentration of the acne symptoms, a hyperkeratosis developed and the skin covering assumed a dirty grey colour; 18 workers were also found to be suffering from neurasthenia, 14 from vasomotor dystonia, 14 from symptoms of chronic gastritis and other conditions of the digestive apparatus. Diseases of the ENT system were diagnosed in 87 cases and this high incidence was attributed to the effect of vapours of the chemical compounds used, resulting in irritation of the respiratory apparatus. The mean values for the erythrocyte, reticulocyte, leucocyte and platelet counts and for the haemoglobin were within normal limits in the great majority of the patients. An interesting point was made in this paper relating to the sensitivity of the skin to ultra-violet irradiation, which was found to decrease with an increase in the intensity of the cutaneous lesions.

(28) A.P. Poland et al., Archives Environmental Health, 1971 22 316.

(29) G. May, British Journal of Industrial Medicine, 1973 30 276.

(30) K.A. Telegina and L.I. Bikbulatova, Vestn. Dermatol. Venerol., 1970 44 35.

Two dermatological papers, published in 1973 and 1974, reported an incident which occurred in Czechoslovakia in a factory producing TCP. TCDD formation caused various disorders in 76 workers (out of a total workforce of 80): chloracne, porphyria cutanea tarda, hepatic lesions, disturbance of the fat, porphyrin, carbohydrate metabolism and of the protein content in the plasma, lesions of the peripheral neuron neurasthenic syndromes and organic conditions. Two workers (aged 47 and 59 years) died as the result of bronchial carcinoma and one worker died as the result of acute pentachlorophenol poisoning⁽³¹⁾, ⁽³²⁾.

There have also been reports in the literature of the death of a large number of horses in Missouri (USA) in 1971, which occurred in a field spread with mud from the industrial residues of hexachlorophene production (obtained from TCP), which contained TCDD. A number of persons were also affected by chloracne and a haemorrhagic cystitis was diagnosed in one female child⁽³³⁾.

Reference should be made finally to the particularly severe symptoms observed in 2 research workers in the course of an experiment involving the preparation of dioxin samples: apart from chloracne and high blood cholesterol values, these workers exhibited symptoms of personality changes, other neurological disorders and hirsutism⁽³⁴⁾.

The general conclusion may be drawn that hundreds of cases had already been described and attributed to TCDD as a result of occupational exposure or environmental pollution, prior to the incident on 10 July 1976 at Seveso. A large number of pathological symptoms due to dioxin had also been reported by medical officers working in Vietnam where, between 1964 and 1970, large areas of ground were covered with herbicides, in particular 2,4,5-T (which is a derivative of TCP), known also as "Agent Orange".

(31) L. Jirasek et al., *Cesk. Dermatol.*, 1973 48 306.

(32) L. Jirasek et al., *Cesk. Dermatol.*, 1974 49 145.

(33) D. Carter et al., *Science*, 1975 188 738.

(34) R.M. Oliver, *Brit. J. Industr. Med.*, 1975 32 49.

The contamination affected both men and animals; in addition to known symptoms, the reports referred to congenital malformations among children (including spina bifida and split palate) and an increased incidence of abnormal births (such as placental tumours and the expulsion of dead fetuses).

Section II

Effects of the incident of 10 July 1976 on the health of individuals exposed to the risk of contamination

1. Population exposed to the risk of contamination

At the time of the escape of the cloud of poison from ICMESA, the population resident in the contaminated area consisted of 733 persons in zone A, about 4800 in zone B and about 22,000 in zone R, domiciled in the commune of Seveso, Meda, Maderno, Desio, Bovisio, Barlassina.

For epidemiological purposes, however, account will be taken of the residents in 11 communes - including the 6 listed above - in the health committee zone Brianza-Seveso (C.S.Z.) 1-2-3, amounting to a total of about 216,000.

It has already been stated that the residents of zone A were evacuated during the week following the incident, whereas the residents in zones B and R were not evacuated. It should also be stated that the residents of zones B and R were obliged to submit to numerous health regulations, including the prohibition on the cultivation of vegetables and fields, on the rearing of animals and the consumption of local products of plant or animal origin.

For epidemiological purposes, the persons examined included therefore those exposed to high levels of TCDD contamination for a short period (zone A), persons resident in other contaminated zones, who were exposed for a long period to decreasing levels of contamination on the basis of the exposure data set out in the fourth part of the report, Section II, paragraph 1, and persons resident in non-contaminated zones.

2. Health measures relating to control checks on the persons affected, epidemiological supervision of the population and laboratory research

The health measures followed three broad lines:

- (1) a systematic long-term control of persons affected and specifically at risk,
- (2) epidemiological supervision of the population in the three health committee zones,
- (3) laboratory research.

The following bodies were involved in the execution of the tasks under (1) above:

- (a) the health groups of the Brianza-Seveso zone 1-2-3,
- (b) the hospitals of Seregno, Desio, Giussano Mariano and Monza ("S. Germano dei Tintori"),
- (c) organizations approved for clinical, immunological, genetic, enzymatic and metabolic research, namely:
 - (i) clinical research in the neurological sector: the "Besta" neurological institute in Milan and the I.C.P. labour clinic in Milan,
 - (ii) for clinical research in the immunological sector: medical clinic IV, the transfusion and immunological transplant centre of the Polyclinical Hospital of Milan, the analytical laboratory of the hospital of Desio, the labour and paediatric clinics of the I.C.P. of Milan,
 - (iii) for clinical research in the genetic sector: the centre for the diagnosis and therapy of conjugal sterility of the "Niguarda" hospital, the first obstetric clinic "Mangiagalli", the clinical research laboratory for anatomy and histological pathology of the I.C.P. at Milan in conjunction with the pathological institute of the University of Lubecca, the institutes of general biology of the faculties of medicine of the Universities of Milan, Pavia and Rome, the biochemical genetics laboratories of the C.N.R. in Pavia, the cytogenetic section of the I.C.P. laboratory and the laboratories of the hospital of Desio,
 - (iv) for research in the enzymatic and metabolic sectors, the third clinic of the Polyclinic Hospital.

The following organizations were engaged on execution of the tasks under (2) (epidemiological supervision of the populations of the three health committee zones):

- (a) the Special Office of the Region of Lombardy for Seveso,
- (b) the office of the provincial medical officer, specifically competent for the area,
- (c) the coordinating committee between the three health committee zones.

It is to be noted that the above three structures were set up many months after the incident: the Special Office for Seveso by means of Regional Act No. 27 of 17 June 1977, the office attached to the provincial medical officer (competent for the 11 communes in the province of Milan, affected by the ICMESA incident) by Decision No. 7831 of 15 February 1977, and the coordinating committee of the three health committee zones on 17 February 1977.

Execution of the tasks under (3) (laboratory research) was entrusted, by appropriate agreements, to the following institutes:

- (a) for research in the sectors of pharmacokinetics, metabolism, carcinogenesis and immunological functions: the "Mario Negri" Institute,
- (b) for research in the sector of carcinogenesis: the National Institute for the Study and Treatment of Tumours,
- (c) for research in the sector of the specific toxicity of organs (liver and kidneys): the institute of pharmacology and pharmacognosy of the University of Milan,
- (d) for research in the field of effects on the peripheral central nervous system: the first department of pharmacology of the faculty of medicine of the University of Milan,
- (e) for research in the cutaneous toxicity sector: the dermatological clinic of the University of Milan,
- (f) for research in the teratogenic effects sector: the institute of zoology of the University of Milan,
- (g) for research on mutagenic effects, the institute of anthropology and human pathology - department of genetics - of the University of Pisa.

The general lines of the health measures taken indicate without any doubt, the wide and multidisciplinary approach required to meet the multiple and largely unprecedented problems of contamination with TCDD - such as that occurring on 10 July 1976 - over an enormous densely inhabited area.

In regard to the systematic control of the population and epidemiological supervision - for which provision was made under (1) and (2) of the programme set out above - before outlining the results obtained, the Commission wish to point out that the following points were taken into account during the evaluation:

- (1) in any research the choice of persons to be examined is made on the basis of their spontaneous presentation for examination, previous invitation by letter or as a result of a previously determined strict method of sampling;
- (2) the clinical research was not carried out on the double blind system: the examiner was in fact aware of the individual histories in regard to the risk exposure, with the consequent possibility of this awareness affecting his judgment, especially in regard to non-quantifiable findings;
- (3) the criteria adopted for the identification and establishment of clinical, statistical and laboratory evaluations were not always sufficiently homogeneous to provide valid and significant comparisons for purposes of synthesis of the data;
- (4) no precise criteria were adopted for the separation by name of the persons exposed to the risk, or for their classification into the different at risk categories;
- (5) in view of the possibility of pathological symptoms, occurring in the future in subjects with chronic exposure to microdoses of TCDD (Part IV, Section 1, paragraph 2), the future occurrence of biological changes, not detectable today, cannot be excluded; for this reason the Commission deems it opportune to set up a "tumour register", which will enable the occurrence of such pathological symptoms to be followed with the passage of time.

The Commission has noted in connection with laboratory analyses - for which provision was made under paragraph (3) of the broad lines of health measures - the delay in the implementation of certain measures. Although the Commission is aware of the objective difficulties involved in the implementation of some of these, and the absence on occasion of complete agreement between some of the agreed organizations, it feels bound to emphasize the need for their implementation as soon as possible.

Having evaluated the results obtained so far, the Commission considers that it is its duty to set out the most significant results which have emerged from the investigations up to now.

A. Dermatological manifestations

The pathological changes in the dermatological field, attributable to the disaster, may be divided into two large groups:

- (1) cutaneous manifestations, observed immediately after contact with the toxic cloud and on subsequent days,
- (2) lesions observed during the delayed phase, attributable to the action of the absorbed TCDD.

Early dermatological symptoms

The following summarized data relating to early pathological changes in the dermatological field have been taken from the report of the coordinator of dermatological services, dated 9 September 1977:

- (a) During the period from 23 July to 31 August 1976, 477 of the 600 persons attending the dermatological outpatient department at Seveso, exhibited "symptoms which could be correlated with the specific toxic episode". . . . "either because they were chronologically linked with the incident, or in the light of certain morphological and diagnostic characteristics".

- (b) the topographical distribution of these cases was as follows:

		Nos.
Zone A	Seveso	113
Commune	of Seveso	97
"	" Cesano M.	92
"	" Meda	53
"	" Desio	22
"	" Seregno	15
"	" Bovisio M.	8
"	" Varedo	6
"	" Barlassina	6
"	" N. Milanese	5
Other communes		30
Total		447

The breakdown of the subjects by age groups was as follows:

	Nos.
Less than 12 months:	19 (4%)
From 1 to 12 years:	167 (38%)
From 12 to 21 years:	46 (10%)
Over 21 years:	215 (48%)
Total:	447

- (c) The pathological symptoms consisted in erythema and oedema of the exposed parts of the body, associated on occasion with fever and a feeling of illness, which tended to regress after two - three weeks; dermatic conditions of the localized caustic type on the hands, or other parts of the body in contact with the hands, cleared up without cicatrization; the nodular erythematous symptoms tended to regress within ten days, the morphological symptoms being similar to those of an annular granuloma.
- (d) Rapid regression of these symptoms was observed during the first fifteen days of August; blood checks of the persons concerned provided pathological data of general significance.
- (e) Only 34 of the 447 patients, who presented the above symptoms, were subsequently found to be suffering from chloracne.
- (f) In many other cases it is probable that exposure to the toxic cloud and all the consequences of this exercised a determining influence on the general course of the dermatological condition.

Chloracne

After the disappearance during the first half of August of the acute cutaneous symptoms - which were in consequence ^{for the part} most probably due to ~~other~~ components of the toxic cloud ^{and not to the} ~~- dioxin~~

the pathological cutaneous condition which is most specific of the pathological pattern of TCDD began to appear, mainly chloracne. According to the report of the dermatological service, chloracne was observed during the months of September and October 1976, in 44 cases (27 females and 17 males, all resident and present in zone A at the time of the incident).

The breakdown of these 44 cases by age groups was as follows:

up to 12 months	0	
from 1 to 6 years	17	(9 males and 8 females)
from 6 to 12 years	13	(6 males and 7 females)
from 12 to 21 years	14	(2 males and 12 females)
over 21 years	0	

In addition to the above 44 cases, a further 6 cases were observed during the following two months, the patients being in every case present in zone A at the time of the incident.

It was decided on the basis of these data that the dermatological outpatient checks were insufficient, even though they had covered 7077 persons, and the dermatological service therefore undertook in 1977 mass examination on the following basis:

A first screening, carried out from 2 February 1977 to 13 April 1977 in the nursery, primary and secondary schools of the communes of Seveso, Cesano, Meda, Desio, Seregno, Cabiato, Bovisio, Varedo, Nova M., Barlassina, covering 32,194 persons.

A second screening, carried out during the month of April 1977 in the nursery, primary and secondary schools of the communes of Seveso, Meda, Cesano and Desio, covering 11,525 persons.

These screening operations made it possible to identify (apart from numerous suspect cases which could not be classified) a further 79 cases of chloracne, which, added to the 44 referred to above and a further 6 diagnosed elsewhere (in clinics, by private examination etc), brought the total to 135 at the end of 1977.

In 75 of these the course of the condition was checked during the early months of 1978 and the results indicated a tendency toward a favourable evolution of the condition. This is

evident from Table 7, drawn up by the dermatological service. In this table 00 denotes negative subjects, CA1 patients with a few pimples in specific sites (minimal stage), CA2 patients with more numerous pimples and cysts (mild stage), CA3 patients with numerous pimples and cysts in specific sites (medium stage) and CA4 patients with diffuse pimples and cysts in non-specific sites (serious stage).

Table 7 Evolution of 75 cases of chloracne as a function of time

Classification of subjects	1st quarter 1977	Beginning of 1978
00	—	19
CA1	29	34
CA2	3	21
CA3	6	1
CA4	9	0

A third screening was carried out by the dermatological service from 12 October 1977 to 6 February 1978 in the nursery, primary and secondary schools of the communes of Seveso, Meda, Cesano and Desio and also in the secondary schools of Como and Lecco, covering 16,686 persons.

The dermatological service concluded, as a result of a re-examination of the material, that the total number of cases with confirmed positive symptoms was 187, subject of course to the results of subsequent observations and surveys.

The overall results indicated:

- (1) a continuation of the occurrence of cases of chloracne – albeit in progressively decreasing quantities – in the populations of Seveso, Meda, Cesano Maderno and Desio,
- (2) a progressive decrease in the cutaneous symptoms in new cases,
- (3) a favourable course of the condition in patients already suffering from chloracne.

B. Neurological symptoms

Neurological investigations also revealed significant findings in respect of persons specifically at risk, as is evident from the results received by the Commission.

The "C. Besta" neurological institute examined 830 persons between March and June 1977, 446 of whom (i.e. 60.7% of the population) were resident in zone A, 105 in zone B, 150 in zone R and 129 in other locations. A second control check is being carried out on the first group of subjects.

The following procedure was adopted for the investigation: clinical examination, electromyography, maximum and minimum conduction rates of the sciatico-popliteal nerves of one side and, where necessary further determinations.

The results of the first neurological examination in 1977 showed that the percentage of cases with clinical idiopathic or neurological subclinical damage, hypothetically attributable to TCDD, was higher in zone A (6.7 and 3.1% respectively) than in zones B and R (1.2 and 1.3% respectively). The most significant findings affected the peripheral nervous system: decreases in the motor conduction rate of the nerves were found, in particular, and polyneuropathy, clinically determined, was confirmed by instrumental tests.

The second neurological control, which is still being carried out, will cover about half of the individuals resident in zone A who were examined previously. The results obtained so far, in comparison with those of the previous investigation, appear to indicate an increasing trend in the number of cases with clinical idiopathic or subclinical damage (11.7 and 4.9% respectively).

The Commission is unaware of any correlation between the abnormal neurological symptoms and the previous presence of chloracne.

The "L. Devoto" labour clinic of the University of Milan examined between February 1977 and January 1978 about 202 operatives from the ICMESSA establishment (131 men and 14 women) and from the firm ENCOL (5 men and 52 women), who underwent clinical neurological examination and a neurophysiological investigation.

The most significant clinical results relate to symptoms of peripheral nerve involvement

of the polyneuropathic type in 8 subjects (3.96%). In 3 patients, admitted in succession to the labour clinic of the University of Milan, polyneuropathy of the lower limbs was diagnosed, clinically and by EMG, which was not attributable to the normal pathogenic aetiologies, namely alcoholism, diabetes, neuropathy, infection or pharmacotoxic factors.

In regard to the neurophysiological findings, research workers reported that, "the mean values of the maximum and minimum motor conduction rates of the external sciatico-popliteal and ulnar nerves, did not differ significantly from the values found in previous studies on non-exposed populations; nevertheless there was a tendency toward an increased dispersion of the values in respect of the ulnar nerve in workers from the ICMESSA factory".

In the light of the data recorded so far, the Commission believes that, since the international scientific literature has indicated a recurrence of pathological changes in nervous systems exposed to TCDD, including a slow and delayed development of symptoms, it is particularly desirable to carry out systematic neurological controls, as has in fact been included in the regional plan.

C. Haematological data

At the instance of the Epidemiological Commission, a number of significant haematological indices (including the SGT, SGPT, SGOT and the blood cholesterol) have been examined over the course of time on:

- (a) 623 ex-inhabitants of zone A and 943 children from zone B;
- (b) 186 employees from ICMESSA and subcontractor firms;
- (c) 449 workers employed on land reclamation.

Statistical evaluation of the collected data is not yet complete and only preliminary analyses are available. Comparison of the data from the first (July - October 1976) and second (October 1976 - January 1977) examinations, has revealed an increase in the percentage of abnormal transaminase and transferase values in individuals from zone A. The percentage of such values decreased appreciably in the third (January -

August 1977) and fourth (August 1977 - March 1978) quarterly examinations. A comparison of the results obtained on children from zones A and B has indicated, as a joint tendency, an increase in the frequency of abnormal values for the three haematological indices from the first to the last examination. These results suggest that, in particular in zone A, exposure to TCDD has caused, at least in a few individuals, a significant increase in some forms of enzymatic activity of the liver function. This increase was very much in evidence during the months immediately following the incident, reaching a peak at the end of 1976. An increased incidence of abnormal transaminase and transferase values was observed, on the other hand, during the second examination of workers from the ICMESA factory.

The significance of these results is not at present clear; non-consistent changes in these haematological indices of the same order of magnitude have in fact been observed also in groups of workers employed on land reclamation in the contaminated zone; these workers were not specifically exposed to TCDD and were all selected on the basis of their healthy results in a preliminary clinical examination.

Porphyrin contents have been found in urine specimens from a number of persons exposed to TCDD in the Seveso zone. These data were obviously related in particular with the clinical findings on liver conditions, which emerged in the course of the internal medical examinations referred to in the following paragraph.

D. Data on internal medical examinations

Up to 21 June 1977, about 1650 persons had undergone examinations in the field of internal medicine. The general conclusion of the coordinator in the field of internal medicine was as follows: "None of the persons examined exhibited symptoms which could be definitely attributed to TCDD contamination, if we exclude the nausea, vomiting, pruritus and headaches which occurred on the days immediately following the incident. Only time and an epidemiological study will enable us to evaluate the possible significance of the hepatomegally and the increase in the gamma-GT,

occurring in a number of persons (although only very few) in the absence of alcohol consumption or the administration of drugs".

The Director of the Higher Institute of Health, Professor Pocchiari, at a recent convention (Science Week, New York, 21-30 June 1977: The scientific basis for the public control of environmental health hazards) refers to these cases in the following words, "A group of 1654 persons from zones A, B and R have undergone internal medical examinations. 8% of these exhibited hepatomegaly of idiopathic aetiology and a further 24% hepatomegaly in connection with alcohol consumption or viral hepatitis. No information is available on the criteria for evaluation of the hepatomegaly. None of the persons examined exhibited symptoms attributable with any degree of certainty to TCDD contamination, excluding the nausea, vomiting, pruritus, and headaches which were reported on occasion during the days immediately following the incident. A moderate hepatomegaly has been found in about 10% of the children in the preschool and school age groups".

Subsequent examinations in internal medicine have raised the overall figure for persons examined to 2830, broken down as follows: Health Committee Zone 1: 868; HCZ 2: 1278; HCZ 3: 684.

The results of the most recent examinations are not yet known. On the basis of the data collected up to now, these results appear to be of particular interest in regard to the incidence of hepatomegaly of idiopathic aetiology.

E. Data on children and newborn infants

There is an obvious relation between the general data in the field of internal medicine and the paediatric findings on children between the ages of 3 and 14 years, selected from among the categories deemed to be at risk.

The overall total figure for children examined is 2099, broken down as follows:
HCZ 1: 171; HCZ 2: 1610; HCZ 3: 318.

The only significant findings were cases of hepatomegaly (for which no figures are given in the report of the coordinator) in a number of children from Cesano Maderno and Seveso.

Postnatal growth of children born in zones A, B and R (numbering about 2000) after the incident, has been and is being followed in periodical clinical checks, including a complete paediatric examination at birth and after 1, 3, 6, 9, 12 and 18 months of life. Urine and blood analyses have been carried out on 10% of all the children examined 6 and 12 months after birth; these data have not up to now undergone statistical and computer examination.

No pathological findings attributable to TCDD have as yet emerged.

The conclusion drawn by the paediatric coordinator, formulated in a letter of 23 May 1978, was as follows, "The results obtained do not appear to me to indicate any particular pathological findings".

F. Malformations

Examination of the untreated data relating to malformations, reported in returns to the provincial medical officer, indicate a substantial upward variation between 1976 and 1977, with a rise in the figure from 4 to 38. The number of malformations reported during the first quarter of 1978 was 5.

The geographical distribution of the reported malformations is shown in Table 8:

Table 8 Geographical distribution of the malformations

Communes	1976	1977	1.1 - 31.3.78
Cesano Maderno	0	5	1
Desio	1	5	0
Meda	0	11	1
Seveso	0	2	1
Totals	1	23	3
Barlassina	0	0	0
Bovisio M.go	1	2	0
Lentato S/S.	0	1	0
Ruggio	1	1	0
Nova Milanese	1	1	1
Saregno	0	7	1
Varedo	0	3	0
Totals	3	15	2
Grand total	3	38	5
Report No.	(1417)	(2664)	674

These data have not been taken into account, however, in view of the possibility of a more strict attitude toward reporting malformations, the fact that these are known malformations and do not present any repetitive character.

The nature of the malformations is summarized in Table 9:

It has to be borne in mind, finally, that the malformations reported in 1977, as stated by the Director of the Higher Institute of Health in his paper to the Science Week Convention in New York, "are within the percentage range (1-3%) found in those populations in which systematic research has been carried out".

Table 9 Types of malformation

Malformation	1976	1977	1st quarter 1978
Pulmonary . . . (illegible)	0	1	
...	0	1	
Atresia of the auditory conduction	0	1	
Congenital cardiopathy	0	8	2 (1 with suspected Down's syndrome)
Vesical dystrophy	0	1	
Gastroschisis	0	1	
Hydrocephalus	0	1	
Hypospadias	2	2	
Abdominal malformation	0	2	
Anal malformation	0	1	
Malformation of the foot	0	10	
Meningocele	0	1	
Neoplasia	0	2	
Incomplete osteogenesis	0	1	
Down's syndrome	2	2	
Syndactylia	0	3	
Severe epispadia			1
Hernia of the rear diaphragm			1
Split palate			1
Totals	4	38	5

Reference should also be made in the present paragraph to the morphological analyses carried out at the pathology institute of the University of Lubeca on fetuses, obtained from 30 therapeutic abortions and 4 spontaneous abortions during the Autumn of 1976. These examinations failed to identify any foetal damage indicating a mutagenic, teratogenic or embryotoxic effect due to exposure to TCDD. These findings do not however constitute an intrinsic limitation in view of the obvious difficulty of identifying a possible damage in the foetal organs at this early stage of development. Determination of the degree of exposure to TCDD of the pregnant woman prior to the abortion is also subject to a measure of doubt.

G. Cytogenetic research

Before giving the results of cytogenetic research in the present connection, the Commission feels it desirable to indicate the significance, value and limits of such research and the methods used. We may quote in this connection, the general observation by the coordinator of this specialist field, Professor Morganti, at the recent convention organized by the Special Office for Seveso and held at Milan on 2-3 July 1978:

"Cytogenetic research constitutes only one part of the investigations carried out to ascertain whether any genetic damage has been caused by a particular physical or chemical agent.

"A complete study of the genetic effects would require the monitoring of the population over long periods of time, covering more than one generation, to bring out any variations in particular epidemiological indices of a more or less specific nature, such as the incidence of particular hereditary diseases of gene or chromosomal origin, the frequency of spontaneous abortions, the mean neonatal weight, the frequency of sterile or infertile mating etc.

"Cytogenetic research has the advantage of providing a result within a relatively short time, but provides direct information^{only} on somatic genetic damage, which can be related to proliferative disorders in the field of carcinogenesis. Only indirect information can be

obtained, on the other hand, in regard to a possible genetic damage, which can be transmitted to the progeny, and cytogenetic findings are restricted to possible, relatively gross changes in the hereditary material, such as those affecting chromosomal structure. The absence of chromosomal lesions does not therefore exclude the possibility of more refined changes in the genetic material, which can only be detected over a period of time by means of an epidemiological study of the population.

"Research on chromosomal changes is normally carried out on peripheral blood lymphocytes cultivated *in vitro* and by subsequent discussion of the significance of chromosomal lesions observable on this type of material: a frequency of cells with chromosomal rupture varying between 1 and 5% is in fact also found in normal subjects, who have not apparently been exposed to any identifiable mutagenic agents. A positive result can therefore only be regarded as the finding of a statistically significant increase in the frequency of chromosomal ruptures. In any case, the data only provide an indication of the risk situation in the ambient conditions in comparison with the population as a whole, and cannot be regarded as proof of a pathological effect in respect of individual subjects".

The cytogenetic research carried out up to now within the health programme is shown in Table 10, which gives details of the number of individuals examined and the cultures and preparations produced.

Table 10 Cytogenetic research

Category	No. of samples taken	No. of cultures grown	No. of preparations	No. of individuals analysed
Controls	95	188	847	87
Acute exposure	162	321	1441	145
Chronic exposure	73	143	645	69
Patients with chloracne	15	30	135	14
Chloracne controls	15	30	135	15

The following bodies participated in this research:

- (a) institute of general biology, faculty of medicine and surgery,
University of Milan (Professor L. De Carli);
- (b) institute of general biology, faculty of medicine and surgery,
University of Pavia (Professor M. Fraccaro);
- (c) institute of general biology, department II, faculty of medicine and surgery,
University of Rome (Professor B. Nicoletti);
- (d) institute of genetics, faculty of natural, physical and chemical sciences,
University of Pavia (Professor F. Nuzzo);
- (e) cytogenetic section, laboratory division, institute of clinical training,
Milan (Professor F. Cefis);
- (f) analytical laboratory of the hospital of Desio (Professor C. Mocarelli);
- (g) for statistical analysis: Professor G. Zei (laboratory of biochemical and
evolution genetics of the CNR, Pavia);
- (h) coordinator: Professor G. Morganti (department of human genetics, faculty of
medicine and surgery, University of Milan).

The results obtained have been described in the following terms by Professor Morganti:

"The frequency of cells with chromosomal lesions, found in subjects belonging to the five categories, are shown in graph form in Figs. 2 and 3. There is a slight tendency for an increase in the percentage of cells with chromosomal lesions in the categories of persons presumed to be exposed either to chronic or acute contamination.

"Further statistical studies are being carried out with a view to more specific comparisons of individual types of chromosomal damage and a more far-reaching research programme which will include:

- (a) further investigations on previously acquired material,
- (b) repetition of the analyses on individuals who have already exhibited abnormal values, both exposed persons and controls,
- (c) extension of the research to all workers in the ICMESA factory.

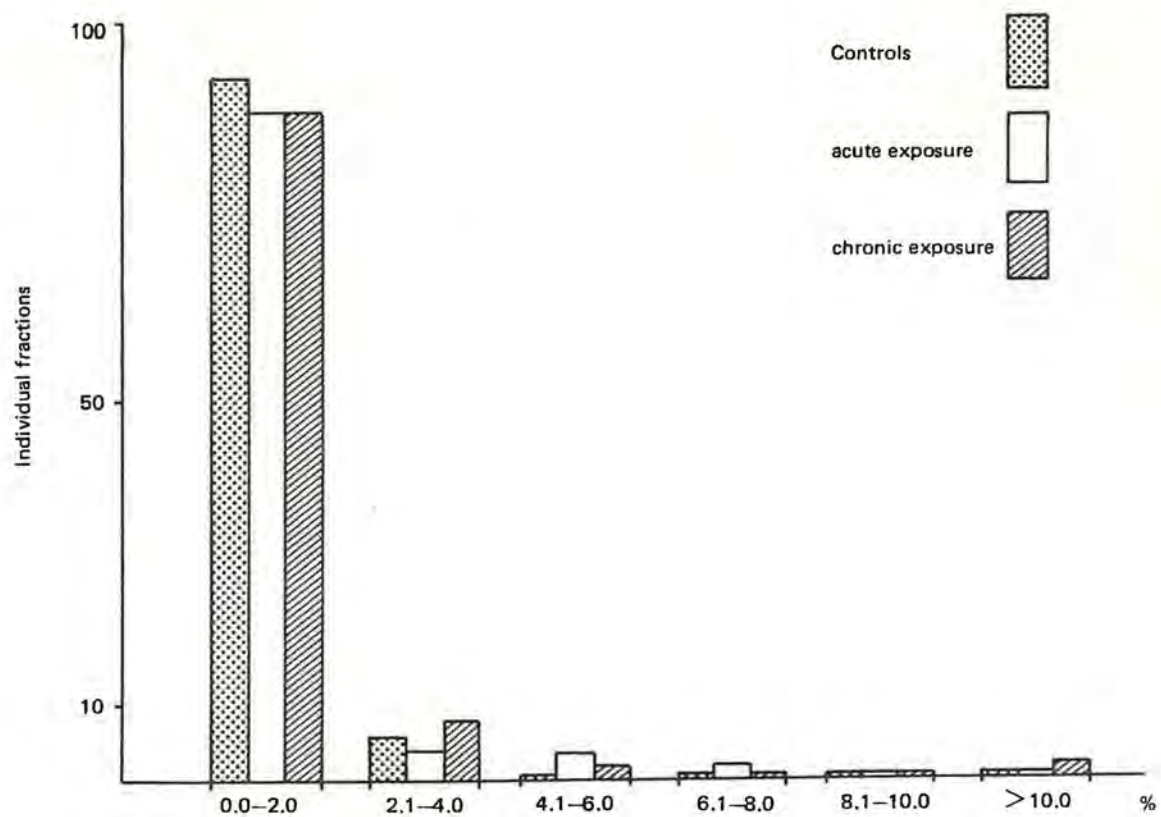
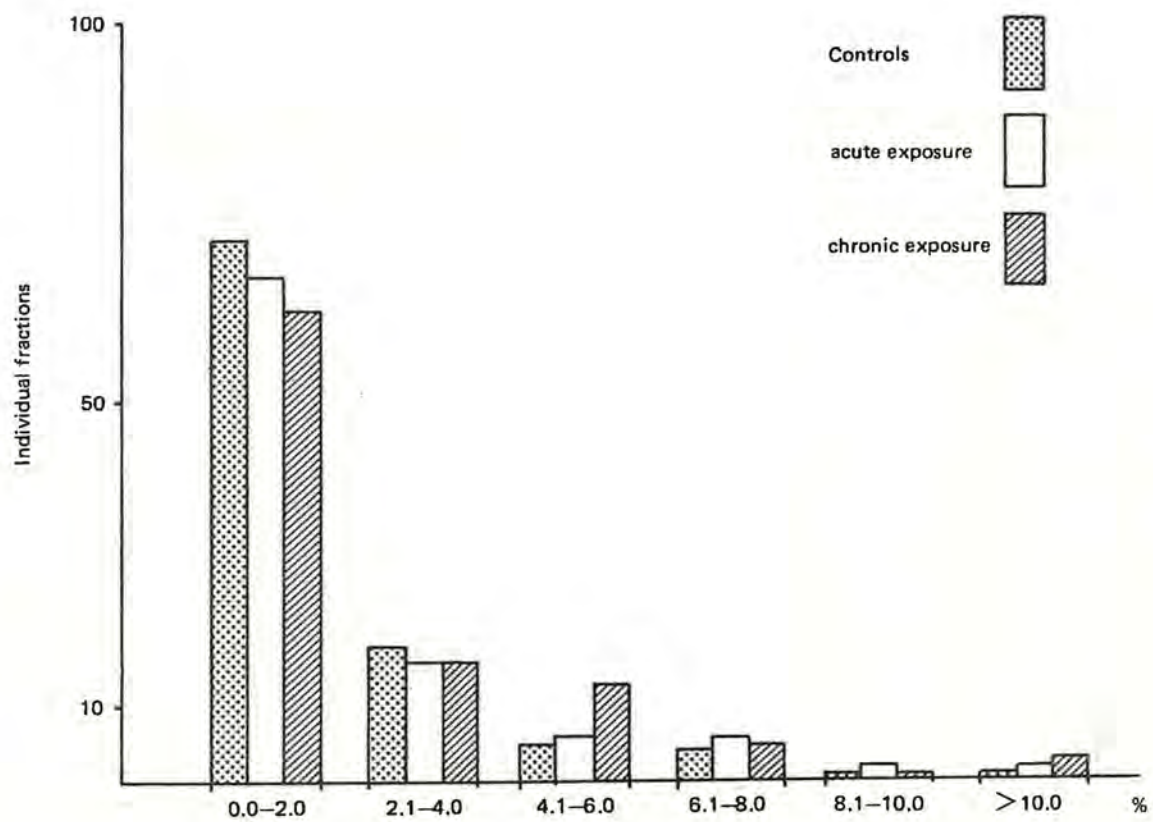


Fig. 2 Frequency of cells with chromosomal lesions

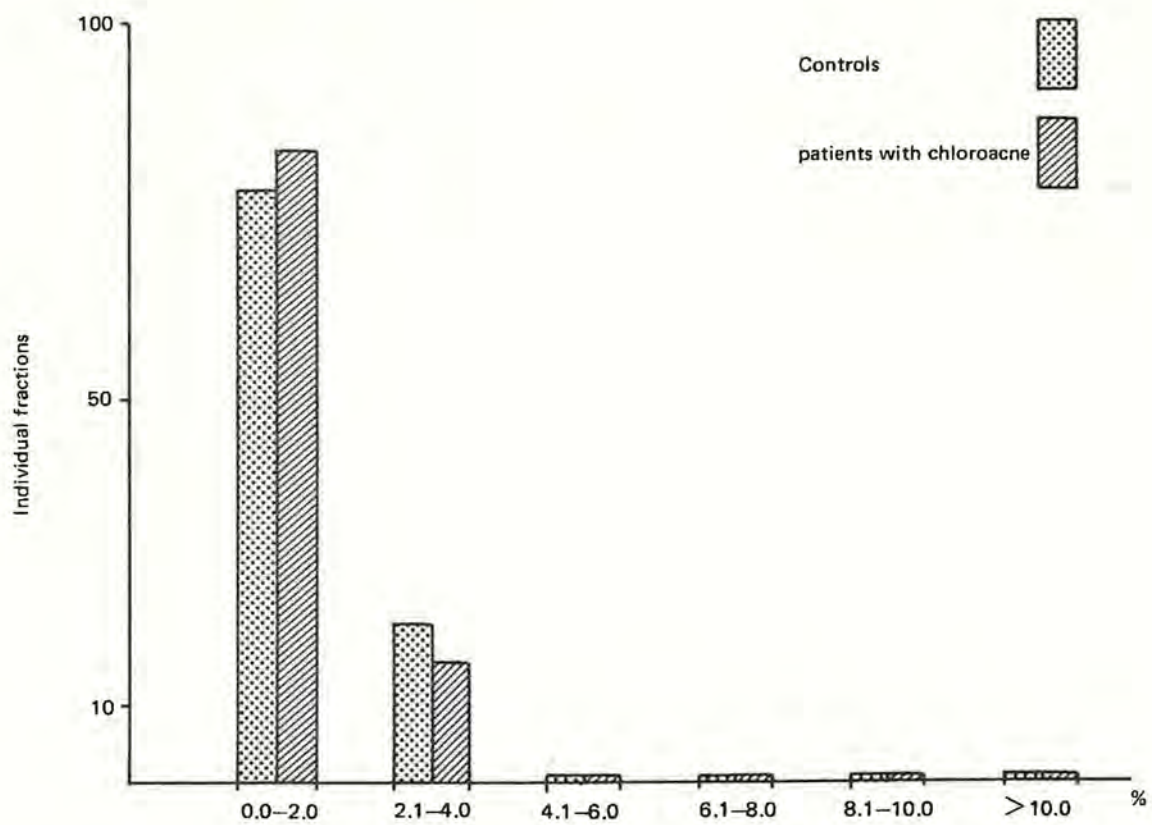
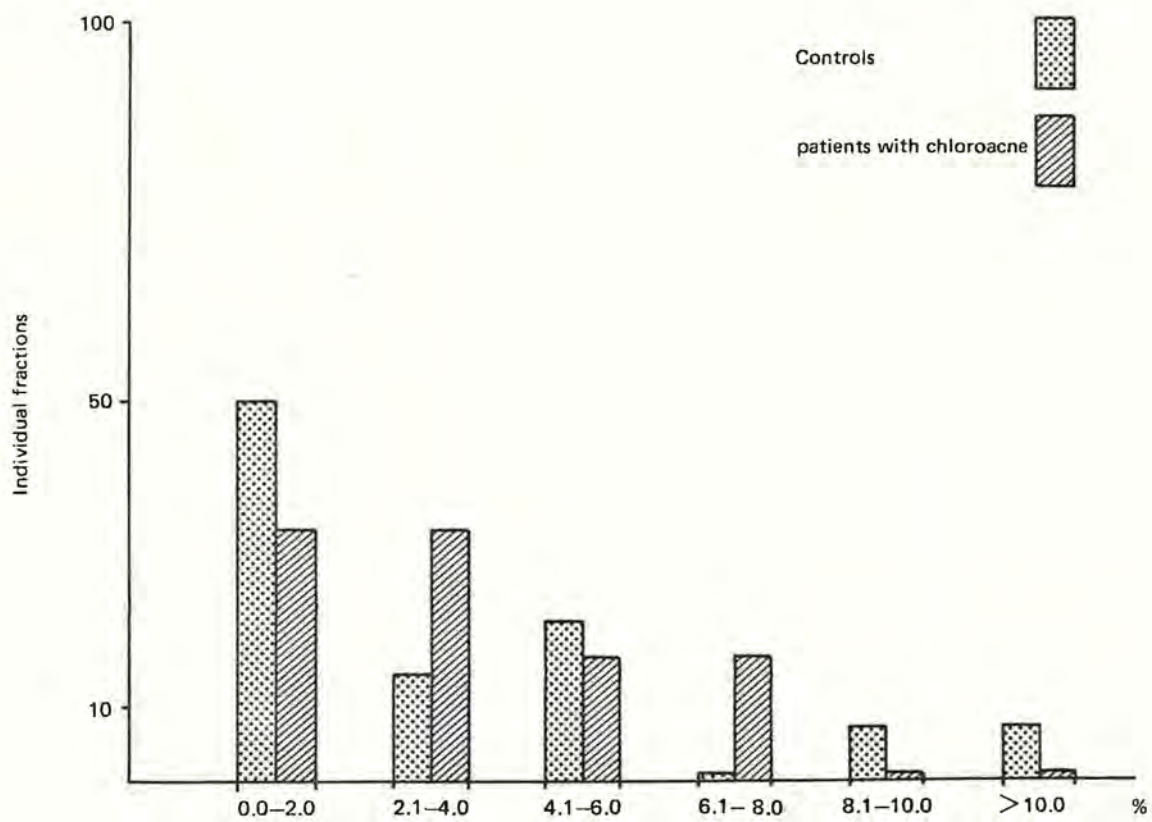


Fig. 3 Frequency of cells with chromosomal lesions

"As a general conclusion, the results of cytogenetic analyses up to now have not indicated in the sample examined a significant increase in the incidence of chromosomal lesions, involving a greater risk of the somatic type, which could be correlated with the occurrence of tumours in exposed subjects, or of the gamete type, which could be correlated with the occurrence of hereditary diseases in the progeny".

H. Immunological data

The Commission has examined the results of the periodical immunological investigations (carried out every four months from September 1976 to March 1978) on 45 children resident in zone A, within the age group from 3 to 7 years (including 21 positive cases of chloracne), and on 44 control children who had not been exposed to TCDD.

The following tests were carried out - generally in two different laboratories simultaneously:

- (1) serum immunoglobulin rate,
- (2) measurement of the total serum complement,
- (3) rosette E and rosette Zy^mC ,
- (4) phytohaemagglutinin response (PHA) and Pokeweed mitogen response (PWM),
- (5) MLC .

Statistical analysis of the results obtained at different times have not revealed any significant immunological difference between exposed and control children.

I. Course of infectious diseases

In similar fashion to malformations, the number of infectious diseases reported in 1977 showed a net increase over the previous year, rising from 433 to 1219.

This appears to contradict the result of the immunological research reported above and appears to be attributable mainly to a stricter compliance with the obligation to report infectious diseases. The reported increase does not in fact appear very great in relation to the diseases most frequently reported (e.g. viral hepatitis, salmonellosis, meningitis, scarlet fever and whooping cough); the increase affected to a lesser extent residents in the more highly contaminated zones; it did not affect poliomyelitis and diphtheria (which were the subject of general vaccination programmes); the reaction to antigen stimulation was normal.

The infectious disease rate in the zone under examination did not exceed overall the mean value for the Region of Lombardy.

More detailed analytical data are shown in Tables 11 and 12.

L. Tendency to abortion

The tendency to abortion has been analysed for the contaminated zone by the office of the provincial medical officer on the basis of reports submitted in accordance with Article 103 of the single text of the Health Act No. 1265 of 1934 (which has now been cancelled in respect of the obligation to render such reports). The following data were taken into account in connection with the 1973 - 1977 period:

- (a) women of child-bearing age,
- (b) pregnancies (derived from the total number of live births + stillbirths + spontaneous abortions + therapeutic abortions),

- (c) abortions per 1000 women in the child-bearing age,
- (d) abortions per 100 pregnancies.

These data have also been presented in relation to each commune in the area covered by the Brianza-Seveso health committee zone, the communes being combined on the basis of their location in the contaminated area: the communes of Cesano, Desio, Meda and Seveso were taken in one group, and the remaining seven communes in the other.

The results are shown in Table 13.

Table 11 Absolute values and morbidity rates, (per 10,000 inhabitants) of the principal diseases transmitted by oral and faecal means, in 11 Communes of health committee zones 1, 2 and 3 of Brianza di Seveso in the province of Milan, in the Commune of Brescia and in the Region of Lombardy during the years 1976 and 1977

Orally and faecally transmitted infectious diseases	Year	4 communes (1) pop: 103359		7 communes (2) pop: 115754		11 communes pop: 219113		Province of Milan		Commune of Brescia pop: 220000		Region of Lombardy	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Typhoid fever	1976	0	0.0	4	0.34	4	0.18	171	0.42	4	0.18	363	0.41
	1977	3	0.30	5	0.43	8	0.36	143	0.36	4	0.18	304	0.34
Paratyphoid fever	1976	7	0.67	4	0.34	11	0.50	553	1.37	1	0.04	823	0.93
	1977	8	0.77	10	0.86	18	0.82	295	0.73	1	0.04	406	0.43
Gastro-enteritis due to Salmonella	1976	11	1.06	13	1.12	24	1.09	616	1.52	79	3.59	1751	1.97
	1977	11	1.06	14	1.20	25	1.14	452	1.11	82	3.72	1577	1.77
Viral hepatitis	1976	32	3.09	32	2.76	64	2.92	1735	4.42	101	4.59	4179	4.72
	1977	35	3.38	61	5.26	96	4.38	1754	4.57	90	4.09	4108	4.62
Poliomyelitis	1976	0	0	0	0	0	0	0	0	0	0	0	0
	1977	0	0	0	0	0	0	0	0	0	0	0	0

(1): Cesano Maderno, Desio, Seveso, Meda

(2): Bovisio M., Lentate, Barlassina, Muggid, Nova M., Varedo, Serogno

Table 12 Absolute values and morbidity rates (per 10,000 inhabitants) of the principal diseases transmitted via the respiratory tract, in 11 Communes of health committee zones 1, 2 and 3 of Brianza di Seveso in the province of Milan, in the Commune of Brescia and in the Region of Lombardy during the years 1976 and 1977.

Infectious diseases transmitted via the respiratory tract	Year	4 communes (1) pop: 103359		7 communes (2) pop: 115754		11 communes pop: 219113		Province of Milan		Commune of Brescia pop: 220000		Region of Lombardy	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Diphtheria	1976	0	0	0	0	0	0	2	0.005	0	0	5	0.005
	1977	0	0	0	0	0	0	1	0.002	0	0	7	0.008
Scarlet fever	1976	41	3.9	4	0.34	45	2.05	2223	5.50	215	9.7	3788	4.28
	1977	39	3.7	11	0.95	50	2.28	2511	6.19	142	5.45	3359	3.77
Meningitis	1976	2	0.2	0	0	2	0.09	32	0.07	1	0.04	54	0.03
	1977	0	0	2	0.17	2	0.09	42	0.10	0	0	73	0.08
Whooping cough	1976	19	1.8	9	0.77	28	1.27	835	2.06	73	3.31	3097	3.49
	1977	7	0.67	15	1.29	22	1	397	0.97	27	1.22	1041	1.17

(1): Cesano Maderno, Desio, Seveso, Meda

(2): Bovisio M., Lentate, Barlassina, Muggio, Nova M., Vareda, Serogna

Commenting on these data, the office of the provincial medical officer has stated that the abortion/pregnancy ratio was high in 1977, with an increase of 20% over 1976; the relative variation is less apparent if the 1977 value is compared with the preceding years.

It is of interest to note that this phenomenon appeared in uniform fashion in the three groups of communes examined (communes 4, 7 and 11), with a homogeneous pattern in the years under examination.

It may also be pointed out that the number of therapeutic abortions reached a high level in 1976 (33, including 32 in the second quarter), falling to 12 in 1977; the four communes principally affected by the toxic cloud had the greatest increase in therapeutic abortions.

The Commission has noted that the abortion rate per number of women of child-bearing age, recorded in the different years under examination, was substantially homogeneous and in agreement with that recorded in Lombardy from 1970 to 1975, which varied between 9.01 and 11%.

Table 13 Statistical data relating to the predisposition to abortion in 11 Communes of the three health committee zones of Brianza di Seveso (1973 – 1977)

Communes	Women of child-bearing age, 14–45 years	1973							1974							1975							1976							1977						
		Pregnancies	Live births	Stillbirths	Therapeutic abortions	Spontaneous abortions	0- %	Pregnancies %	Pregnancies	Live births	Stillbirths	Therapeutic abortions	Spontaneous abortions	0- %	Pregnancies %	Pregnancies	Live births	Stillbirths	Therapeutic abortions	Spontaneous abortions	0- %	Pregnancies %	Pregnancies	Live births	Stillbirths	Therapeutic abortions	Spontaneous abortions	0- %	Pregnancies %	Pregnancies	Live births	Stillbirths	Therapeutic abortions	Spontaneous abortions	0- %	Pregnancies %
Cesano Maderno	7.550	704	636	5	0	63	8,02	8,94	617	547	2	1	67	8,53	10,85	571	517	4	0	50	6,36	8,75	546	488	0	8	50	6,36	9,15	408	362	4	5	37	4,71	9,06
Desio	7.599	658	554	2	0	102	13,42	15,50	588	509	0	0	79	10,39	13,43	629	541	3	0	85	11,18	13,51	586	528	3	3	52	6,84	8,87	488	415	1	1	71	9,34	14,54
Meda	4.353	335	316	1	0	21	4,79	6,21	358	336	1	0	21	4,79	5,86	333	314	0	0	19	4,33	5,70	333	297	0	6	30	6,84	9,00	310	280	2	1	27	6,16	8,70
Seveso	3.672	343	306	0	0	37	9,55	10,78	357	329	0	0	28	7,23	7,84	265	231	0	0	34	8,78	12,83	314	266	0	13	35	9,03	11,14	216	188	1	1	26	6,71	12,03
Totals	23.704	1.043	1.512	8	0	223	9,40	10,91	1.920	1.721	3	1	195	8,22	10,15	1.798	1.603	7	0	188	7,93	10,45	1.779	1.579	3	30	167	7,04	9,38	1.422	1.245	8	8	161	6,79	11,33
Barlassina	1.293	97	91	0	0	6	4,64	6,18	92	87	0	0	5	3,86	5,43	97	93	0	0	4	3,09	4,12	78	71	0	0	7	5,41	8,97	66	64	0	0	2	1,54	3,03
Bovisio M. go.	2.516	224	201	2	0	21	8,34	9,37	209	185	1	0	23	9,14	11,00	173	146	2	0	25	9,93	14,45	158	135	2	1	20	7,94	12,65	157	129	2	0	26	10,33	16,56
Lentate S/S.	2.872	219	215	0	0	4	1,39	1,82	216	212	0	0	4	1,39	1,85	213	209	0	0	4	1,39	1,87	185	185	0	0	3	1,04	1,59	188	177	0	0	11	3,83	5,85
Ruggio	4.521	393	317	0	1	45	9,95	11,45	379	327	0	0	52	11,50	13,72	375	338	0	0	37	8,18	9,86	292	255	0	0	37	8,18	12,67	292	248	0	2	42	9,28	14,38
Nova Milanese	4.323	373	322	1	0	50	11,56	13,40	400	339	1	0	60	13,87	15,00	367	325	0	1	43	9,94	11,72	360	303	2	0	55	12,72	15,27	340	293	2	2	43	9,94	12,64
Seregno	8.373	715	620	0	0	95	11,34	13,28	667	593	0	0	74	8,83	11,09	670	604	0	0	66	7,88	9,85	560	510	0	1	49	5,85	8,75	527	462	1	0	64	7,64	12,14
Varedo	2.808	195	174	1	0	20	7,12	10,25	210	190	1	0	19	6,76	9,04	230	195	0	0	25	8,90	11,36	186	171	1	1	13	4,62	6,98	174	156	0	0	18	6,41	10,31
Totals	26.706	2.216	1.970	4	1	241	9,02	10,87	2.173	1.933	3	0	237	8,87	10,90	2.115	1.908	2	1	204	7,63	9,64	1.822	1.630	5	3	184	6,88	10,09	1.747	1.529	5	4	206	7,71	11,79
Grand total	50.410	1.259	3.782	12	1	464	9,20	10,89	1.093	3.654	6	1	432	8,56	10,55	3.913	3.511	9	1	392	7,77	10,01	3.601	3.209	8	33	351	6,96	9,74	3.166	2.774	13	12	367	7,28	11,59

Notes

The date in the column "Women of child-bearing age" have been taken from the statistical data based on the 1971 census.

The date in the column "Pregnant women" constitute the sum of the figures in the "Live births", "Stillbirths", "Therapeutic abortions" and "Spontaneous abortions" columns.

The coordinator of obstetric and gynaecological activity, Professor Remotti, pursued a different approach to this problem. He attempted to arrange the data on the tendency to abortion in relation to the rate of contamination and to the chronology of pregnancies, broken down by individual quarters.

The results are shown in Table 14.

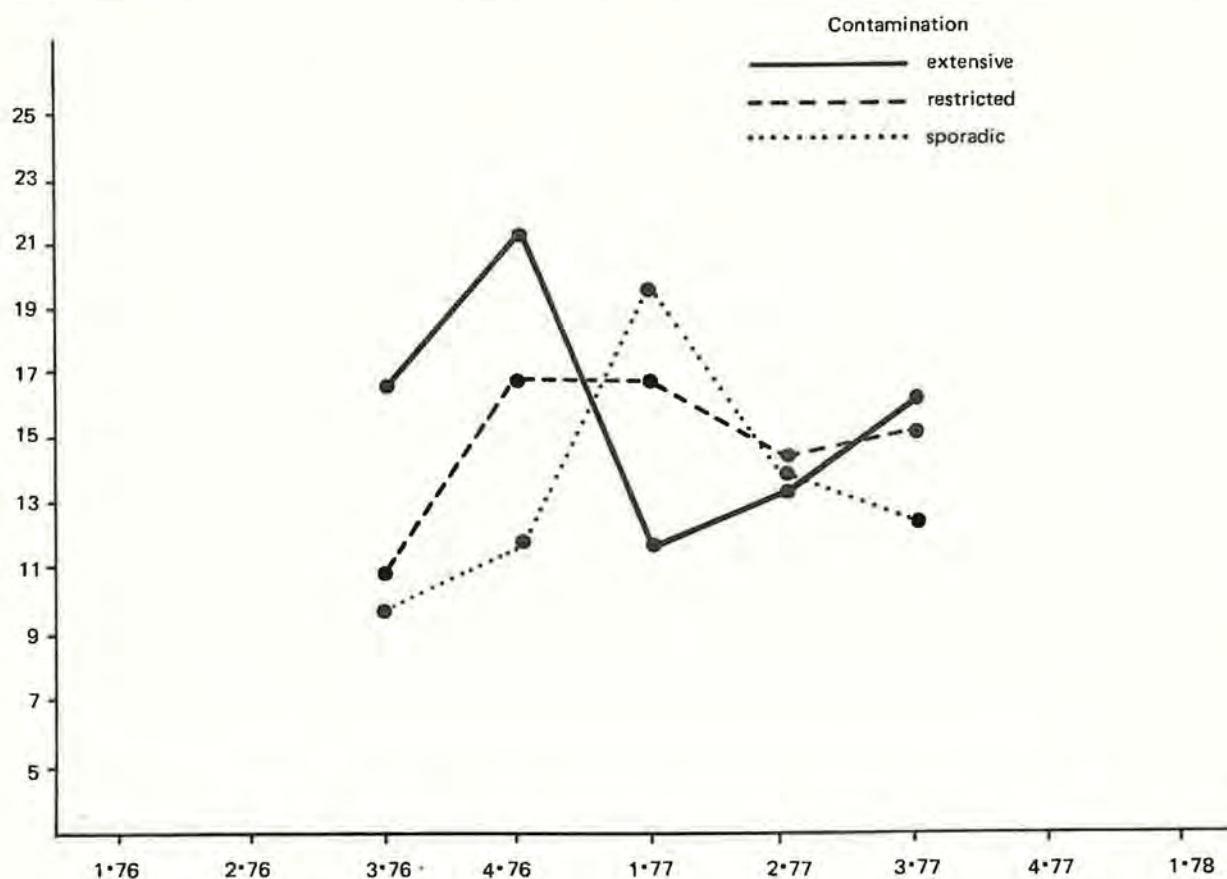
Table 14 Birth and abortion statistics in the 11 communes affected by TCDD contamination

Births = live births + stillbirths; Abortions = spontaneous abortions

The rate reported. . . has been calculated on the basis of pregnancies starting simultaneously with the abortions in question.

P (births) or A (abortions) Quarters	P 3/76	P 4/76	A 3/76	P 1/77	A 4/76	P 2/77	A 1/77	P 3/77	A 2/77	P 4/77	A 3/77	P 1/78	A 4/77	P 2/78	A 1/78	A 3/78
Cesano Maderno	119	95	15	88	21	76	14	103	10	95	17	91				
Seveso	56	70	12	49	9	35	7	57	11	43	9	46				
Extensive contamination pregnancy loss	175	165	27 16.5 %	137	30 21.3 %	111	21 11.6 %	160	21 13.2 %	138	26 16 %	137				
Desio	125	117	6	98	18	98	24	104	17	104	20	107				
Meda	74	69	12	84	8	63	9	66	10	60	7	63				
Nova Mil	68	74	14	87	21	73	15	71	13	77	16	72				
Restricted contamination pregnancy loss	267	260	32 10.6 %	269	47 16.7 %	234	48 16.6 %	241	40 14.2 %	241	43 15.1 %	242				
Barlassina	12	15	0	25	8	11	0	9	0	12	1	10				
Lentate	51	44	7	35	0	35	9	41	10	34	1	43				
Seregno	111	118	12	129	7	116	23	95	16	103	13	119				
Bovisio M.	29	36	5	38	5	28	9	36	7	29	2	33				
Varedo	43	38	4	44	4	31	10	36	6	43	7	36				
Muggio	57	49	8	65	13	62	17	64	7	61	12	51				
Sporadic contamination pregnancy loss	303	300	36 9.7%	336	37 11.6%	283	63 19.5%	281	46 13.8%	257	41 12.3%	292				

The numerical data are show in graph form in the figure below (p. 176 of original):



The data supplied by the obstetric-gynaecological coordinator have confirmed the higher abortion rate in the more contaminated zone at the end of 1976; an opposite picture was obtained in the zones of restricted and sporadic contamination in the first quarter of 1977, followed by a return to uniformity during the subsequent period.

It is clear that the above data do not permit a clear interpretation and further research is necessary. It should be noted in passing, that the cancellation of paragraph (b) of Article No. 103 of the single text of the Health Act, relating to the obligation to report spontaneous abortions, will prevent in the future the compilation of such tables as an analytical tool.

The Commission shares the view that hospital admission and discharge cards are a useful means for the future study of this aspect.

M. Pattern of the birthrate

The demographic curve shows a constantly decreasing birthrate percentage, falling from 17% to 12.6% during the period 1973 (?) to 1977 in the 11 communes in question.

This decrease is more clearly marked in 1977 (? illegible) and appears more evident in the four districts most closely affected by the contamination. This may be the result of psychological phenomena associated with the incident, the greater use of contraceptive devices or the recommendation to abstain from procreation. It does however suggest the need for research on the fertility of the affected population.

N. Mortality pattern

Examination of the mortality statistics reveals an overall increase in 1976 in the 11 urban districts in question. The mortality rose in fact from 1682 (7.74%) in 1975 to 1821 (8.32%) in 1976, returning to an equivalent level of 1667 (7.60%) in 1977.

These data, taken overall, do not appear however to be specific to the most highly contaminated zones.

The Commission paid particular attention to the data relating to Seveso which appeared at first glance alarming: 162 deaths in 1976 by comparison with 115 in 1975 and 131 in 1977.

A monthly breakdown was therefore made of the deaths occurring over the years from 1970 to 1977. The results are shown in the table below:

Deaths in the urban district of Seveso

Month	1970	1971	1972	1973	1974	1975	1976	1977
January	10	6	13	18	11	13	24	18
February	16	12	19	11	16	9	8	8
March	14	12	14	16	14	12	20	12
April	16	14	9	12	9	7	12	10
May	7	15	15	14	6	7	13	9
June	11	8	14	11	10	9	19	5
July	4	9	8	13	8	4	11	10
August	9	11	12	13	7	10	8	9
September	12	15	9	10	7	10	12	12
October	12	14	12	5	8	13	13	14
November	7	8	14	12	11	6	8	14
December	15	13	8	14	17	15	14	13
Total	133	137	147	149	124	115	162	134

Table 15 Birthrate and mortality statistics in the 11 communes of the three health committee zones of Brianza
– Seveso (during the five year period 1973 – 1977)

Communes	1973								1974								1975								1976								1977							
	Live births	Still-births	Children dying during the year	Total deaths	Residents 31/12	Q. nat. %	Q. mor. %		Live births	Still-births	Children dying during the year	Total deaths	Residents 31/12	Q. nat. %	Q. mor. %		Live births	Still-births	Children dying during the year	Total deaths	Residents 31/12	Q. nat. %	Q. mor. %		Live births	Still-births	Children dying during the year	Total deaths	Residents 31/12	Q. nat. %	Q. mor. %		Live births	Still-births	Children dying during the year	Total deaths	Residents 31/12	Q. nat. %	Q. mor. %	
Cesano Maderno	636	5	1	210	33,523	18,97	6,26		517	2	2	223	33,458	16,34	6,66		517	4	0	229	33,536	15,41	6,82		488	0	1	237	33,476	14,57	7,07		362	4	0	217	33,127	10,92	6,55	
Desio	554	2	11	280	31,655	17,50	8,81		509	0	7	265	32,400	15,70	8,18		541	3	8	289	32,830	16,47	8,80		528	3	2	298	33,011	25,99	9,02		415	1	4	254	33,030	12,56	7,68	
Meda	316	1	4	157	18,583	17,00	8,41		336	1	2	145	18,939	17,74	7,65		314	0	6	159	19,199	16,35	8,28		297	0	5	160	19,571	15,17	8,17		280	2	4	171	19,668	14,23	8,69	
Seveso	306	0	1	149	16,351	18,71	9,11		329	0	0	124	16,706	19,69	7,42		231	0	0	115	16,927	13,64	6,79		266	0	0	162	16,978	15,66	9,54		188	1	1	131	16,958	11,08	7,72	
Totals	1,812	8	17	796	100,112	18,09	7,95		1,721	3	11	757	101,503	16,95	7,45		1,603	7	14	792	102,492	15,64	7,72		1,579	3	8	857	103,036	15,31	8,31		1,245	8	9	773	102,783	12,11	7,52	
Barlassina	91	0	1	38	5,436	16,74	6,99		87	0	2	18	5,526	15,74	10,49		93	0	0	43	5,600	16,00	7,67		71	0	2	42	5,659	12,54	7,42		64	0	1	40	5,635	11,35	7,09	
Bovisio M. go.	201	2	0	91	11,116	18,08	8,18		185	1	5	86	11,208	16,50	7,67		146	2	1	93	11,161	13,08	8,33		135	2	3	99	11,185	12,06	8,85		129	2	1	97	11,170	11,54	8,68	
Lentate S/S	215	0	0	125	12,631	17,02	9,89		212	0	0	99	12,832	16,52	7,71		209	0	0	121	13,015	16,05	9,29		185	0	0	136	13,037	14,19	10,43		177	0	1	123	13,128	13,48	9,36	
Ruggio	317	0	2	127	18,230	19,03	6,96		327	0	0	119	18,302	17,86	6,50		338	0	0	106	18,545	18,22	5,71		255	0	1	129	18,690	13,64	6,90		248	0	0	122	18,827	13,17	6,48	
Nova Milanese	322	1	4	109	17,121	18,80	6,36		339	1	3	103	17,610	19,25	5,84		323	0	4	124	18,038	17,90	6,87		303	2	5	123	18,467	16,40	6,66		293	2	2	109	18,845	15,54	5,78	
Seregno	620	0	5	315	36,041	17,20	8,74		503	0	4	333	36,403	16,28	9,14		604	0	3	313	36,660	16,47	8,53		510	0	3	346	36,838	13,84	9,39		462	1	1	314	36,891	12,52	8,51	
Varedo	174	1	3	77	11,382	15,28	6,76		190	1	1	97	11,524	16,48	8,41		195	0	2	90	11,687	16,68	7,70		171	1	1	89	11,841	14,44	7,51		156	0	0	89	12,003	12,99	7,41	
Totals	1,970	4	15	882	111,957	17,59	7,87		1,933	3	15	895	113,403	17,04	7,89		1,908	2	10	890	114,706	16,63	7,75		1,630	5	15	964	115,717	14,08	8,33		1,529	5	6	894	116,502	13,12	7,67	
Grand total	3,782	12	32	1,678	212,069	17,83	7,91		3,654	6	26	1,632	214,906	17,00	7,63		3,511	9	24	1,682	217,198	16,16	7,74		3,209	8	23	1,821	218,753	14,66	8,32		2,774	13	15	1,667	219,235	12,65	7,60	

Notas

1. The data in the present table are based on the models in I.S.T.A.T. D/7/A – B.

2. The data in the column "Q. nat. %" are based on the following formula: $Q. nat. \% = \frac{\text{live births}}{\text{residents as at 31. 12}} \times 1000$

3. The data in the column "Q. mor. %" are based on the formula: $Q. mor. \% = \frac{\text{Total deaths}}{\text{residents as at 31. 12}} \times 1000$

It therefore appears that the increased mortality in Seveso during 1976 occurred largely during the first quarter and in consequence before the incident on 10 July 1976.

Nevertheless, on the basis of the overall mortality data (which have been summarized in Tables 16 and 17), the Commission has suggested to the competent authorities - in the context of research on problems of even greater complexity - to undertake a more detailed examination of the postmortem data.

Table 16 Number of deaths and mortality indices, broken down by zones, in the urban districts of Seveso and Cesano Maderno

Zone	Seveso				Cesano Maderno			
	1976		1977		1976		1977	
	No.	% ^(a)	No.	%	No.	%	No.	%
A	3	8.99	5	7.49				
B	2	6.36	6	9.55	14	5.11	18	6.57
Third belt (zone R)	30	7.55	67	8.43	86	5.73	91	6.07
F.Z. (free zone?)	33	8.52	58	7.49	122	7.59	105	6.53
TOTAL	103	6.06	136	8.01	222	6.56	214	6.33

(a) Annual rate estimated on the number of deaths in the first quarter of 1976.

Table 17 Number of deaths and mortality indices in the 11 urban districts of the health committee zones Brianza-Seveso 1-2-3 during the years 1973-1977

	1973		1974		1975		1976		1977	
	No.	%	No.	%	No.	%	No.	%	No.	%
Cesano Maderno	210	6.26	223	6.66	229	6.82	237	7.07	217	6.55
Desio	280	8.84	255	8.18	289	8.80	298	9.02	254	7.68
Meda	157	8.44	145	7.65	159	8.28	160	8.17	171	8.59
Seveso	149	9.11	124	7.42	115	6.79	162	9.54	131	7.72
Total	796	7.95	757	7.45	792	7.72	857	8.31	773	7.52
Barlassina	38	6.99	58	10.49	43	7.67	42	7.42	40	7.09
Bovisio M.	91	8.18	86	7.67	93	8.33	99	8.85	97	8.69
Lentate	125	9.89	99	7.71	121	9.29	136	10.43	123	9.38
Muggio	127	6.96	119	5.50	105	5.71	129	6.90	122	6.48
Nova M.	109	6.36	102	5.84	124	6.87	123	6.66	109	5.78
Seregno	315	8.71	333	9.4	313	8.53	346	9.39	314	8.51
Varedo	77	6.76	97	8.41	90	7.70	89	7.51	89	7.41
Total	832	7.87	895	7.89	890	7.75	964	8.33	894	7.67
Grand Total	1678	7.91	1652	7.68	1682	7.74	1821	8.32	1667	7.60
Milano Prov.	—	—	33505	8.29	33088	8.59	34450	8.53	—	—
Lombradia	—	—	84288	9.50	87383	9.85	88283	9.95	—	—

Section III

Effects of the contamination on the ground, waters, fauna and flora

1. Extent of the contaminated zone

The toxic cloud, which escaped from the ICMESSA reactor, contained trichlorophenol, sodium chloride, sodium hydride, ethylene glycol, xylene, tetrachloro-dibenzo-para-dioxin and presumably also other unidentified chlorides. These compounds dispersed in the atmosphere and then fell to the ground over an area of 6-7 km from the site of emission, depending on the direction of the wind which, immediately after the disaster and for a certain period thereafter, was blowing in a constant south-south-westerly direction. The dynamic aspect of the phenomenon determined therefore the location of the sediment, which was mainly along the direction of the wind, with a minor spreading into the belts on either side of the principal axis of propagation.

The area affected by the consequences of the incident amounted to 1807 hectares. This area has been classified in relation to the degree of contamination into:

- Zone A covering an area of 108 hectares (mean value of TCDD contamination: $240 \mu\text{g}/\text{m}^2$; non-evaluable variation: $5.477 \mu\text{g}/\text{m}^2$);
- Zone B covering an area of 269.4 hectares (mean value of TCDD contamination: $3 \mu\text{g}/\text{m}^2$; non-evaluable variation: $43 \mu\text{g}/\text{m}^2$);
- Zone R (third belt), covering an area of 1430 hectares (uncontaminated or contaminated at levels less than $5 \mu\text{g}/\text{m}^2$).

The plan of the contamination was drawn up by the Special Technical-Scientific Commission of the Ministry of Health at its session of 10 August 1976 and finally approved by the Regional Council of Lombardy, on 7 October 1976.

These zones include the territory of the six urban districts shown in Table 18.

The charting by zones and subzones, was based on determinations carried out during December 1976, which showed TCDD concentrations as set out in Table 19.

Table 18 Areas of zones A, B and R

Commune	Zone A	Zone B	Zone R	
Barlassina	—	—	10 hectares	
Meda	16	0.4	153	"
Seveso	92	42	275	"
Cesano M.	—	117	477	"
Desio	—	110	429	"
Boviso M.	—	—	86	"
Total	108	269.4	1430	"

Table 19 TCDD concentrations in zones A and B

Zone	mean value $\mu\text{g}/\text{m}^2$	maximum value $\mu\text{g}/\text{m}^2$	minimum value $\mu\text{g}/\text{m}^2$
Zone A1	580.4	5477	n.v.d
Zone A2	521.1	1700	6.1
Zone A3 (north)	453.0	2015	1.7
Zone A3 (south)	93.0	441	n.v.d
Zone A4	139.9	902	n.v.d
Zone A5	62.8	427	n.v.d
Zone A6	29.9	270	n.v.d
Zone A7	15.5	91.7	n.v.d
Zone B	3	43.8	n.v.d

n.v.d. = no value determined

Minor phenomena, indicating the presence of TCDD were detected outside the limits determined in this way, but the levels were extremely low. The area affected by contamination is shown on the plan

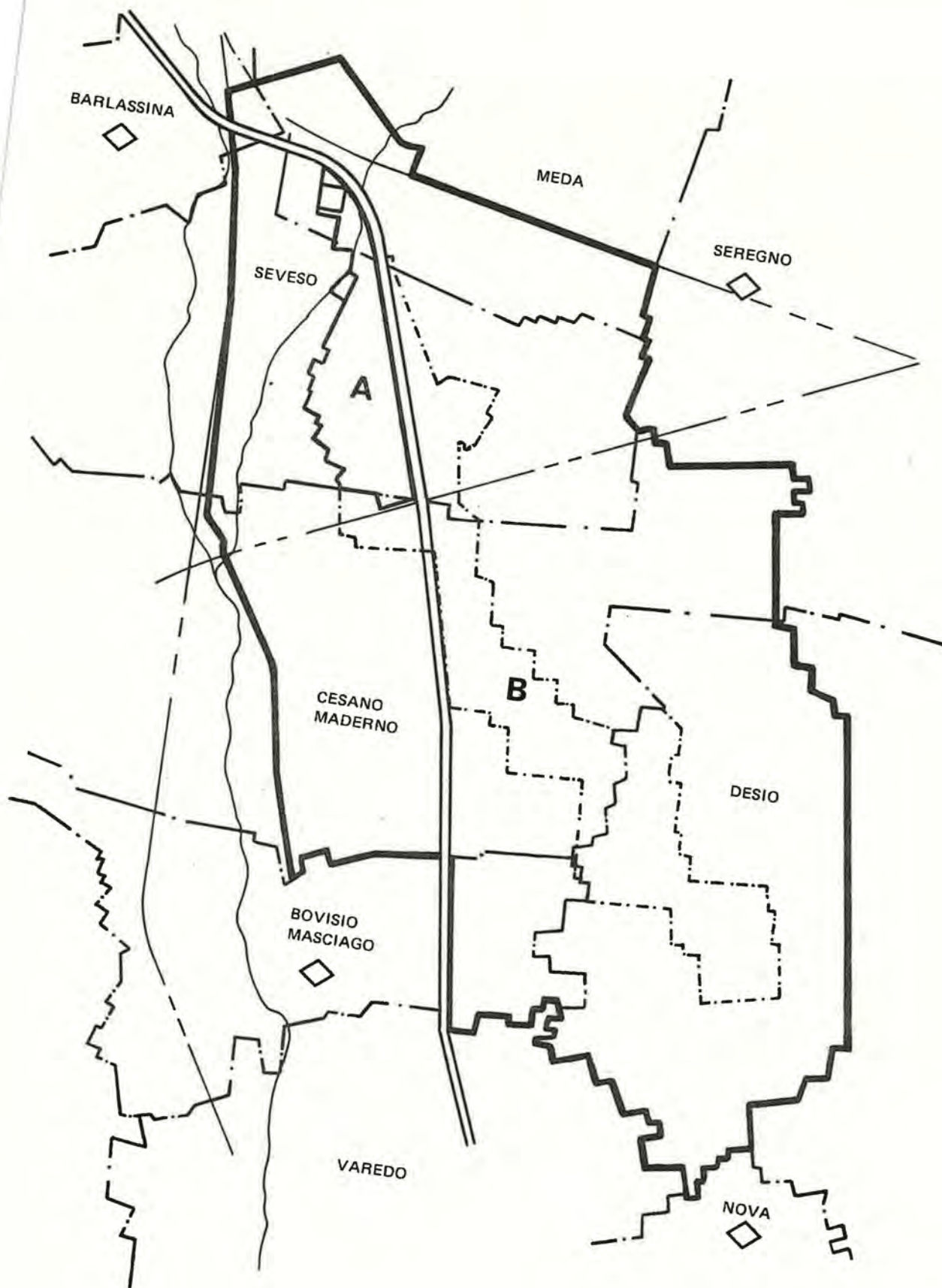


Diagram of zones A and B and the belt of minor concern

Lozenge symbols = communes outside the contamination diagram with positive findings in the drainage networks.

2. Penetration, stability and persistence of TCDD on the ground

The degree of penetration of TCDD into the ground is obviously a factor of great relevance for purposes of evaluation of the nature of the contamination. This problem has been the subject of experimental research, undertaken, since November 1976, by the Higher Institute of Health and the Provincial Hygiene and Prophylaxis Laboratory of Milan. Research of this nature was carried on throughout 1977.

The Higher Institute of Health arranged in particular during April 1977 for trenches to be dug in different positions and drillings made, so as to obtain soil samples 4 cm in thickness and up to 40 - 50 cm in depth. The provincial hygiene and prophylaxis laboratory carried out during the months of July and November 1977, in five trenches, drillings of up to 1.5 m in depth, from which samples were taken 4 cm in thickness.

The Higher Institute of Health found five soils with surface concentrations of TCDD within the range from 2.5 to $246 \mu\text{g}/\text{m}^2$, four of which were less than $52 \mu\text{g}/\text{m}^2$; the provincial hygiene and prophylaxis laboratory found soils with higher concentrations (between 921 and $1803 \mu\text{g}/\text{m}^2$).

The results obtained so far have shown that the TCDD concentration falls rapidly from the surface layers on an exponential basis. It has been found in particular that on average about 90% of the TCDD is contained in the first 20 cm, with a rapidly decreasing concentration at greater depths, as shown in Table 20.

It may be deduced from the overall results, obtained at different times by the Higher Institute of Health and the provincial hygiene and prophylaxis laboratory, that the penetration of TCDD into the ground occurs very slowly. The fall during the course of a year in the critical layer (the section containing 50% of the total TCDD) was in fact extremely low.

Table 20 TCDD values as a percentage of the total found, for each 4 cm layer of soil from 0 to 20cm in depth

Sample	ug/m ² totals	Depth in cm					
		0 – 4	4 – 8	8 – 12	12 – 16	16 – 20	0 – 20
1	2	3	4	5	6	7	8
Higher Institute of Health 1	246.0	37.1	22.7	15.1	1.8	1.6	93.3
Higher Institute of Health 2	51.2	61.8	5.9	2.2	0.4	2.7	73.0
Higher Institute of Health 3	2.7	84.8	8.1	7.1	N.V.	N.V.	100.0
Higher Institute of Health 4	23.8	97.4	2.6	N.V.	N.V.	N.V.	100.0
Higher Institute of Health 5	5.5	81.6	8.3	9.6	N.V.	N.V.	100.0
Mean value		72.54	9.62	6.8	3.44	0.85	93.26
Provincial Hygiene and Prophylaxis Laboratory A ₁	1803	97.4	0.5	0.0	0.5	0.4	98.8
A ₂	1632	7.6	30.8	10.7	0.3	0.2	99.6
B ₁	1736	55.5	23.1	2.7	3.8	3.0	88.1
B ₃	931	24.4	1.1	0.9	0.5	1.6	28.6
C ₁	1686	75.1	9.6	5.3	1.2	1.5	92.7
D ₁	976	44.7	26.2	14.2	14.9	0.0	100.0
E ₁	1491	28.9	61.7	4.5	0.9	1.3	97.3
Mean value		47.65	29.0	5.47	3.16	1.14	86.40
Mean value excluding B ₃		51.53	33.65	6.23	3.66	1.05	36.06
Overall mean value (excluding B ₃)		60.10	19.51	6.13	3.30	1.00	90.00
		62.03	21.63	6.45	3.52	0.95	94.66

In order to determine the presence of TCDD in atmospheric dusts liable to sedimentation, the Higher Institute of Health set up over the area a network of deposition meters and were able to demonstrate the absence of any ambient diffusion of TCDD.

The decisive factor for a correct prediction of the pattern of contamination as a function of time is clearly the determination of TCDD persistence in the soil. It is known from the scientific literature that the level of TCDD, dispersed in the soil, tends to decrease as a result of natural

causes by 50% in about twelve months. Over 500 analyses carried out in the contaminated zone have confirmed the tendency for the TCDD concentration to fall as a function of time as a result of natural factors. This process has however occurred more slowly in the contaminated zone than has been described in the literature, and half-lives of the order of 2-3 years have been found. The Higher Institute of Health have found in fact a reduction of 25% in 480 days in laboratory samples from a number of soils in the zone.

Twelve points of high contamination in zone B have been rechecked with 60 analyses. By comparison with the analyses carried out at the end of 1976, the TCDD concentration was lower at twelve points, identical at one point and 20% higher at the final point. Taken overall, the concentration was 60% of that recorded in 1976. This difference may be due to degradation of the TCDD, diffusion and penetration into the soil and uncertainty factors in the analyses.

3. Analysis of river waters

The river Certesa flows through the zone in question, passing at a distance of about 50 m from shop B of the ICMESA establishment. It then passes through subzones A1 and A2 in a north-south direction for about 600 m and flows into Seveso at a distance of about 2.5 km from the establishment.

Sedimentation on to the river-bed of the Certesa, which is located over an area of about 9000 m² in the contaminated zone, was similar during the period immediately following the incident to the sedimentation on the neighbouring ground, the toxic compounds - in particular TCDD - being released from the atmosphere after the disaster. The Certesa receives in addition precipitation waters from the area of the ICMESA establishment, collected in a drainage system covering the 7 buildings located in zone A1 to the west of the river and to the south of shop B. The abundant rain on 22 and 31 July 1976 certainly caused a further inflow of TCDD into the Certesa.

In this connection the Special Office for Seveso stated in its report to the Commission: "In view of the locations of the confluent sectors of the Certesa and the contribution from the drainage of precipitation waters. . . . it is highly probable that more than 20 g TCDD overall flowed into the Certesa".

The collector main from the Varedo purification plant, which discharges its waters into the Seveso, will undoubtedly have contained TCDD, to which has to be added the contributions from the sewers serving the districts of Meda, Seveso, Cesano Maderno and Bovisio Masciago. The state of contamination of the river waters has been repeatedly checked since July 1976 by the water section of the office of the regional adviser on ecology for Lombardy, making use of the services of the provincial hygiene and prophylaxis laboratory and the ENEL central laboratory at Piacenza. Such control checks were repeated whenever extensive atmospheric precipitations occurred.

The Special Office for Seveso has reported to the Commission on these investigations in the following terms: "All the analyses on clear waters have yielded a negative result. During high-water, however, traces of TCDD have been found in the solid suspensions from river waters, separated by filtration (although analysis of the clear water yielded a negative result).

"Traces of TCDD, in low percentages of the samples examined, have been found in the sediments from the Certesa and the Seveso. The positive results relate however to contents of the order of a few parts per 3000 million. Concentrations of this order of magnitude have been restricted to a few samples, obtained from sludge collected from discharges from the Varedo plant. Successive control checks of sludges taken from the same plant have yielded a negative result, thus confirming the transport of these very small quantities with the precipitation waters and their exhaustion immediately after the first rain.

"Sediments from the Seveso, collected to the north of Milan, continue to yield positive results of the same order of magnitude, as was only to be expected.

"All the control checks carried out to the south of Milan have yielded negative results. In the hydrological network to the south of Milan, analyses in the river Po, carried out by the ENEL laboratory immediately after the incident, never revealed any positive values".

These results may be interpreted to mean that the TCDD, falling or flowing into the Certesa and transmitted from there into the Seveso, was carried along the bed of the river by the water during the period immediately following the incident of 10 July 1976. However, since the TCDD (which is very sparingly soluble in water) is on the other hand adsorbed by mud and sludge, it is probable that a finite proportion will have been incorporated in the river sediment, and, in company with the latter, carried slowly along the river-bed.

This necessitates a constant control of the situation, to prevent any danger due to the use of unfiltered waters for irrigation purposes.

4. Analysis of ground waters

Chemical analyses, carried out between 3 August 1976 and May 1978 with ultra-sensitive methods (1 pg/l), have yielded constantly negative results in 135 samples taken from springs in the checked aquifers.

The Special Office for Seveso has also pointed out that in the affected zone the surface water system does not appear to communicate with the underlying layers, supplied from springs in the aquifer. Periodical checks should nevertheless be carried out, in the view of the Commission, since the possibility cannot be excluded altogether of the migration of TCDD to deeper layers, via springs, caves etc.

5. Animal husbandry

The present paragraph deals predominantly with the types of animals in the affected zone. No precise data are in fact available in regard either to pets or to wild animals. The Commission is aware that this absence of information prevents any adequate conclusions being drawn on the damage to the ambient fauna.

According to information supplied by the regional veterinary office, the following rearing animals were present in zones A, B and R at the time of the incident:

poultry	80430	pigs	233
cattle	349	sheep	21
horses	49	goats	49

According to data supplied by the Special Office for Seveso, the following animals were living on 2 May 1978:

poultry	71	horses	19
sheep/goats	3	cattle	68
pigs	0		

These data, in spite of their probably approximate nature, bear witness to the complete disappearance of more than 80,000 rearing animals (95% of which consisted of poultry) and the almost total loss of rearing animals in the contaminated area. This was due to an only slight extent to the direct effects of the emission of TCDD, but is nevertheless a consequence, albeit indirect, of the contamination. The competent authorities in fact ordered on grounds of hygiene/health, the slaughtering of rearing animals in the contaminated zone, with the only exception of those required for toxicological and veterinary research and economic evaluation.

An Order issued by the mayors in August 1976 required, in particular, the slaughtering of all rearing animals and poultry in zones A, B and R and medium and large-sized animals in zones A and B, including pets.

In December 1976 an estimate was required of medium and large sized animals in the third belt, which were then subsequently slaughtered.

6. Findings relating to the fauna during the days immediately following the incident

During the period between the date of the disaster and the date when the escape of TCDD became known, various centres of animal mortality and animal infection were recorded. Since the rearing animals in the zone - largely kept on a domestic basis and farmyard animals - were fairly widely spread, this phenomenon provides a valuable biological indicator on the extent of the contamination.

Pathological effects on animals affected mainly rabbits, to a lesser extent other farmyard animals (chickens, geese, ducks) and extending to wild animals such as birds, rats etc. Dogs and cats suffered mainly from painful lesions on the paws, with a consequent difficulty over walking and a measure of unruliness. No deaths were recorded among cattle and pigs.

The Commission has received from the regional veterinary service summary reports on postmortem examinations, carried out on a number of animals which died in the contaminated zones or the zones adjacent to them, during the weeks following the incident. This material is extremely various, relating to different animal species and includes very few measurements of TCDD. On 10 August 1976, the veterinary service sent to the "M. Negri" pharmacological research institute for examination, the livers of 17 rabbits, which had died at Cesano Maderno, Seveso, Desio and Bovisio Masciago. In 16 of these high TCDD contents were found as shown in Table 21.

Table 21 TCDD concentrations in the livers of rabbits

Rabbit	Origin	ng TCDD per g liver
2	Cesano M. via F. Sforza 3	52
3	Seveso via Rosmini 3	n.v.
7	Cesano M. via Stromboli 9	54
8	Cesano M. via Fieramosca 16	460
9	Cesano M. via Orsini 8	32
11	Desio via Dei Boschi 14	65
12	Cesano M. via G. da Buglione 1	223
13	Cesano M. via Fieramosca 16	361
14	Cesano M. via Resinelli 11	25
15	Cesano M. via Valsugana 11	7
16	Cesano M. via F. Sforza 3	112
17	Seveso via V. Monti 4	52
18	Bovisio M. via XX Settembre 20/24	14
21	Cesano M. via F. Fieramosca	167
24	Cesano M. via Serraglio 23	73
27	Cesano M. via A. Doria 3	24
31	Desio via Dei Boschi 44	10

The overall postmortem data, submitted to the Commission and relating to an enormous quantity of animal material (Table 22) are not easy to interpret in view of the extremely summary nature of the report, the absence of uniformity of terminology, the fact that they relate to individuals from many different animal species and from different origins, and the fact that the contamination probably varied very considerably. Subject to these reservations, a recurrent feature would appear to be necrotic-degenerative lesions of the liver, endothoracic lesions of an oedematous-exudative type, and lesions of the renal parenchyma. These results were broadly confirmed by the histopathological findings.

Table 22 Data relating to animal material undergoing postmortem examination

Commune	Poultry	Sheep	Birds	Dogs/cats	Other wild animals	Fish	Examination performed between	No. of cases of detection of TCDD
Barlassina	17	—	1	—	—	—	28.7.76/23.9.76	—
Bovisio Masciago	49	—	5	—	—	—	28.7.76/ 8.9.76	—
Cormano	2	—	—	1	—	—	30.7.76/13.8.76	—
Cesano Maderno	613	5	46	2	1	11	22.7.76/29.9.76	6
Desio	182	—	13	—	2	—	27.7.76/27.9.76	13
Lentate sul Seveso	4	—	2	1	—	—	28.7.76/24.9.76	—
Lissone	6	—	11	—	—	—	30.7.76/ 7.9.76	—
Nova Milanese	11	2	—	—	2	—	28.7.76/30.9.76	4
Meda	124	—	4	—	2	1	27.7.76/27.9.76	5
Paderno Dugnano	18	—	8	3	—	—	27.7.76/ 9.9.76	—
Seregno	33	—	8	1	—	—	27.7.76/14.9.76	—
Seveso	854	5	13	1	1	—	27.7.76/29.9.76	34
Vareto	13	—	—	1	—	—	28.7.76/27.8.76	—
Vari	29	—	50	1	5	—	27.7.76/28.9.76	1
Total	1,945	12	161	11	13	12		63

7. Further findings

Toxicological and genetic research on animals remaining in zone A up to 6 August, 1976, was included in the regional programme. Further research is being carried out on behalf of the judicial authorities. The documentation received so far does not permit any unequivocal interpretation.

The report of the veterinary service of the Region of Lombardy, sent to the Special Office for Seveso on 14 February 1978, shows that 488 animals of different species were sent to the Brescia institute of zooprophyllaxis, an equivalent number of animals being kept in zone A. Controls were provided by local animals and animals from other areas, which were located in zone R.

The above report states that, "apart from zones A and B, the animal pathological picture exhibited a normal pattern", but states elsewhere that control checks on rabbits frequently revealed TCDD accumulations in the liver, that some animals had died as a result of the contamination, and that others, which had been slaughtered, had exhibited significant concentrations of TCDD in the liver in spite of an apparent state of good health.

The Commission has also heard the evidence of Professor Corsico, head of the department of veterinary anatomy/pathology, who carried out during the months of June and July 1977, on behalf of the judicial authorities, postmortem examinations on 16 cattle, 11 pigs, 3 sheep and 8 animals which had died spontaneously (including 3 bovine foetuses aborted in the stable at the Seminary in Seveso, during March, May and June 1977).

The veterinary officer stated that macroscopic examination revealed no abnormal findings, apart from a defect in the cervical vertebrae of one bovine foetus; examination for the presence of TCDD in the tissues yielded a negative result.

Histological and chemical/toxicological tests on the postmortem material has proceeded slowly due to technical and administrative difficulties, and no evaluation can be expected in the near future.

One significant finding in the field of bovine physiopathology has emerged from the experimental farm of the archiepiscopal Seminary at Seveso. The animals from this farm, which probably consumed contaminated forage after the incident, exhibited symptoms of a general nature (emaciation, asthenia), accompanied by cutaneous hyperkeratosis. Professor Corsico was able to confirm to the Commission, however, that these animals are now in good health.

The head of the provincial veterinary service made the following specific report in relation to this experimental establishment:

"The present animal stock is 19 cows, 10 heifers, 4 bullocks, 10 bulls, 7 calves. After the pathological symptoms exhibited in the past, affecting to a fairly pronounced extent

the nutritional state, the cattle at the Seminary are today - and have been for some time - in an excellent nutritional condition. Clinical examination has revealed no signs of disease. According to their recent veterinary history, none of these animals have exhibited clinical symptoms of disease and all are in an optimal general condition. The results of allergic and tuberculin tests have been negative and foot-and-mouth disease vaccinations have been carried out. The most reassuring aspect is the state of health in the genital sphere. The fertility index is in fact normal: the cattle have come on heat regularly and been regularly covered. Seven calves (5 female and 2 male) have been born from the end of October up to today, all with normal births and in an excellent state of health".

8. Effects of the contamination on the flora

As stated above, the first fear that the substances contained in the toxic cloud could be harmful was aroused in the inhabitants of Meda and in the local authority as a result of the fact that the leaves of some plants (in particular acacia) close to the ICMESA establishment (and up to a distance of a few hundred metres away) first of all turned yellow, then withered and fell.

The caustic effect was not due to the dioxin, however, but to other chlorinated compounds contained in the toxic tube (statement by Bellini, XXIX/2), since it is known that dioxin produces no such effect on leaves and grass.

The mayors of Meda and Seveso, although initially unaware, as has been stated, of the presence of dioxin in the deposited substances, took very timely measures to prohibit the consumption of fruit, vegetables, milk, meat and eggs.

Once clear information was obtained on the deposition of dioxin, immediate research and experiments were carried out to establish the ratio between the TCDD content in the vegetation and in the soil. To this end, the Region of Lombardy requested the institute of agrarian chemistry and the institute of agronomy of the University of Milan, to undertake the necessary research and experiments and draw up the necessary agreements with these institutes.

Although it is not yet possible to draw definite conclusions from the experiments, which are still in progress, and furthermore, the research workers themselves have maintained a cautious reserve on the validity of the data obtained and on the possibility of drawing conclusions of definite scientific value, attention may nevertheless be drawn to some of the elements which have emerged: it has been proved, for example, that TCDD is always absorbed by plants and probably entrained in the systems developed for the transport of water; it is also clear that TCDD has not been found in plant life at a distance from the contaminated area. There may be many reasons for this; it is possible to assume a system of elimination by natural ultra-violet rays in the plant leaves, dispersion in the transpiration flow in the leaves or metabolism of the compounds.

It may be emphasized here that according to the findings of the institute of agrarian chemistry of the University of Milan, all plants taken from contaminated fields contained appreciable quantities of TCDD. The concentration in the plants, expressed in $\mu\text{g}/\text{kg}$ - varied from a minimum of 1/20 of the mean TCDD content in the surface layer of the soil (to a thickness of 15 cm) up to values equivalent to those found in the soil.

Leaves and newly formed fruit, young branches and sap from the trunk, have been taken from long-trunked trees (figs, apricots, pears, peaches, cherries and vines) and from horticultural and ornamental plants. The leaves were more highly contaminated than the fruit (by a factor of 4 to 10 or more) and the young branches were more contaminated than the sap.

The parts of herbaceous plants exposed to the air, which grew during the period following the appearance of the toxic cloud, were all contaminated.

Experiments have also been carried out in which carrots with the part above ground cut and onions with the part above ground uncut, were transplanted from contaminated to uncontaminated soils. Four months later (when new foliage had grown above ground) the following net reductions were found in the TCDD concentrations:

	)	root from	8 to 0.76 $\mu\text{g}/\text{kg}$
carrot	)		
	)	part above ground from	2 $\mu\text{g}/\text{kg}$ to 0

onions { subterranean part from 2.2 to 0.06 µg/kg
{ part above ground from 1.3 µg/kg to 0

After 4 months less than 10% of the TCDD, assimilated in the contaminated soil, could be detected.

The above experiments were carried out in highly contaminated soils. It still remains to be established whether the ratio between the TCDD in the soil and the TCDD absorbed by the plants is constant or varies as a function of the degree of contamination.

The results of the above research indicate that the contaminated zones cannot be used for agricultural activities until an effective decontamination of the soil has been completed, since dioxin is present, in variable quantities, in different parts of the cultivated plants, although without causing phytotoxic effects (statement by Bellini, XXIII/2).

Section IV

Effects of the contamination on the economy of the zone

1. Effects on agricultural activities

The contamination has brought to an end all activity in the fields of agriculture and animal husbandry in the zone, resulting in the losses listed in the fifth part of the present report: all activities have in fact been brought to an end in 61 agricultural or domestic establishments, 12 of which were less than 1 hectare in area, 9 between 3 and 6 hectares, 7 between 6 and 10 hectares, 7 between 10 and 15 hectares, 4 between 15 and 20 hectares, 10 between 20 and 30 hectares and 12 of an area greater than 10 hectares. More than 4000 domestic vegetable and flower gardens have also ceased all cultivation in this zone.

The possibility of renewal of such activity depends obviously on the course of reclamation operations and in consequence on the duration of the prohibition on all cultivation. The same considerations apply to activities in the sphere of animal husbandry, the situation of which at the time of the incident has already been set out in Section III of the fourth part of the present report.

2. Effects on industrial activity

When considering the immediate effects of the incident on industrial activity in the affected zone, a distinction has to be made between industries in zone A and those in zone B.

Three establishments were installed in zone A, engaged on the production of articles of clothing, the laundering of linen and on machinery production. These establishments employed overall 119 labour units (workers).

As the result of the evacuation of the zone, these establishments have been obliged to suspend all activities, until other premises suitable for the relevant industrial structures could be found, either on their own initiative or by the Region of Lombardy. The

interruption of production for long periods has not only prevented the execution of work already commissioned, but has also made it impossible to take new orders.

Eleven establishments were installed in zone B, engaged on the production of furniture and fittings, the laundering of linen, building, flooring, electrical engineering, machinery, the manufacture of machinery for laundries and glass making. These establishments employed overall 284 labour units. These industries have been obliged to close for varying periods, depending on the time required to determine the state of contamination of the zone.

The industries installed in zone A, and then transferred elsewhere, and also those installed in zone B have suffered the effects of the alarm created by the incident and the fear – often unfounded – that their products could be contaminated and in consequence a source of contamination.

The zeal and initiative of these undertakings, the influence of the press and promotional measures taken by the Region of Lombardy have however enabled an appreciable renewal of activity to be achieved; it is evident that the long-term effects have had a progressively decreasing relevance.

3. Effects on activities in light (home) industries

Light industry activities, which include predominantly furniture production, are of particular importance in the economy of the zone.

The effects of the incident of 10 July 1976 were obviously different for zone A and zone B. The 37 light industry undertakings, located in zone A, employed 152 labour units. Eight of these were engaged on the production of furniture and fittings, 7 on the laundering of linen, 8 on building activities, 6 on transport, 5 on flooring and 3 on the production of carpeting and clothing articles.

After evacuation, these undertakings were located in buildings, found either on their own initiative or by the Region of Lombardy, in which the necessary work had to be carried out to render them suitable for the intended purpose. This involved varying periods of suspension of their activity, pending renewal of production in the new locations. An additional factor is the reluctance of the public to purchase products originating from undertakings in the zone for fear of their having been contaminated or being a source of contamination.

The consequences of this situation have been kept under control thanks to the initiative of the press and promotion measures undertaken by the Region of Lombardy.

118 light industry undertakings, employing 306 workers, were located in zone B. 20 of these undertakings were engaged on the production of furniture and fittings, 15 on the laundering of linen, 23 on building, 12 on flooring, 16 on coachwork and machinery and 32 on various forms of production.

These undertakings underwent immediate closure on a temporary basis, pending determination of the possible level of contamination in zone B and experienced appreciable difficulties in renewing their sales in view of the manifest reluctance of the public to purchase their products.

4. Effects on commercial activities

The 9 commercial undertakings in zone A were of course evacuated: these were family businesses, employing not more than 2 persons in each case.

3 of these have been unable to renew their activities; the remaining 6 have had to move: their installation in a different zone has in fact resulted, and continues to do so, in a restriction on the exercise of their previous activities which were based on an established goodwill.

No particular finding can be reached in regard to commercial undertakings located in zone B, although these have of course also been affected by the general phenomena resulting from the incident.

Section V

Reclamation of the contaminated zone

1. Introduction

The Act, setting out the terms of reference of the Commission, does not oblige it to report to Parliament problems in connection with the reclamation of the contaminated zones.

It is however evident that the degree of contamination of the zone constitutes a criterion relevant to questions which are the subject of the Parliamentary Enquiry. There is no doubt in fact that the health of citizens, the balanced state of the environment, the economy of the zone, the procedure and measures of compensation, are strictly related to the nature and persistence of the contamination.

It will be recalled that the Senate on 8 June 1977, at the session in which the Act setting up the Commission of Enquiry was approved, instructed the Commission in a unanimous vote, "to examine the measures which had been taken or were intended to be taken for decontamination of the affected zones".

A summary report will therefore be given on the principal information received in regard to reclamation of the contaminated territory. It emerges from the official reports, on which wide discussion is still being held, that reclamation operations have not been brought to a successful conclusion as a result of difficulties and inadequacies of various types. The Commission nevertheless feels bound to report on this subject without adopting a specific attitude to the more controversial questions.

2. Demarcation of zones and subzones affected by contamination and TCDD concentration rates

The relevant material has already been set out in Section II of the fourth part. Nevertheless it is necessary to repeat it here for systematic reasons as an essential preliminary to any discussion of the problem of reclamation.

Zone A has the highest contamination rate (a mean TCDD value of $240 \mu\text{g}/\text{m}^2$ with a "non-evaluable" figure of $5477 \mu\text{g}/\text{m}^2$); the zone covers an area of 108 hectares in the urban districts of Meda and Seveso, with a perimeter of 6 km. This zone has been divided in turn into 7 subzones or belts.

Belts A1, A2 and the north part of A3, occupying 10.7, 5.1 and 3 hectares respectively, located in the district of Meda (in the vicinity of ICMESA) and in the district of Seveso, constitute the most highly contaminated areas with a mean rate of $518 \mu\text{g}/\text{m}^2$ TCDD. Belts A3 (southern part), A4 and A5, occupying an overall area of 27 hectares, are regarded as areas of medium contamination with a mean rate of $97 \mu\text{g}/\text{m}^2$ TCDD. These areas were engaged on agricultural activities. Belts A6 and A7, occupying an overall area of about 60 hectares, have a relatively lower contamination than the previous 5: 30 and $15.5 \mu\text{g}/\text{m}^2$ respectively. Isonzo Street, which is the main road connection between the centre of Seveso and the village of Baruccana, passes through these densely populated belts.

Zone B has a low contamination rate (a mean TCDD value of $3 \mu\text{g}/\text{m}^2$, with a "non-evaluable" figure of $43 \mu\text{g}/\text{m}^2$); the zone occupies an area of 269.6 hectares in the districts of Seveso, Cesano Maderno, Desio and Meda, with a perimeter of 16 km.

Zone R ("the observation zone"), has, in some parts, TCDD values below $5 \mu\text{g}/\text{m}^2$; it extends over an area of 1430 hectares in the districts of Barlassina, Meda, Seveso, Cesano Maderno, Desio and Bovisio, with a perimeter of 26 km.

3. Difficulties involved in reclamation operations

Reclamation operations have run into serious obstacles:

- (1) the difficulty of drawing a map showing the exact TCDD distribution in the various parts of the contaminated zone in view of the problems arising in connection with analysis of the contamination of the different substrata and of the point-type (leopard spot) distribution, which has complicated enormously statistical extrapolation;

- (2) the absence of any acceptable methods for the destruction of TCDD in situ, since, although various chemical and physical methods are known for the elimination of dioxin in isolated form, the compound is present in the particular case in mixture with a wide range of materials. It therefore became necessary to have recourse to removal of the contaminating agent from the surfaces for reclamation in zones of highest contamination, pending solution of the problem of the elimination of the toxic substance;
- (3) the need to experiment on new methods of decontamination, the validity of which had to be checked in turn, with the consequent inevitable delays;
- (4) the obvious requirement of protecting the health of those employed on decontamination and ensuring that the actual reclamation activities did not produce the paradoxical effect of contributing to the dispersion of the contaminating agent, causing further danger to the exposed populations;
- (5) the inevitable psychological problems arising between those responsible for reclamation operations and the local population which has been already sorely tried by the incident.

4. Regional reclamation plan

The Region of Lombardy, in Regional Act No. 2 of 17 January 1977, laid out the plans for reclamation operations in accordance with the procedure approved by the Technical - Scientific Commission set up by the D.P.C.M. of 4 August 1976.

The plan was divided into two programmes of measures, not necessarily successive, and allowed for an intermediate phase. The first programme of measures

related to the reclamation of zone B and the less contaminated and economically more important parts of zone A (A6 and A7).

Provision was made for the following operations:

- (a) fencing off of zone A,
- (b) removal of grass and foliage from the above zone, with registration and storage of the vegetation, pending subsequent incineration,
- (c) removal of agricultural soil with a contamination rate in excess of $15 \mu\text{g}/\text{m}^2$ and its transport and accumulation in an agricultural zone specially prepared for this purpose (A/5),
- (d) fencing off and isolation of agricultural land with a contamination rate within the range $5 - 15 \mu\text{g}/\text{m}^2$,
- (e) reclamation of the internal areas and external walls of houses, with forced ventilation and washing operations,
- (f) reclamation of the appurtenances of houses in which contamination rates in excess of $5 \mu\text{g}/\text{m}^2$ had been found.

The intermediate phase provided for the following operations:

- (g) systematic storage under safe conditions of all materials intended for destruction, in particular perishable materials,
- (h) the transport of containers with the carcasses of farmyard animals and the building of a cement tank in the neighbourhood of the ICMESA establishment,
- (i) implementation of the rat elimination and disinfection plan in zones A, B and R,
- (j) possible hoeing of the ground in zone R and zone D, from which the surface had not been removed, after prior technical and scientific approval of the operations by the Regional Board, having heard the opinion of the advisory committee,

- (k) restoration of the agricultural land in the scarified areas of zones A6, A7 and B, and also of the external appurtenances of dwellings, schools, undertakings and factories.

The second programme of measures provided for the following operations:

- (l) cutting and removal of the soil in zone A and its storage under safe conditions in the vicinity of the ICMESA establishment,
- (m) reclamation, on a trial basis for at least twelve months, by biological degradation in zones of second priority,
- (n) emptying of the houses in the Via Carlo Porta and trials of reclamation by photodegradation, aspiration and washing, as an alternative to demolition,
- (o) construction in the area of the ICMESA establishment of a pilot furnace intended for the incineration of vegetation, animals and materials produced as a result of reclamation of the contaminated ground, if alternative experimental procedures had not yielded positive results,
- (p) suitable disposal of the combustion residues,
- (q) restoration of the agricultural land in the scarified areas,
- (r) completion of elimination of chemical substances inside the factory (at the date of approval of the plan, about 30% of the chemical substances, present at the time of the incident on 10 July 1976, were still in the factory),
- (s) drawing up of the plan for emptying the reactor, installed in shop B, to be carried out by the company GIVAUDAN,
- (t) possible removal of the above reactor and its positioning in a suitable place,
- (u) reclamation of the above shop B, which is at present subject to the judicial authorities.

5. State of implementation of the regional reclamation plan

The above programme has achieved up to now partial but significant results; at the same time it has met with delays, difficulties and reservations, especially in regard to the proposed destruction of TCDD by incineration, which has been the subject of widely differing views.

The following operations have been carried out in the context of the first programme:

- (a) fencing off with a heavy fence of zones A1, A2, A3, A4 and A5,
- (b) the fencing off with a light fence, followed by removal for reclamation purposes of zones A6 and A7,
- (c) operations on the provision of special roads, so as to avoid the equipment used during reclamation operations passing through urban districts,
- (d) the removal of vegetation in 235 hectares in zone B and in the contaminated area of zone R, followed by the treatment and burial of the material in trenches,
- (e) the scarification, repeated where laboratory control checks indicated the persistence of contamination, of the ground in zones A6 and A7, with removal of about 35,000 m³ of material,
- (f) decontamination of the insides of dwellings in subzones A6 and A7, so as to obtain TCDD values not exceeding 0.01 µg/m², with previous removal of furniture and fittings unsuitable for reclamation; removal and washing of the internal fittings; replacement of floors which could not be contaminated; repainting or re-covering of the walls with the transfer of the contaminated material to zone A5, including washing liquids,
- (g) decontamination of the external surfaces of dwellings in subzones A6 and A7 with high-pressure jets (60 bar), so as to obtain TCDD values not exceeding 0.750 µg/m²,

- (h) decontamination of the appurtenances of dwellings, with the transfer to zone A5 of the material removed, so as to obtain TCDD values not exceeding $5 \mu\text{g}/\text{m}^2$,
- (i) decontamination of the agricultural areas in subzones A6 and A7 by scarification, so as to obtain a level of $5 \mu\text{g}/\text{m}^2$; fencing off of areas with contamination levels within the range $5 - 15 \mu\text{g}/\text{m}^2$; removal of the materials,
- (j) return to the houses of a proportion of the inhabitants of subzones A6 and A7, subject to a phased monitoring programme for control checks of possible re-contamination,
- (k) decontamination or dilution by mulching of the soil in zone B, recently subdivided into subzone B1 (including 60 hectares with a mean TCDD concentration of $6.2 \mu\text{g}/\text{m}^2$) and in subzone B2 (including the remaining 200 hectares, with a mean TCDD concentration of $2.5 \mu\text{g}/\text{m}^2$). This subdivision is shown in the plan on page 158.

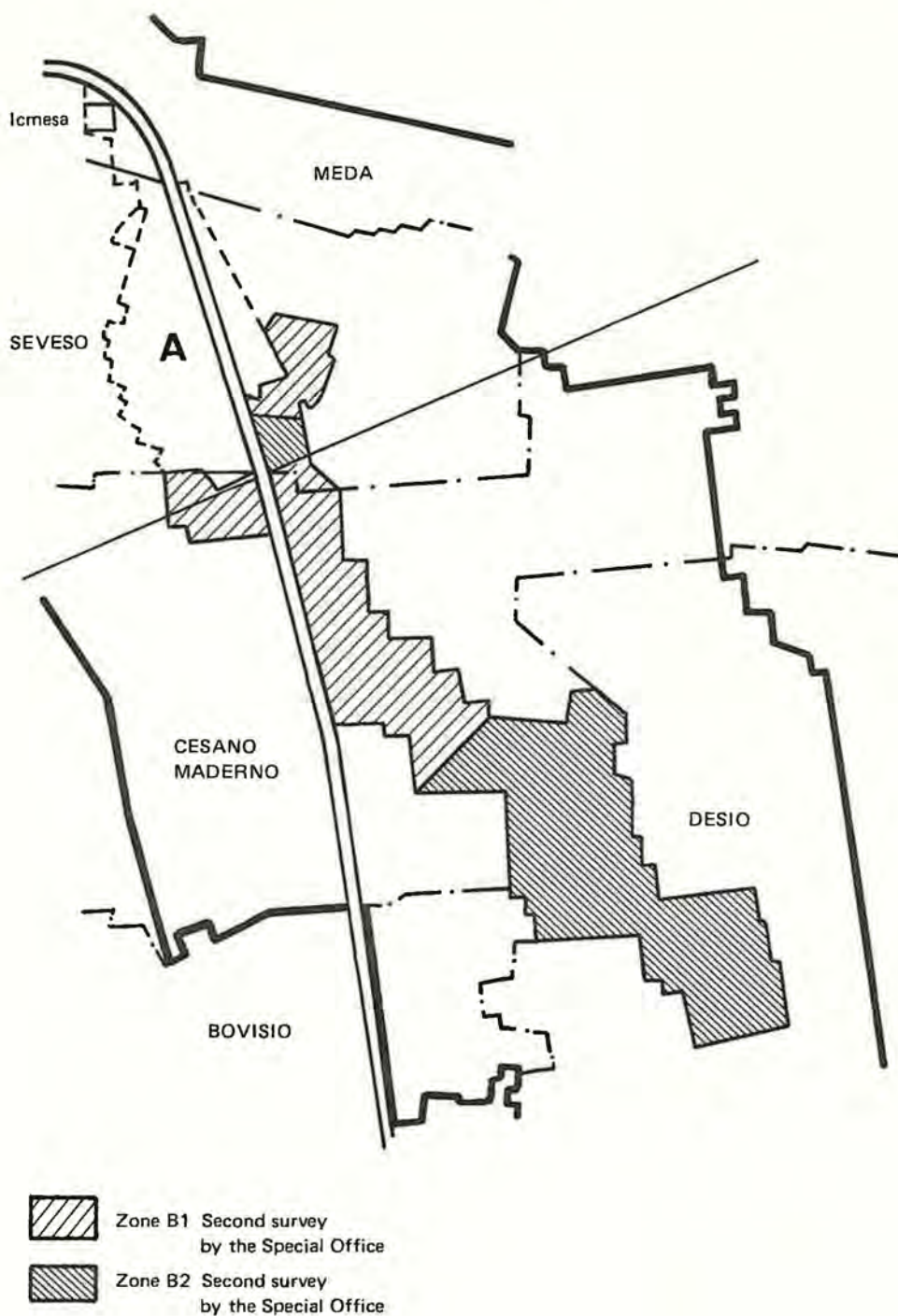
The following operations were carried out during the intermediate phase:

- (l) placing of more than 4000 animal carcasses (inserted in about 700 plastic containers containing caustic soda) in deposition tanks covered with 1 m soil in the immediate vicinity of ICMESA,
- (m) rat elimination and disinfection of zone A, B and R,
- (n) restoration with fresh soil of the scarified area, amounting to about 50000 m^3 and sowing with grass.

The following measures were carried out during the second stage of the programme:

- (o) removal, after suitable treatment, of chemical products present in the ICMESA establishment,
- (p) experiments (some still continuing and the remainder as described in Section II of

the fourth part) relating to: (i) the acquisition of data on TCDD, e.g vapour pressure, carbon absorption etc, (ii) microbial processes for TCDD destruction, (iii) plant-soil ratios in zones contaminated with TCDD, (iv) ratios between the vegetation, distribution and mean life of the TCDD in the soil, (v) tests on TCDD penetration in the soil, (vi) tests on the photodegradation of TCDD.



6. Operations to be carried out

In addition to completing reclamation operations in zone B, in which the greater part of the area had already undergone soil removal and the addition of fertiliser, the principal problems associated with reclamation were as follows:

- (a) elimination of the TCDD where it was still persisting in its maximum concentration, i.e. in zones A1, A2, A3 (?), amounting to 18.8 hectares and calculated to contain 1.80% of all the TCDD present in the contaminated area,
- (b) elimination of the contaminated material which had been removed and was to be removed in the future,
- (c) decontamination of the remainder of zone A.

The completion of all these tasks involved one central problem, namely how to destroy or neutralize the TCDD.

As stated above, the regional reclamation plan originally made provision for the destruction of the dioxin residues present in the soil at a high contamination level by means of incineration, where trials of alternative procedures had not yielded positive results.

This approach, which was adopted also by the Technical-Scientific Commission appointed under D.P.C.M. of 4 August 1976, was inspired by the wish to give preference to systems of destruction of the dioxin rather than to systems of conversion (? illegible), provided that this could be done under safe conditions.

The method to be adopted has not yet been finally decided. Indeed, this can only be done on the basis of a rigorous analysis of the cost/benefit ratio, the benefit being understood to mean the complete decomposition of the TCDD and the cost being the incidence of these operations on the population and the area.

The Technical-Scientific Commission, referred to above, and the Special Office for Seveso have examined the following possible hypotheses:

- (a) accumulation of contaminated material in caissons or other containers, to be located on the surface or at a depth (subject to the possibility of subsequent treatment of the soil contained therein),
- (b) combustion in furnaces,
- (c) the accumulation in caissons for sinking in the sea.

The Parliamentary Commission cannot obviously intervene in a choice which is dictated by technical and scientific considerations. It would like nevertheless, to emphasize the need for arriving at a decision, after clearly weighing all the relevant elements, which will lead in the shortest possible time to a solution of this essential problem.

7. Conclusions

The difficulties and limitations, which have held up and continued to hold up reclamation, are well known to the Commission, which is also aware that the incident of 10 July 1976 was the first known case of serious and extensive TCDD contamination outside the bounds of a factory and covering an enormous, densely populated area.

In the case of Seveso, the escape of toxic substances has exerted an effect on the population, dwellings, economic activities, fauna, vegetation, soil and waters. These serious problems have been further complicated by the fact that scientific knowledge of TCDD was, at least in part, incomplete in many decisive aspects.

Having said this, the Commission wishes to emphasize the need for attacking and solving, within the shortest possible time, the problem of TCDD neutralization in the contaminated material, which has been removed and will be removed in the future. This is in fact the indispensable prerequisite for the solution of the principal problems associated with the complete implementation of the reclamation plan.

Fifth Part

Assessment of the losses and measures for
compensation and indemnification

Introduction

The terms of reference of this Commission, pursuant to Act No. 357 of 16 June 1977, included "to establish what measures have been taken or should be taken to indemnify persons who have suffered damage as a result of the incident of 10 July 1976, and to obtain from those responsible, compensation for those losses".

The Commission understood this to mean that the above determination should relate not only to physical persons, but also to undertakings exercising an economic activity. The Commission further realized that this determination could not be carried out directly, in view of the impossibility of hearing the very large numbers of persons, who had suffered damage, and evaluating the different forms of compensation.

It is also necessary to state that the information and data set out in the present part of the report have been supplied to the Commission by Advocate Antonio Spallino, discharging the functions of Special Representative for Seveso of the Region of Lombardy.

It should also be pointed out that the normal judicial authorities will also give an opinion on the matter of damages and on the amount of compensation to be paid in the criminal proceedings which are pending against the directors of ICMESA in which, in addition to numerous private individuals, the communal administrative authorities of Seveso, Meda, Cesano Maderno and Desio, the Region of Lombardy, the works council of ICMESA and the Union of Light Industries of Monza and Brianza are represented as civil parties in the action.

Section I

Legislative provisions relating to the initial measures.

Operative programmes and special structures.

1. Legislative provisions

To deal with the emergency situation in the communes affected by the contamination, the Government, Parliament and the Regional Council of Lombardy, approved as a matter of extreme urgency a series of legislative measures involving operative regulations and provisions of a financial nature. These measures were in chronological order as follows:

- (a) D.L. (Legal Decree) No. 537 of 3 August 1976, transformed with amendments into Act No. 615 of 19 August 1976, which laid down: (a) the suspension "in communes of the province of Milan affected by the contamination" of the course of the statutory and mandatory periods falling due during the period between 10 July and 31 December 1976; (b) the suspension in the same communes of the collection of taxes (IRPEF and ILOR) and the suspension of the payment of leases and rents, combined agricultural contributions and credit titles having executive force,
- (b) the D.P.C.M. (Public Decree of the Council of Ministers) of 4 August 1976, setting up a Technical-Scientific Commission to study and propose measures for the decontamination of the territory affected by contamination,
- (c) the D.P.C.M. of 5 August 1976 specifying, for purposes of application of Legal Decree No. 537, that the communes affected by contamination were Seveso, Meda, Cesano Maderno and Desio,
- (d) Law No. 5 of the Region of Lombardy dated 5 August 1976, which (a) authorized the Regional Board to adopt urgent measures in favour of the affected populations,

allocating for this purpose an amount of 500,000,000 lire, (b) authorized the chairman of the said Board to implement by decree the above provisions,

- (e) D.L. No. 542 of 10 August 1976, transformed with amendments into Act No. 688 of 8 October 1976, covering regulations of various types, such as the allocation of a special contribution of 40,000 million lire in favour of the Region of Lombardy for measures in favour of the workers and industries, the establishment at Seveso of a decentralized office of the Ministry of Health, the establishment in the Region of Lombardy of a detached section of the Higher Institute of Health and the analytical break down of the sums allocated to the special contribution,
- (f) Law No. 2 of the Region of Lombardy dated 17 January 1977 which - in implementation of Law No. 688 - laid down the operative programmes of intervention to be submitted to the Regional Council for approval, and introduced simplified procedures in regard to town administration, accountability, recruiting of staff and documentary control,
- (g) Act No. 339 of 2 June 1978 which, in order to meet the financial requirements of the five operative programmes, added to the special contribution allocated by the State to the Region of Lombardy, a further 75,000 million lire, distributed between the financial years 1977 (5000 million), 1978 (25,000 million) and 1979 (45,000 million).

The same Act also laid down that the Region of Lombardy was to submit to the President of the Council of Ministers, for subsequent submission to Parliament, an analytical break-down of the amounts spent during the previous six month period and in execution of the programmes approved in the Regional Law itself (Article 2) and that the sums allocated were intended to be used in anticipation of the compensation awarded following determination of possible liability. The Act also provided that, within the limits of the anticipated sums, the Region of Lombardy was appointed as subrogate for the anticipated beneficiaries in regard to compensation for damage to property in any determination of liability, and that,

where the subrogate rights could not be exercised, the anticipated sums would remain finally in the possession of the beneficiaries (Article 4).

2. Operative programmes, financial forecasts and special structures

At its session of 2 June 1977, the Regional Council of Lombardy, in implementation of the aforesaid Regional Law No. 2, approved the following operative programmes:

No. 1 - Determinations and control checks on the contamination of the soil, waters and vegetation and measures for the decontamination and reclamation of land and property and for prevention of the spreading of contamination.

No. 2 - Determinations and control checks in the health sphere, health aid and protection of public health in general in the affected zone; determinations, control checks and measures in the field of medico-veterinary prophylaxis and veterinary aid.

No. 3 - Social and educational aid, including provisions for the accommodation of evacuated populations.

No. 4 - Restoration or reconstruction of civil structures and habitations which could not be repaired and execution of the necessary work for the reestablishment of adequate conditions of life in the particular situation of the affected zone and of the productive capacities of the agricultural land in question.

No. 5 - Measures in favour of undertakings, individual or corporate, agricultural, light industry, tourist and hotel undertakings, industrial and commercial undertakings, which had suffered damage as a result of the contamination with the toxic substance.

This was followed by Regional Law No. 27 of 17 June 1977 covering regulations for implementation of previously approved operational programmes and established a Special Office, headed by a Special Representative for Seveso, to whom were allocated the following functions:

- (a) to take all necessary measures, including the pledging and provision of funds, in connection with the implementation of programmes within the competence of the Regional Board or of its Chairman; to agree the relative contracts, even without obtaining the prior opinions laid down in the valid regulations, except in the case of the Commissions referred to in (c) below,
- (b) to coordinate, for purposes of ensuring the implementation of programmes, the activity of subordinate officials and services of the Regional Board, requesting the necessary collaboration from the relevant advisers,
- (c) to submit proposals to the Chairman of the Regional Board on the establishment and composition of the technical consultative commissions, for which provision was made in Article 16 of Regional Law No. 2 of 17 January 1977, and to chair and coordinate their activities,
- (d) to issue technical, planning and operational directives, and to supervise bodies and organizations competent for the implementation of the programmes,
- (e) to ensure that all the measures, adopted by regional organizations and local bodies, including urgent measures, complied with the provisions of the programmes and technical, planning and operational directives,
- (f) to make provision for the recruiting of outside staff,
- (g) to supervise relations between the bodies, associations and social organizations, responsible for ensuring a constant supply of information to the public,
- (h) to submit proposals to the chairman and to the Regional Board on possible amendments to programmes, for submission to the Regional Council,
- (i) to carry out, in relation to all emergency situations, those urgent measures which would brook no delay, where these measures were not included in the programmes but remained within the competence of the chairman of the Regional Board.

In addition to approving the five operational programmes, the Region of Lombardy made the following financial provisions, amounting to a total of 121,635,866,606 lire, broken down as follows:

Operational programme No. 1	66,404,407,648	lire
Operational programme No. 2	18,142,352,910	lire
Operational programme No. 3	15,064,554,389	lire
Operational programme No. 4	7,825,864,000	lire
Operational programme No. 5	13,678,687,659	lire
General non-distributable services	520,000,000	lire
	<u>121,635,866,606</u>	<u>lire</u>

This provision of finance - which was presented to the Commission together with a
into individual measures - exceeded by about 6000 million lire the
contribution allocated by the State to the Region.

At the date of approval of the operative programmes (2 June 1977) the situation of the Fund, based on this contribution and other sources (funds autonomously administered by the Region outside the framework of the regional balance) was as follows:

Programme	Special fund and various other sources	Forecasts	Payments	Available balance
Op. progr. No. 1	21.655.407.648	21.182.700.332	13.838.308.727	472.707.216
Op. progr. No. 2	5.272.013.910	4.505.156.843	2.262.457.331	776.857.067
Op. progr. No. 3	6.330.517.663	5.956.504.840	5.941.393.422	374.012.823
Op. progr. No. 4	458.864.000	458.846.632	243.359.632	17.368
Op. progr. No. 5	6.552.836.218	6.070.299.399	6.008.871.609	482.536.819
General expenses	80.000.000	175.045.415	175.045.415	95.045.415
Total	40.349.639.439	38.348.553.461	25.469.436.136	2.001.085.878

On 30 September 1977 the Special Fund, originally fixed at 40,000 million lire, was increased by 349,538,239 lire by addition of assets and by 101,200 lire from various contributions and repayments.

Section II

1. Evacuation of the population from the contaminated zones. Social assistance measures and various charges.

A total of 736 persons, comprising 212 families, were evacuated from the contaminated zones.

Evacuation was carried out for residents in zones A1 and A5 on 26 July and for residents in zones A6 and A7 on 2 August. On 26 July 225 persons were evacuated (170 from Seveso and 55 from Meda, representing 46 families from Seveso and 14 families from Meda); on 2 August 511 persons (152 families) were evacuated, all from Seveso.

The evacuated families were provisionally accommodated as follows:

- 53 families in the Bruzzano home,
- 129 families in the Assago home,
- 12 families in other establishments in adjacent zones,
- 18 families with relatives or elsewhere (arranged independently).

On 30 June 1976 the population present in zones A, B and R was distributed as follows:

Commune	Zone A	Zone B	Zone R	Outside the zones	Total numbers resident in the commune
Seveso	674	626	7,745	7,738	16,979
Meda	62	—	4,017	15,493	19,572
Cesano M.	—	2,731	14,991	16,111	33,833
Desio	—	1,342	4,608	27,061	33,011
Barlassina	—	—	72	5,559	5,631
Bovisio M.	—	—	167	11,058	11,225
Total	736	4,699	31,800	83,020	120,251

The measures taken to evacuate the population from the contaminated area were intended to achieve the following aims:

- (1) the finding and fitting out of accommodation, to be made available to evacuated family units; the alternative provision of financial aid for those making their own arrangements; the systematic availability of hotel accommodation;
- (2) the setting up and administration on an exceptional basis of daily centres, located in adjacent non contaminated zones, intended for minors resident in zones A and B, who were not attending school;
- (3) the daily evacuation of the school population from areas of contamination, by means of full-time services;
- (4) the setting up and temporary administration of nursery schools and the finding of suitable premises, disregarding where necessary the structural and functional standards laid down in Regional Law No. 39 of 22 December 1972 and subsequent amendments;
- (5) the establishment, either directly or on a concessional basis, of transport services for evacuated persons;
- (6) the temporary accommodation, possibly in health resorts, of the elderly, minors and pregnant women resident in zones A and B.

To reduce to a minimum the systematic use of hotels, furnished accommodation was allocated to evacuated persons or an optional financial allowance, not exceeding 4,500,000 lire per family, based on the anticipated compensation.

The following amounts were also made available as family aid:

- (a) to the head of the family, 300,000 lire as a lump sum payment and 5,000 lire as a daily allowance,
- (b) to the head of the family, per dependant member 100,000 lire as a lump sum payment and 3,000 lire as a daily allowance.

The financial burdens, resulting from the above measures up to 31 May 1978, are summarized in the tables below (see p. 232-237 of the original):

Expenses incurred in the accommodation of minors resident in the contaminated zone

Commune	Beneficiaries	Costs	Note
Seveso	1.740	178.700.000	Costs incurred for payment of accommodation charges and for financial contributions.
Meda	235	117.800.000	
Cesano Maderno	2.900	407.400.000	
Desio	1.401	153.000.000	
Bovisio	44	2.900.00	
Barlassina	30	3.700.000	
Nova Milanese	28	4.100.000	
Seregno	12	1.300.000	
Varedo	6	1.000.000	
Totals	6.396	869.900.000	

Costs incurred for the accommodation of pregnant women resident in the contaminated zone

Commune	Beneficiaries	Costs
Seveso	2	1.300.000
Meda	13	4.400.000
Cesano Maderno	19	15.100.000
Desio	5	2.800.000
Totals	39	23.600.000

Costs incurred for the accommodation of the elderly and persons specified by the health aid committee, resident in the contaminated zone

Commune	Beneficiaries	Costs	Note
Seveso	109	19.600.000	Costs incurred for payment of accommodation charges and for financial contributions
Meda	130	30.200.000	
Cesano Maderno	308	65.400.000	
Desio	249	55.200.000	
Totals	796	170.400.000	

Costs incurred in the systematic accommodation in hotels of families evacuated from the contaminated zone

Item

Hotel accommodation	59,220,000	Family units accommodated in hotel No. 2 on 31.5.1978.
Allowances as an optional alternative to hotel accommodation	70,714,000	
Payment of rent	289,569,000	
Restoration of rented premises (painting, minor repairs etc)	63,800,000	
Furnished accommodation	283,011,000	
Allowances in lieu of furnished accommodation	603,050,000	The company GIVAUDAN paid in this connection a first instalment of 247,000,000 lire to the Region
Lump sum payment for urgent necessities	675,310,000	
	2,044,674,000	

Costs incurred in the establishment and administration of kindergartens

Commune	Number of kindergartens	Mean attendance per day	Costs
Cesano M.	2	70	208,600,000 lire
Desio	1	40	74,000,000 lire
	3		282,600,000

Expenses incurred in the establishment and administration of an exceptional basis of daily accommodation centres

Commune	Number of centres	Mean attendance per day	Costs	Note
Seveso	6	300	160.000.000	Children from Bovisio and Barlassina were sent to the Cesano and Seveso daily centres.
Meda	3	250	88.600.000	
Cesano M.	7	180	152.000.000	
Desio	3	300	151.500.000	
Totals	19		552.100.000	

Commune	Number of	Mean attendance per day	Costs
Cesano M.	2	70	208.600.000
Desio	1	40	74.000.000
Totals	3		282.600.000

Costs incurred for transport services

Commune	Number of lines	Costs
Seveso	2	26.600.000
Meda	1	18.300.000
Totals	3	44.900.000

Financial burdens incurred for the accommodation of the population of school age as at 31.5.1978

Commune	Number of schools	Costs
Seveso	11	671.600.000
Meda	4	148.600.000
Cesano M.	5	503.100.000
Desio	4	303.500.000
Totals	24	1.626.800.000

Summary

1. Evacuation of minors	869,900,000 lire
2. Evacuation of pregnant women	23,600,000 "
3. Evacuation of the elderly and persons indicated by the health aid committee	170,400,000 "
4. Systematic accommodation of evacuated persons	2,044,674,000 "
5. Establishment and administration of day centres	552,100,000 "
6. Establishment and administration of nursery schools	282,600,000 "
7. Transport services	44,900,000 "
8. Evacuation of population of school age	1,626,800,000 "
9. Allowances to private individuals (purchase of milk)	16,900,000 "
Total	5,631,874,000 lire

Section III

Decontamination of zones A6 and A7. Restoration of inhabitable or existing structures. Statistics of uninhabitable dwellings. Measures in favour of the owners of such dwellings and compensation values

1. Decontamination of zones A6 and A7. Restoration of inhabitable or existing structures

In the autumn of 1977, after decontamination had been certified by the Higher Institute of Health, 152 family units (511 persons) resident in Seveso, in zones A6 and A7, were authorized to return to their dwellings.

GIVAUDAN made a direct contribution to the reclamation of the two zones in accordance with the agreement reached with the Region of Lombardy on 14 December 1976, Articles 2, 3 and 6 of which are set out below:

"Article 2

The company Givaudan undertakes vis-à-vis the Region of Lombardy to restore, at its own care and expense and up to the limits set out in the preambular subparagraph (c), all buildings of any nature or type, including gardens, vegetable gardens and appurtenances (with the exception of fields intended for agricultural cultivation or uncultivated fields) in the southern part of zone A of Seveso, contaminated by a cloud escaping on 10 July 1976 from the ICMESA establishment in Meda, bounded on the north by the Redipuglia road, on the west and south by the limits of the said zone A, and on the east by the main road from Milan to Meda, in zone A2 between the T. Grossi road and the Certesa, and in zone A3 looking onto the Certesa, as shown in red on the plan attached at (b) to the present agreement, which is to be regarded as an integral part thereof.

"Article 3

All the buildings are to be entirely restored both internally and externally. All buildings, in which the system of washing cannot achieve adequate decontamination results and which cannot be suitably restored in any other way, are to be scraped and,

after checking of the decontamination by the Region of Lombardy, restored at the care and expense of GIVAUDAN; in this connection, the rooves of these buildings are to be replaced (tiles) or rebuilt (flat rooves), again at the care and expense of the company GIVAUDAN.

"Article 6

The furniture present in dwellings will have to be washed, with the exception of goods which cannot reasonably be decontaminated. In this case they will have to be destroyed and replaced at the care and expense of the company GIVAUDAN".

The Special Office has informed this Commission that notification has been made to GIVAUDAN to the effect that the expenses on reclamation in zones A6 and A7 amount to 4324 million lire, consisting of 2803 million lire for decontamination of buildings, appurtenances and furniture and 1511 million lire for compensating the owners of furniture which could not be decontaminated and was therefore destroyed.

2. Buildings in private ownership which could not be restored. Measures in favour of the owners and amounts of compensation.

In contrast to the position in zones A6 and A7, the evacuation of the other zones (A1, A2, A3, A4, A5) is likely to continue for an indefinite period of time, in view of the high and persistent level of contamination of buildings and the various problems in connection with reclamation which have not yet been resolved. The situation in regard to buildings, which are not suitable for restoration, is shown in the following table:

Location	Number of buildings	Number of dwellings	Number of families	Number of inhabitants
Seveso	29	46	46	170
Meda	6	14	14	55
Totals	35	60	60	225

The Region of Lombardy has seen fit to adopt different measures, according to the options exercised by individual owners:

- (1) a monetary contribution, commensurate with the actual cost of reconstruction of the property which could not be restored (building, area and appurtenances), to be allocated to those owners who intend to acquire a new dwelling in districts other than those affected by the incident, or in the same district in an area of their own choice, by direct acquisition,
- (2) a monetary contribution, to be determined as above, but relating **only** to the building, for owners who intend to reconstruct directly their own dwellings in an area indicated to them, acquired or requisitioned by the urban district, to which the Region will allocate the necessary funds,
- (3) the construction by the I.A.C.P. of Milan, of single-family, two-family or multi-family dwellings, of cubic capacity, spatial and natural characteristics similar to the dwelling which could not be restored, to be constructed on the basis of a type project, in an area to be indicated and acquired as under sub paragraph (2),
- (4) the construction by the I.A.C.P. in an area to be indicated and determined as under (2), of buildings equivalent to those which could not be restored, on the basis of a plan duly submitted for the granting of a building permit.

In the zones in question, the owners have suffered total losses and in consequence the compensation values have been determined by calculating the costs of construction of buildings having equivalent structural and functional characteristics to those which can no longer be used.

The task of calculating these costs has been entrusted by the Special Representative for Seveso to expert panels each consisting of three members (appointed by the Region of Lombardy, by GIVAUDAN and by the private party suffering damage), which have arrived at the compensation values shown in the following table:

Location of building (zone)	Reconstruction costs	Compensation for plot	General total
A ₁	526.740.465	218.300.000	745.040.465
A ₂	62.401.976	63.455.000	125.856.976
ex A ₂	436.000.000	133.000.000	569.000.000
A ₃	1.192.640.000	396.958.000	1.589.598.000
ex A ₃	372.140.774	78.378.525	450.519.299
A ₄	115.808.168	216.904.905	332.713.073
Totals	2.705.731.383	1.106.996.430	3.812.727.813

It is also necessary to take into account the sums of compensation due to light industry undertakings, assessed by experts at a total figure of 402 million lire (262 million lire for buildings and 140 million lire for land), which GIVAUDAN is obliged to meet directly, according to an agreement concluded with the Special Office on 14 June 1978. The overall financial burden for compensation to private owners of buildings, which cannot be restored, amounts therefore to 425,000 million lire.

Section IV

Assessment of damages in various sectors of economic activity and total indemnification

1. Damages determined and settled. Practices adopted during the investigation

The data and information in the present paragraph relate to undertakings which suffered damage as a result of the incident of 10 July 1976, and more particularly to the consequential damage and the loss of earnings of each of these undertakings, the amount of indemnification already paid and which GIVAUDAN has in part already compensated, and also the amount of monetary contributions which the Region of Lombardy has allocated or has undertaken to allocate on an anticipatory basis.

On 10 July 1976 209 undertakings were operating in the contaminated zone, distributed as follows between the different sectors of economic activity (see page 243 of the original):

Sector	Undertakings	Owners	Employees	Associates	Total
Agriculture					
Zone A	1				
Zone B	4				159
Zone R	24				
Total	29				
Industry					
Zone A	3	5	114	—	119
Zone B	10	21	263	—	284
Total	13	26	377	—	403
Commerce					
Zone A	9	9	—	18	27
Light industry					
Zone A	37	47	99	10	156
Zone B	121	172	140	—	312
Total	158	219	239	10	468
General total	209	254	616	28	898

The situation obtaining in individual sectors as a result of the contamination may be summarized as follows:

- (A) In the sector of agriculture and animal husbandry of zones A, B and R, the toxic cloud necessitated the destruction of the greater part of the crops, the loss of all hanging fruit (the death, natural or by slaughter) of a large number of animals and the loss of other products, such as milk, eggs etc.

The analytical estimate of the consequent damage and the loss of income has been prepared, on the basis of real values, by the inspectorate of agriculture of the Region of Lombardy in the presence of an expert appointed by GIVAUDAN. The following tables give a general picture of the data relating to all the undertakings which suffered damage, the extent of the damage in question and the amounts paid by way of compensation. It should be pointed out that the amounts owed in respect of consequential damage have already been paid by the Region of Lombardy, which is in course of obtaining reimbursement from GIVAUDAN. In regard to the amounts due in respect of loss of earnings in relation to 1977, on the other hand, GIVAUDAN has undertaken, in a letter of 21 April 1978, to compensate those concerned directly, starting from 20 May of the present year.

Amounts paid to agricultural undertakings in respect of consequential losses of crops

Commune	Number of undertakings	Amounts (in 000 lire)
Seveso	20	96.204
Desio	30	188.607
Meda	4	12.706
Cesano Maderno	16	60.630
Bovisio Masciago	10	34.307
Total	80	392.454

Amounts paid to agricultural undertakings in respect of loss of earnings (solar year 1977)

Commune	Number of undertakings	Amounts (in 000 lire)
Desio	24	122.323
Cesano Maderno	17	72.225
Seveso	14	53.350
Bovisio Masciago	5	34.084
Meda	1	7.579
Total	61	289.561.=

The numerical difference between the number of undertakings to which payments have been made for consequential damages and those to which payment has been made for loss of earnings, is due to the fact that some undertakings only possesses dead stock (i.e. implements), so that no amount was therefore due in respect of loss of earnings.

It has also to be borne in mind in regard to the difference between the amounts paid for consequential damages and for loss of earnings, that the latter payment does not take into account the reimbursement of labour wages.

Amounts paid to owners of vegetable and family gardens in respect of consequential losses

Commune	Zone A		Zone B		Third Belt		Totals	
	No. of businesses	Amount in 000 lire	No. of businesses	Amount in 000 lire	No. of businesses	Amount in 000 lire	No. of businesses	Amount in 000 lire
Cesano Maderno	==	===	495	83.969=	1364	251.647=	1859	335.616.=
Seveso	148	44.511.=	173	40.880=	780	148.915	1101	234.308.=
Desio	==	===	228	70.961	799	162.058=	1027	233.019.=
Meda	10	2.896.=	===	===	335	53.866=	345	56.763.=
Bovisio Masciago	==	===	===	===	40	17.622	40	17.622.=
Barlassina	==	===	===	===	7	2.272=	7	2.272.=
Total	158	47.407=	896	195.810=	3325	636.380=	4379	879.600.=

Amounts paid to owners of vegetable and family gardens in respect of loss of earnings (agrarian year 1977)

Commune	Zone A		Zone B		Third belt		Totals	
	No.	Amount in 000 lire	No.	Amount in 000 lire	No.	Amount in 000 lire	No.	Amount in 000 lire
Barlassina	===	===	===	===	11	3.161=	11	3.161=
Bovisio Masciago	===	===	===	===	41	21.711=	41	21.711=
Desio	===	===	189	68.316=	670	181.679=	859	249.996=
Cesano Maderno	===	===	492	112.097=	1441	332.986=	1933	445.083=
Seveso	44	13.902=	99	30.993=	887	212.264=	1030	257.159=
Meda	8	2.992=	===	===	358	66.338=	366	69.260=
Total	52	16.824=	780	211.406	3408	813.139=	4240	1.046.370

The above accounts do not include the sum of 25 million lire paid directly by GIVAUDAN to 93 businesses running vegetable gardens in zones A6 and A7.

Estimate of losses of ornamental plants
(Settlement of these claims has not yet been made)

Commune	Zone A		Zone B		Third belt		Totals	
	Business	Amount in 000 lire	Business	Amount in 000 lire	Business	Amount in 000 lire	Business	Amount in 000 lire
Cesano Maderno	===	===	304	126.729=	1	27.547=	305	154.276=
Desio	==	===	150	61.887=	1	23.079=	151	84.966=
Meda	11	9.428=	===	===	==	===	11	9.428=
Seveso	150	116.804=	143	55.952=	1	24.879=	294	197.636=
Total	161	126.232=	597	244.568	3	75.505=	761	446.306=

Amounts paid in respect of consequential losses due to the death or slaughter of animals

Commune	Zone A		Zone B		Third belt		Totals	
	No. of businesses	Amount in 000 lire	No. of businesses	Amount in 000 lire	No. of businesses	Amount in 000 lire	No. of businesses	Amount in 000 lire
Barlassina	—	—	—	—	3	930	3	930
Bovisio Masciago	—	—	—	—	27	68,977	27	68,977
Cesano Maderno	—	—	178	35,262	880	134,154	1058	169,416
Desio	—	—	101	22,931	323	151,712	424	174,644
Meda	4	468	—	—	269	53,809	273	54,277
Seveso	56	31,407	68	17,843	524	168,416	648	217,666
Total	60	31.875	347	76.036	2026	578.008	2433	685.910

Amounts paid in respect of loss of earnings due to the death or slaughter of animals

Commune	Zone A		Zone B		Zone R		Totals	
	No. of businesses	Amount in 000 lire	No. of businesses	Amount in 000 lire	No. of businesses	Amount in 000 lire	No. of businesses	Amount in 000 lire
Barlassina	—	—	—	—	—	—	—	—
Bovisio Masciago	—	—	—	—	29	26,961.085	29	26,961.085
Cesano Maderno	—	—	166	19,525.000	849	35,371.025	1,015	104,896.025
Desio	—	—	112	19,003.000	297	64,515.655	409	83,518.655
Meda	4	351.000	—	—	206	25,290.425	210	25,641.425
Seveso	49	20,799.630	72	12,933.375	506	63,450.980	627	97,183.985
Total	53	21.150.630	350	51,461.375	1,887	265,588.170	2,290	338,201.175

Amounts paid in respect of consequential losses due to the destruction of milking cows

Commune	Period	No. of businesses	Payment in 000 lire	Remarks
Vari	10.7 .76/15.8 .76	10	3.897.=	
Vari	16.8 .76/15.9 .76	12	4.473.=	
Vari	16.9 .76/15.10.76	9	4.165.=	
Vari	16.10.76/15.11.76	8	4.372.=	
Bovisio Masciago	16.8 .76/15.10.76	4	5.697.=	
Bovisio Masciago	16.10.76/15.11.76	4	3.146.=	
Bovisio Masciago	16.11.76/15.12.76	4	3.151.=	
Vari	16.11.76/15.12.76	7	3.192.=	
Seregno	29.7 .76/2 .8 .76	2	502.=	
Vari	16.12.76	10	13.019.=	
Total		70	45.614.=	

Amounts paid in respect of consequential losses due to the destruction of eggs

Commune	Zone	No. of businesses	Amount (in 000 lire)
Meda	C	169	1.987.=
Cesano Maderno	B—C	451	11.781.=
Bovisio Masciago	C	22	293.=
Barlassina	C	3	29.=
Seveso	ABC	483	8.447.=
Desio	B—C	96	3.527.=
Cesano Maderno	B	29	452.=
Cesano Maderno	C	272	7.354.=
Total		1.525	33.870.=

The overall picture of the expenses incurred or liable to be incurred in respect of indemnification measures in the sectors of agriculture and animal husbandry as at 31 May 1978 is therefore as follows:

Item	Consequential damages	Loss of earnings for 1977	Totals
Crops	392,454,000	289,561,000	632,015,000
Vegetable and horticultural gardens	879,600,000	1,046,350,000	1,925,950,000
Ornamental plants	446,306,000	not determined	446,306,000
Animals (already determined)	685,910,000	338,201,175	1,024,111,175
Animals (to be determined)	—	61,301,950	61,301,950
Milking cattle	45,614,000	—	45,614,000
Eggs	33,870,000	—	33,870,000
Totals	2,483,754,000	1,735,414,125	4,219,168,125

The sum of 4,219,168,125 lire has been earmarked by the Region of Lombardy to cover expenditure from the Special Fund, amounting to 3,711,560,000 lire, leaving amounts of 446,306,000 lire for compensation in respect of ornamental plants and 61,301,950 lire for loss of earnings in the animal husbandry sector. It may also be stated that GIVAUDAN has paid in respect of direct compensation for damage to vegetable and horticultural gardens 25,312,040 lire, an amount which is to be added to the overall total damages in the sectors of agriculture and animal husbandry.

- (B) In the industrial sector, the two undertakings present in zone A (ENCOL and COPPA) have claimed consequential losses amounting to a total of 2,014,815,000 lire.

The Region of Lombardy has requested information on the basis of calculation of these losses and a determination of the criteria of appropriate measures to be taken from three Commissions⁽³⁵⁾ and has in the meantime taken steps to establish a method for the

(35) The Regional Commission for the determination of losses, the Regional Advisory Commission and the Technical Advisory Commission for the economy.

systematic allocation of buildings to the two undertakings in question, to permit the restarting of production. All the undertakings in the Region have also received in advance, on account of the sum which will be finally due, 837,189,415 lire and GIVAUDAN, for its part has made an advance payment of 403.5 million lire.

In regard to the ten undertakings in zone B, investigations on the measures to be adopted are still being carried out by the Special Office. No amounts have therefore yet been paid in advance either by the Region or by GIVAUDAN, but it is anticipated that the sum due to these undertakings will amount to 316 million lire.

- (C) In the commercial activities sector, regional programmes have taken into account only the fate of the nine commercial undertakings located in zone A and obliged to suspend commercial activity indefinitely.

Consequential losses have been claimed in respect of loss of merchandise and fittings amounting to 214,607,280 lire.

Expert assessments are being carried out to determine the compensation for these losses in accordance with the criteria drawn up in the programmes, which will make provision for the payment of a "starting fund" and further sums proportional to the income prior to closure and to the rent of new buildings in which to continue activity.

The Technical Advisory Commission for the economy has undertaken to complete the relevant determinations by 31 July 1978.

The company GIVAUDAN, at the same time, has entered into direct relations with the commercial undertakings in question, paying up to now the sum of 170,770,000 lire, while the Region of Lombardy has allocated, again in the form of an anticipatory payment, the sum of 10,000,000 lire.

- (D) In the light industry sector, 37 undertakings were located in zone A and 121 in zone B.

Pending the drawing up of operational programmes and the criteria proposed by the three Commissions referred to above, the Region of Lombardy has adopted up to now the following measures in favour of the undertakings in question:

- (1) for the 37 undertakings in zone A (which have claimed consequential losses of 1,274,493,000 lire): the allocation as a matter of urgency of 37,000,000 lire, representing amounts of one million lire for each undertaking as an advance payment on the extent of the losses which will in fact be determined; an allocation of 772,769,000 lire (limited up to now to 24 undertakings), equivalent to 70% of the claimed losses, again in the form of an advance payment. Investigations are still being carried out in relation to the remaining 13 undertakings. GIVAUDAN has also paid a sum of 222,739,000 lire to 23 of the 24 undertakings in question,
- (2) for the 121 undertakings in zone B, investigations are still being carried out and in consequence the Region of Lombardy has up to now only been able to make an advance payment of one million lire to each of 79 undertakings.

The Region of Lombardy has also made the following advance payments:

- 1,993,754,000 lire for the acquisition and conversion of the Iso Rivolta and Gomma-Gomma buildings, intended for various undertakings and industries which have been transferred;
- 306,858,000 lire for publicity in the press and for participation in the Arte-Casa exhibition at Locano.

Section V

General summary of the losses and indemnification referred to in the preceding sections

The table below shows a breakdown of all the losses and amounts of indemnification referred to above.

General summary of the losses and amounts of indemnification set out in the preceding sections (as at 31 May 1978)

Nature of measure	Amount of losses claimed	Amounts paid in respect of losses			Remarks
		by the Region	by Givaudan	Total	
Evacuation of minors	869.900.000	869.900.000	—	869.900.000	Nos. assisted up to 31.5.78: 6396
Evacuation of pregnant women	23.600.000	23.600.000	—	23.600.000	" " " " " 39
Evacuation of the elderly	170.400.000	170.400.000	—	170.400.000	" " " " " 796
Systematic accommodation of families evacuated from the contaminated zone	2.044.674.000	1.797.674.000	247.000.000	2.044.674.000	" " " " " 736
Establishment and administration of day centres	552.100.000	552.100.000	—	552.100.000	" " " " " 1030
Establishment and administration of nursery schools	282.600.000	282.600.000	—	282.600.000	" " " " " 110
Transport services	44.900.000	44.900.000	—	44.900.000	
Evacuation of school age population	1.626.800.000	1.626.800.000	—	1.626.800.000	
Exceptional payments to private individuals	16.900.000	16.900.000	—	16.900.000	Purchase of milk powder
Decontamination of ground, buildings and furniture (zone A6 — A7)	2.803.000.000	—	2.803.000.000	2.803.000.000	Amount paid by Givaudan
Compensation for furniture and chattels, unsuitable for decontamination (zone A6 — A7)	1.511.000.000	—	1.511.000.000	1.511.000.000	" " " "
Compensation for privately owned buildings, unsuitable for restoration (zone A1 — A5)	4.215.422.308	—	—	—	Compensation will be paid directly by Givaudan, as agreed with the Special Office on 14.6.1978
Compensation for agricultural crops	682.015.000	682.015.000	—	682.015.000	Affecting 80 establishments

Nature of measure	Amount of losses claimed	Amounts paid in respect of losses			Remarks
		by the Region	by Givaudan	Total	
Compensation for vegetable and horticultural gardens	1.951.262.040	1.925.950.000	25.312.040	1.951.262.040	Affecting 4379 establishments
Compensation for ornamental plants	446.306.000	---	---	---	Not yet paid
Compensation for animals	1.085.413.125	1.024.111.175	---	1.024.111.175	To be determined for 44 establishments, amounting to 61, 301, 950 lire
Compensation for milking cattle destroyed	45.614.000	45.614.000	---	45.614.000	Affecting 70 establishments
Compensation for eggs destroyed	33.870.000	33.870.000	---	33.870.000	Affecting 1525 establishments
Compensation for industries, zone A	2.014.815.000	837.189.415	403.500.000	1.240.689.415	Affecting 2 establishments
Compensation for industries, one B	316.000.000	---	---	---	Investigations in hand by the Special Office: affecting 10 establishments
Compensation for commercial activities	214.607.280	10.000.000	170.770.000	180.770.000	Investigations in hand by the Special Office: affecting 9 establishments
Compensation for light industry, zone A	1.274.493.000	809.769.000	222.739.000	1.032.508.000	Affecting 37 establishments
Compensation for light industry, zone B	Data being collected	79.000.000	---	79.000.000	Affecting 121 establishments
Acquisition and conversion of building intended for various undertakings evacuated from zone A	1.993.754.000	1.993.754.000	---	1.993.754.000	
Publicity and promotional campaigns	306.858.000	306.858.000		306.858.000	

Nature of measure	Amount of losses claimed	Amounts paid in respect of losses			Remarks
		by the Region	by Givaudan	Total	
Compensation to owners of rented accommodation in zone A, for loss of rent from persons evacuated as the result of the contamination	25.744.285	—	25.744.285	25.744.285	Affecting 46 accommodation units
Compensation to private individuals for loss of earnings as the result of assistance with the work of reclamation on their own property	2.759.800	—	2.759.800	2.759.800	Affecting 35 persons
Compensation to undertakings, rendering services within ICMESA on behalf of the firm	117.926.280	—	117.926.280	117.926.280	Affecting 15 establishments
Payment of amounts by ICMESA to its own staff with no corresponding services and various expenses incurred on the placing of staff with other firms	2.000.000.000	—	2.000.000.000	2.000.000.000	Information provided by Givaudan to the Special Office for 'Seveso
Compensation paid in respect of chattels and furniture unsuitable for decontamination in zone A1 – A5	601.780.000	—	601.780.000	601.780.000	Affecting 56 establishments
Totals	27.272.014.118	13.133.004.590	8.131.531.405	21.264.535.995	

Note To the amounts paid by Givaudan, amounting to 8,131,531,405 lire, we have to add 2,000,000,000 lire paid by Givaudan to the Region of Lombardy as a payment on account for possible compensation. The complete figure paid by Givaudan thus amounts to 10,131,531,405 lire.

The preceding table shows that the losses listed in the previous sections, as claimed up to 31 May 1978, amount to 27,272,014,118 lire, of which 21,264,535,995 lire, equivalent to 78% of the total, have already been paid. The table also shows that the details of payment of a proportion of the losses are still being worked out. The Commission concludes from this that no further legislative measures are required in this connection by the central and regional authorities.

Decisions on the amounts to be paid by way of compensation by those responsible for the disaster will be made - as has already been stated - by the normal courts. It should be borne in mind, in connection with the payment of these amounts, that arrangements were made under Act No. 339 of 2 June 1978, whereby the Region of Lombardy was appointed as substitute in respect of the rights of persons suffering damage, within the limits of the sums paid in advance by the Region itself.

The Commission has been notified that the Region (like other bodies and individuals) is participating as civil party in the criminal proceedings before the Court of Monza and also that the State itself is participating in respect of losses directly sustained by the Treasury and Health administrations.

In any case Italian judicial procedures and international agreements will enable suitable means to be found for obtaining concrete payment for the losses suffered for which no liability can be established.

Section VI

Considerations affecting further elements of loss

The Commission is aware that the data set out above are not comprehensive either in regard to the effects of the incident of 10 July 1976, or of the measures of intervention required. The incident has in fact necessitated, and continues to do so, large-scale measures for reclamation of the environment, experiments, studies, research, health measures and public works, involving exceptionally high costs.

The five operative plans of the Region of Lombardy, to which reference was made in Section II of the fourth part of the Report, which attempt to set out in quantitative terms these elements of the losses sustained, over and above those shown with a detailed break-down in Sections II, III and IV, estimate the overall costs of compensation, restoration and reclamation measures at 121,635,866,606 lire.

The Commission is not in a position to verify directly the correctness of the data supplied by the Region of Lombardy. Nevertheless, having examined the break-down, shown below, of the forecast expenses on the five operative plans, the Commission believes that these plans will meet real requirements arising out of the incident of 10 July 1976.

Operative plan No. 3

Provision of accommodation for the evacuated population	2.512.600.000
Temporary hotel accommodation	1.244.552.995
Establishment and administration of day centres	1.993.463.350
Establishment and temporary administration of nursery schools	450.000.000
Transport services	132.095.070
Temporary evacuation of minors, pregnant women and the elderly	4.206.090.194
Full-time schooling	4.049.781.680
Emergency measures for the temporary evacuation of schools to permit reclamation work	213.000.000
Exceptional payments to private individuals	115.000.000
General expenses	80.498.600
General expenses (Seveso)	57.472.500
General expenses (Meda)	5.000.000
General expenses (Cesano M.)	2.500.000
General expenses (Desio)	2.500.000
Total	15.064.554.389

Operative plan No. 2

Regional measures	4.383.912.400
Measures by the Zonal Health Committees (C.S.Z.)	2.920.296.000
Co-ordinating body	285.000.000
University research institutes	1.777.500.000
Hospitals and scientific institutes	5.656.919.490
Health checks of the population, delegated to district administrations	268.472.000
Experimental research: stables	125.000.000
Veterinary sector within the regional competence	427.253.020
Veterinary sector, delegated to district administrations	495.000.000
Emilia Institute of Zooprophyaxis of Lombardy	303.000.000
Various charges – Contingencies	1.500.000.000
Total	18.142.352.910

Operative plan No. 1

Situation as at 30 June 1978:

Work administration infrastructure	2.558.642.885
Protection of workers	5.814.151.205
Fencing	1.898.000.000
State of roads	3.311.000.000
Removal of vegetation	4.239.000.000
Scarification	5.421.000.000
Reclamation of external appurtenances	1.611.000.000
Reclamation of schools	4.839.262.808
Protection of the Certesa	625.000.000
Transfer of carcasses	34.000.000
Rat elimination	1.192.000.000
Treatment of agricultural areas	4.040.000.000
Restoration of vegetative covering	1.116.000.000
Burning of contaminated material	15.869.000.000
Experimentation	860.000.000
Planned supervision	1.357.000.000
Analytical determinations	8.267.220.580
Studies and research	3.352.130.170
Total	66.404.407.648

Operative plan No. 4

Reconstruction of dwellings, unsuitable for restoration	3.893.000.000
Construction of an iron bailey bridge on the state railways in the district of Meda (Measure No. 2)	100.864.000
Extension of existing building for civic services in the village of Baruccana in the commune of Seveso (Measure No. 3)	140.000.000
Reconstruction of pipes for the aqueduct connecting to a site in zone A of the commune of Seveso (Measure No. 4)	18.000.000
Fitting out of outpatient clinics in the communes of Seveso and Meda (Measure No. 5)	774.000.000
Exceptional treatment, carried out on privately owned buildings during reclamation (Measure No. 6)	650.000.000
Establishment of a nursery school in the commune of Seveso (Measure No. 7)	200.000.000
Construction of communal sporting installations, the previous installations being unsuitable for restoration and required for re-establishment of sporting activities in the commune of Seveso (Measure No. 8)	1.950.000.000
General expenses	100.000.000
Total	7.825.864.000

Operative plan No. 5

Agricultural sector	3.513.410.289
Light industry sector	6.367.328.770
Commercial sector	214.000.000
Industrial sector	1.453.948.600
Vegetable and horticultural gardens	1.330.000.000
General expenses	800.000.000
Total	13.678.687.659
General services	520.000.000

A final element to be taken into consideration for an exact determination of the amount of compensation is that of the injury to the person. The contamination gave rise in fact to a temporary disability to a few hundred persons and probably permanent sequelae in some of these; there is also, as far as can be seen, a possibility of future injury. It is obviously impossible to put a figure on biological damage of this type, but the Commission feels bound to draw attention to it. This aspect has also in some cases been the subject of actions for compensation.

Sixth Part

Proposals for a more effective system of regulations

Introduction

In the present part of the Report, the Commission will deal with that part of its terms of reference covered in Article 3 of the Instituting Act, which requires the Commission to formulate "proposals for a more effective system of regulations for the protection of the health of workers and the public, of the balance of the natural environment, and for ensuring adequate services and effective controls".

When dealing with this aspect, the Commission has taken into account the matter which has emerged in general from the course of the enquiry, and also the documentation submitted in connection with "the cases of contamination occurring at Manfredonia and Priolo-Melilli", referred to in the agenda item voted by the Senate on 8 June 1977 and also in the first part of the present Report⁽³⁶⁾.

The aim here was to provide Parliament, in the light of foreign legislation of this type and the most highly qualified contributions to this subject, ^{with} a number of indications of the possible content of such regulations and even more so a method of attacking and solving so complex a problem and one with such immediate implications.

This necessitates a critical analysis of the regulations at present in force in our country, so as to establish their limits with particular reference to organization, efficiency and application in concrete cases. The enquiry on the incident of 10 July 1976, and on its consequences has demonstrated that our system of regulations is fragmentary, confused, complicated and above all, incomplete. The nature of the regulations was in fact liable to promote or increase industrial risks or aggravate the consequences of possible disasters.

This emerges particularly clearly from the fact that the organizations concerned with the problem of safety and their powers are frequently set up on a "piecemeal" basis and uncoordinated, so that it is not easy to determine the role and in consequence the responsibility of each.

(36) In these cases of contamination, which were not moreover included in the Instituting Act, the Commission has not carried out any investigations, but has merely taken from the Ministry of Health and Ministry of Labour and Social Security their reports, which are attached complete (Annexes XIII and XVI), which thus constitute "elements to be taken into account", as laid down in the agenda item of the Senate.

The Commission has found in particular an enormous gap in connection with the prevention of so-called "major industrial risks". It is therefore desirous of drawing the attention of Parliament to this aspect in particular, with a view to future legislative measures.

The Commission is however unable to put forward precise and detailed draft regulations; it can only suggest a number of guiding principles (or reference points) within which a debate on the social issues will have to be held, involving the political forces, social parties and the public in general. Account has of course been taken of the state of development of plans and proposals, which have been already proposed at different institutional levels and are under discussion, in order to provide indications on levels of security administration, based on the existing state of the local authorities (which are however in course of rapid and not easily foreseeable evolution).

Within these limits, the Commission believes that its work may make a useful contribution for further discussion and consideration, so as to enable the Parliament of the Republic to lay down as soon as possible, the principles and practices, the instruments and organizations which will enable one of the most disquieting problems of contemporary industrial life to be solved.

Section I

Italian legislation

1. General recognition of the standards currently in force

The number of statutory texts in the field of safety (an approximate estimate is 1243) is such as to make it difficult to refer to them and indeed even more to incorporate them in a systematic view of the situation. If we then examine only the most significant regulations, they nevertheless present a picture, in their characteristic heterogeneity, of a return to the pursuit of multiple and uncoordinated aims.

Leaving aside the Acts of the Constitution – in particular Articles 32 and 35 which raise a primary conceptual problem in regard to the coordination of the protection of the citizen and that of the worker as such – we have to consider, in the category of regulations of a general nature, the provisions of Articles 2050 and 2087 of the Civil Code and those of Articles 437, 451, 589, second paragraph, and 590, second paragraph of the Penal Code. To these we have to add Article 9 of Act No. 300 of 1970 which attributes to workers' representatives certain powers in checking the application of preventive regulations and regulations promoting research on, and the development and implementation of, all measures for the safeguarding of the physical safety of the individual.

Royal Decree No. 773 of 1931 (the only legal text on public safety) provides *inter alia* special principles for monitoring and control in regard to the prevention of accidents and to industrial hygiene.

Articles 216 and 217 of the single text of the health regulations, approved by Royal Decree No. 1265 of 1934, give the trade unions power of control and intervention in regard to industrial safety and industrial hygiene.

Royal Decree No. 383 of 1934 (single text of communal and provincial legislation) contains a number of regulations, giving the urban district authorities competence in regard to the construction of buildings, the production, storage, sale and use of flammable, toxic and infectious substances; it also recognizes the powers of the trade unions in regard to industrial safety and hygiene, authorizing the latter to put in hand any necessary work and charge the costs to the person who has failed to take the necessary measures.

Reference should also be made to Royal Decree No. 147 of 9 January 1927, with subsequent amendments, which contains regulations relating to the custody, use and storage of toxic gases.

Act No. 51 of 1955 delegated to the Government the power to issue general and special regulations in regard to accident prevention and industrial hygiene, with the following exclusions: services and installations managed by the State Railways and the Ministry of Posts and Telecommunications, the exercise of public transport on land, sea and air, and finally safety in quarries and peat diggings. Presidential Decree No. 547 (consisting of 406 articles), also issued in 1955, provided for implementation of the preceding Act and dealt in general lines with the prevention of industrial accidents. This is a predominantly technical text covering, by means of special regulations, the different industrial sectors, machinery, plant, equipment, tools and apparatus, providing mechanisms for bringing the regulations up to date in the light of the evolution of technology. The range of application of the regulations is such as to cover all activities on which subordinate workers are employed. The regulation contains provisions laying down the individual obligations of employers, directors and managers, the duties of workers and the obligations of builders and merchants. It also sets up advisory, monitoring, authorizing and supervisory bodies and contains in addition a series of penal provisions. In implementation of the same Act No. 51, Presidential Decree No. 303 of 1956 (consisting of 70 articles) contains general regulations in regard to industrial hygiene with a range of applications similar to the preceding decree, covering in addition the State Railways and privately managed railways under concessionary regimes.

Presidential Decree No. 128 of 1959 (consisting of 692 articles) contains the police regulations in relation to quarries and mines, issued by virtue of Act No. 128 of 1958. This sector also is covered therefore by a detailed system of regulations of a technical nature. Of particular relevance here are the powers of inspection given to the mining authority.

A text of particular interest is Presidential Decree No. 185 of 1964, relating to the safety of industrial plants and the protection of the health of workers and the population against dangers from ionizing radiation resulting from the peaceful uses of nuclear energy. This is probably the most complete reference work, from the point of view of safety criteria, relating to the protection of workers and the public.

Act No. 996 of 1970 contains regulations on aid and assistance to populations, afflicted by disasters, and provides for coordinated measures by the various organizations and bodies concerned, either in the field of scientific study, research and programming or from the operational aspect, based on the hypothesis of natural disasters or catastrophes.

Act No. 319 of 1976 relating to the protection of waters against contamination, lays down the specific fields of competence in this connection between the State, the Region and the local authorities.

Reference should be made finally to Presidential Decree No. 616 of 1977 in implementation of Act No. 382 of 1975 which, in the course of transferring administrative functions from the State to Regions, touches on aspects of significance in connection with the safety of the living environment and the industrial environment (in particular in Articles 27, 30 and 62).

2. Institutional references

The fragmented and multiple character of the relevant regulations is accompanied by a correspondingly fragmented distribution of powers between the central authorities, public organizations and local authorities. Reference will be made to some of the more significant powers, to provide the background for a critical assessment of the position.

The Minister of labour and Social Security is broadly and generally competent in regard to accident prevention and occupational diseases and is also responsible for inspection and the control of the application of accident prevention regulations; these powers are exercised by the inspectorate of labour and its regional and provincial sections. The Minister of Labour is also chairman of the Standing Commission for Accident Prevention and Industrial Hygiene, which exercises consultative functions and puts forward legislative proposals.

The Ministry of Health, pending completion of the reorganization of the health service, has general powers in regard to public health and hygiene, and also in regard to the prevention of accidents and occupational diseases. The Minister makes use of the services of the Higher Council of Health, which also enjoys powers in connection with study projects and research.

The Ministry of Health exercises important control and inspection functions in connection with atmospheric pollution. Act No. 615 of 13 July 1966, relating to measures against atmospheric pollution, established (in Article 3) in the Ministry of Health a Central Commission against atmospheric pollution, with the following terms of reference:

- (a) to examine any material pertinent to atmospheric pollution,
- (b) to express an opinion on any questions relating to atmospheric pollution, submitted to it for examination by public and private bodies,
- (c) to promote studies and research on problems affecting atmospheric pollution.

On the basis of all the above legislation, a regional committee against atmospheric pollution was set up in each provincial capital, to advise the provincial medical officer.

The Ministry of Internal Affairs, within the framework of its responsibility for public safety, has powers in connection with the production of dangerous substances, and also their storage and use. These powers, within the limits imposed on the public administration by the provisions of Presidential Decree No. 616, are exercised by means of the provincial administrations under the prefect, the magistracies, the police and the fire brigade.

The Ministry of Industry, Trade and Light Industry, exercises powers under Presidential Decree No. 128 of 1959 in regard to the policing of mines and quarries. The Ministry can also make use of advisory organs, such as the Higher Council of Mines and the Technical Committee on Hydrocarbons.

The Ministry also exercises a very important function of preventive control in regard to the planning of technical installations for the generation and transmission of high-voltage electric power. Plans submitted to the Ministry have to be accompanied, in fact, by a detailed technical documentation, showing the safety measures for the protection of the environment, with particular reference to noise, vibrations and waste water purification, including systems for the detection of atmospheric pollution (Act No. 880 of 18 December 1973, Article 4). In the execution of these functions, the Ministry makes use *inter alia* of opinions expressed by the Central Commission against atmospheric pollution.

The Ministry of Public Works, by virtue of the provisions of Act No. 319 of 1976, takes the chair in the ministerial committee which exercises the powers of the state in connection with water pollution.

The independent administrations of the State Railways, the Ministry of Posts and Telecommunications and the Ministry of Transport, also have specific powers in this connection, within the limits laid down in the relevant legislation or regulations.

The Regions, again by virtue of Article 27 and also Article 62 of Presidential Decree No. 616, also enjoy powers, the effective exercise of which is to some extent suspended, pending approval of the legislation on the reorganization of the health service, i.e. until 1 May 1979.

Urban district (commune) administrations are also competent for the activities of the administrative police under Article 19 of Presidential Decree No. 616. The sanitary inspection service is also a local responsibility under the provisions of the same Decree.

A wide range of public bodies of various types are also competent in this connection. Some of these, which have a particularly important part to play, are referred to briefly below. In the first place ENPI (National Accident Prevention Organization) is competent for research and technical advice to organizations and undertakings, at whose request it undertakes

periodical visits in connection with accident prevention; it is also responsible for approving and inspecting plant and machinery, unless this function is reserved to the central administration; it is also competent in the field of training and publicity, and also professional guidance.

INAIL (National Institute for Industrial Accident Insurance) has an indirect part to play in stimulating compliance with accident prevention measures, by varying the insurance premium in accordance with a number of factors relating to safety in the undertaking. To this end, the organization carries out investigations and control checks to determine the mean risk and, in case of accident, establishes the circumstances in order to determine liability. It is also competent in this connection for the collection of statistical data.

ANCC (National Combustion Control Agency) supervises the application of the regulations relating to the safety of vapour and gas pressure vessels, apparatus and combustion plant, both during the construction phase and during installation and operation.

CNEN (National Committee for Nuclear Energy) has powers of inspection of activities associated with nuclear energy generation and the handling and utilization of the relevant substances; it controls and inspects nuclear plant during the construction and operating phases and issues the necessary authorizations. It also has powers of control in connection with the protection of the population and of workers against radiation risks.

The CNR (National Research Council), as a research centre, performs its functions in the prevention of occupational diseases and industrial accidents. It cooperates with study and research centres and also with associations and committees operating in the various sectors concerned.

RIN (Italian Naval Register) controls and supervises naval construction and exercises functions in relation to safety on board.

RAI (Italian Aeronautic Register) performs general functions in regard to the safety of aerial navigation.

Reference should be made finally, among many others, to the Italian Institute of Social Medicine which is responsible *inter alia*, on the basis of the instituting act, for the study of medico-social aspects of human work, in connection also with social insurance and assistance systems.

3. Critical analysis of the various sources of authority

The excessive fragmentation of the relevant regulations gives rise in the first place to very great difficulty in recognizing, and in consequence being familiar with, the regulations in force; this obviously makes it impossible to form a clear idea of the position and difficult to evaluate the adequacy of safety measures.

In the second place, the existence of so large a series of regulatory provisions, which have furthermore been issued at different times, brings out clearly the absence of homogeneity in the underlying criteria and the frequent contradiction between individual provisions and makes it impossible to discover the aims of the proposed system of protection. This situation appears even more serious where the object of protection is the environment itself, which combines in its multiple components (water, air, soil and installations) a unity which should be taken into account in any programme of legislative and administrative measures.

All this gives rise to a serious difficulty of interpretation on the part of the administrative organs, each of which is responsible for a particular sector, and also on the part of the courts themselves.

The multiplicity of administrative organizations is obviously an inherent cause of disorder and prevents the implementation of a serious system of protection, especially since the situation is aggravated where each of these organizations exercise frequently burdensome and confused powers of inspection and advisory competence. This latter fact is of course liable to give rise to contradictory positions, if indeed it does not paralyse the activities of the relevant public institutions.

The proliferation of different organizations is accompanied by a heterogeneous and fragmentary data collection system which, instead of being directed toward meeting unified aims and requirements, is based on the institutional requirements of each organization (the activities of INAIL, for example, which has one of the most up to date data collection systems, are concerned solely with insurance problems associated with industrial accidents).

The present system, furthermore, only meets with extreme difficulty and a number of serious gaps, the requirements of the community and has very serious repercussions on the circulation of goods (for example, obstacles are placed in the way of the exportation of machinery, instruments and tools, which do not comply with European legislation).

It is to be noted, finally, that there is no machinery for trade union organizations and other social elements to participate directly in the formulation of regulations and in the control of their implementation. This particular aspect has formed the subject of comment and proposals in the European community.

In general terms and anticipating some of the proposals which will be formulated below, the most serious deficiency in current regulations is the absence of any provision - in connection with dangerous plant, installations, machinery, apparatus and tools - of an integral system of authorization during the stages of planning, construction and operation of the plant, so as to ensure adequate control before it is brought into operation, and also means for ensuring periodical control checks, with an exact indication of which organs are competent in this connection. This procedure, for which specific provision is made in particular sectors (Presidential Decree No. 185 in regard to protection against ionizing radiations; Act No. 1415 of 21 October 1942, and Presidential Decree No. 1767 of 24 December 1951, in regard to permits to install and operate lifts and hoists in private service; Act No. 880 of 18 December 1973 in regard to thermal electricity generating plant and the corresponding high-voltage transmission system; the Ministerial Decree of 16 July 1975 in regard to the authorization of the operation of radio and television diffusion equipment and repeater equipment for the transmission over the ether of external and national television programmes), has not been included in the most important existing regulations on industrial safety and hygiene, such as Presidential Decrees No. 547 of

27 April 1955, No. 302 of 19 March 1956, No. 303 of 19 March 1956 and the corresponding special regulations.

4. Drafts and proposals at present under discussion

Reference should be made among the drafts and proposals which may affect to some extent the subjects of safety and the prevention of industrial risks – restricting the list to those of principal concern – to the proposal for the establishment of a national hygiene service, either on the basis of a central body or by the distribution of the powers thus allocated between the state, regions, provinces, districts and local health units. Article 21 of the unified text, at present under examination by Parliament, makes provision for the establishment of a Higher Institute for the Prevention of Industrial Accidents and Industrial Safety, which will be responsible *inter alia* for the development of accident prevention techniques and the determination of safety criteria and data collection methods. Article 22 makes provision for the passing of a national Act in regard to industrial hygiene and industrial safety in accordance with the directives of European organizations and taking into account the experience of other countries.

One proposal which, at the instance of the President of the Council, is being worked out by the Ministry of Health in conjunction with the Ministry of Labour and Social Security, on the basis of a scheme proposed in the directive by the European Economic Community, is directly pertinent to the subject of major industrial risks.

The Confederation of Industry has also collected in documentary form, certain views on industrial risks.

The trade union movement has also prepared a number of suggestions in a document presented to Parliament during discussion of the reorganization of the health service.

Reference may be made finally, at the international level, to contributions by the OECD and the United Nations.

Section II

Foreign legislation, with particular reference to the industrialized nations of Europe

1. Method adopted in this survey

In order to undertake a survey, even on broad lines, of foreign legislation on accident prevention and major risks in industrial plant, it is necessary first of all to draw attention to the diversity, and in consequence the absence of comparability in an absolute sense, of the constitutional and administrative systems of the countries to which reference is made here, and to emphasize also the different levels of development of technological and industrial structure.

It is of interest to note that the legislation most directly pertinent to the present subject is of recent origin and is the fruit of a long cultural development, starting during the years 1968 - 1970 as a result of an incident of the type occurring at Seveso. In consequence of the serious incident which occurred on 1 June 1974 at Flixborough in Britain, the Minister of Employment ordered a public enquiry into the causes and circumstances of the incident, suggesting at the same time that the enormous problem, created by technological development, should be examined by a Committee of Experts, which would then report to the Health and Safety Commission, set up at that time in application of the new Act on industrial safety and industrial hygiene. The Committee's terms of reference included also the formulation of proposals to prevent the occurrence of similar incidents.

Since these foreign regulations are of recent date, it is not possible to express an opinion on the implementation and the concrete effectiveness of the legislative provisions.

Although the Commission is satisfied that the study of the relevant foreign legislation can provide valuable information for the formulation of proposals for a similar effective system of regulation within our legal framework, it should be pointed out that,

as has happened in other cases, the introduction of the most restrictive regulations from foreign legislation can result in the formulation of inapplicable regulations, especially in view of the technological levels obtaining in Italy. It is important at the same time to prevent our country becoming the priority location for high-risk industries as a result of too permissive regulations.

A satisfactory solution to these aspects of the problem will of course be found, when the subject in question is effectively regulated by the European Community. This is at present the subject of a draft proposal, the preparation of which is proceeding rather slowly, mainly due to the complexity of the subject.

It may be pointed out, finally, that many people have realized, as a result of the application of the regulations in some of the countries of Europe, that the law is one of the important factors (but not the only one) in providing protection against major industrial risks: the contribution and participation of the public, of the social parties and the public administration, represent in fact cardinal elements in the effective implementation of a safety system.

2. Implicit criteria in the legislation under examination

The first characteristic, common to all the legislation examined, is that it contains solely matters of principle, in other words, the regulations indicate aims and lay down a wide range of methods to achieve these aims.

These fundamental regulations consist of regulations in the field of applied technology, produced by centres which are particularly well qualified in the technical field, and are characterized by extreme flexibility. In almost all cases the regulations are contained in specific texts, which are separate from those containing provisions relating, on the one hand, to industrial hygiene and, on the other, to the protection of the environment, although obviously provisions relating to one or other of these subjects may also be contained in the regulations.

A particularly interesting aspect is the fact that the legislator, in addition to dealing with the activities of the public authorities, calls for and requires forms of responsible collaboration and participation by the public and the social forces.

A further common characteristic is that all legislations rightly regard the problem of the prevention of major industrial risks as a problem of national scale and concern, even though the local authorities are to some extent concerned, depending on the various powers attributed to them.

Another common and fundamental aspect of the legislation under examination is its pragmatism: it deals with the subject of "major risks" on the basis of concrete principles and "a judicious approach", without including abstract and general considerations which do not contribute to efficiency or affect the existing situation which forms the background for the application of the regulations themselves.

A further but no less important criterion is the provision of a series of protective rules, which are intended to be brought into concrete operation on a gradual basis.

3. Range of application of the regulations

There appears to be a measure of difference in the range of application of the regulations which have been examined: some in fact deal only with the planning and operation of the plant itself, while others are concerned with the substances produced, others with individual items of machinery and others again with the transport and processing of the substances themselves.

Certain substances and certain types of plant, for example nuclear plant and those engaged on national defence, are excluded from liability to the provisions of the legislation under examination. A distinction is always made between plants and/or substances involving major or minor risks.

4. Subject of the protection provided

The subject of protection is obviously in the first place man, considered in his double capacity as a worker and citizen, involved in the industrial installation. In the second place, the regulations are intended to protect the ecological equilibrium in its various aspects (water, air, ground).

We have to point out how little consideration is given to the socio-economic environment: the regulations do not in principle pay sufficient attention to the effects which the anticipated catastrophes of disasters may cause in the socio-economic sphere.

The public interests requiring protection are the public and individual health and hygiene and in addition the harmonious and ordered development of the system of production. Reference is also made to the protection of interests directly involved in public safety, which can obviously be prejudiced by incidents such as those which have repeatedly occurred.

5. Instruments of policy

In this paragraph we shall indicate in very summary terms the institutions, for which alternative or cumulative provision is made in the various legislations, without referring in detail to individual systems.

As indicated above, provision is made above all in the regulations of principle for a set of technical rules of general application, to which all workers are intended to be subject. The system of regulations has the secondary aim of restricting subsequently the range of application of some provisions to particular plants or particular substances.

A characteristic feature of the technical regulations is their suitability for modification at any time, where the development of scientific and technical knowledge so requires.

A second type of policy instrument consists of lists prepared by the public authority and indicating plants and/or substances involving major risks, or – and this appears to be an approach of more recent origin – substances, the use of which is permitted ("positive lists").

In some countries, where items of industrial plant or substances are particularly at risk, provision is made for the issue of authorizations which may, in each case, contain specific requirements, or partial or provisional requirements. Where the substances and plant, although included in these dangerous categories, are sources of only minor risk, provision is made merely for a notification to the authorities by the person responsible, coupled with compliance with the technical regulations referred to above.

The system of authorizations and notifications is replaced in some countries by a so-called notification of requirements or prohibitions: in case of contravention of the technical requirements, the illegal behaviour is punished by closing of the plant.

A common factor in all countries, where the legislation was examined, was the obligation on operators to comply with the general and more particularly technical regulations, and to maintain adequate documentation in regard to the system of production and the substances undergoing processing.

An element of particular interest was the provision made for a form of "popular action", which enabled any citizen to take judicial proceedings in respect of the relevant regulations.

6. Organizations responsible in the sector

Returning to the question of the relative comparability of these data on regulations, we find that all the legislative provisions, which were examined, confer on a central authority powers in relation to safety and the prevention of danger due to industrial plants.

In some cases the legislation includes the establishment of ad hoc organizations consisting of scientifically and technically qualified personnel. It is important to emphasize in this connection the measures taken both for the planning of applied research, and also for the

training of technical personnel at all levels. A distinction is also made between the political and the technical levels and a further distinction between the latter and those responsible for the inspection and control of the application of the regulations.

The institutional central authorities (ministers and consultative councils or committees) also possess powers which are normally exercised on the basis of information provided by the technical bodies referred to above. Provision is also made in some cases for administrative measures by peripheral organs of the state authority.

Some regulations provide for an individual known as the "qualified expert", responsible for the safety of the plants; he is an employee of the firm, but in a special position and with a legal status, which protects him in his relations with the employer and renders him responsible, vis-a-vis the public authority, for compliance with safety regulations.

The effective application of the regulations is checked by means of a coordinated system of inspections, which are sufficiently wide-ranging and flexible to guarantee their functional efficiency.

Finally, the judicial authorities have a particular part to play among the public authorities responsible for this sector; the intervention of the courts forms in some cases an integral part of the measures taken by the administrative authorities (in particular the inspectors), wherever the actions of the latter are disputed by operators.

7. Levels of government

When we consider the distribution of power in this connection between the central and local organs of government, we find once again that in all the legislation under examination the problem has been regarded, in overriding uniformity, as a problem of national character, a problem affecting the interests of the nation as a whole, and in consequence the sphere of the central authority. Nevertheless, an important role is always entrusted to the local government, which is responsible in some cases for incorporating its own regulations in the

framework of the national regulations. Provision is made in general terms for the local bodies to provide by means of administrative control and inspections, a form of "support" for the central authority.

In the field of land planning, however, the local authorities have a decisive part to play since they are principally responsible for implementing a system of safeguards in connection with risks deriving from industrial plants. These measures at the planning level, as will be shown in the section dealing with this aspect, are obviously an essential preliminary to any subsequent activity under the safety legislation.

8. Penal regulations

The system of penal sanctions is a graduated one, covering specific forms of behaviour both by private and public operators, which are liable under the regulations to both administrative and penal sanctions. It is important to emphasize this aspect, since the lack of specific penal provisions is one of the factors which renders difficult the application of the regulations in order to ensure safety.

Particular importance attaches to measures of a preventive or cautionary character – such as the temporary or partial closing of plants – which provide the public authorities with flexible means of intervention, so as to ensure a proper compliance by private operators with all the statutory provisions.

It is well known that the prevention of risks due to industrial plants is complicated by the question of industrial information being confidential; foreign regulations appear to be adequately capable of guaranteeing secrecy for the industrial operator by the provision of graduated penalties for any violation of industrial secrecy.

Section III

Background history

1. Experience gained by operators

The following considerations are derived from a number of studies and also in particular, from the evidence of research workers and operators, whose views were heard by the fourth working group of the Commission. These contacts, which made an extremely useful contribution to the work of the Commission, brought out clearly the fact that in our country there has always been a lively discussion on this subject, with an attitude of progressively increasing awareness on the part of the public and also of the more sensitive local authorities, reflected in a wide range of measures.

This background provides, therefore, the necessary basis for the building up of a new organic legislative and administrative system.

Opinion is unanimous on the absolute inadequacy of current Italian legislation for the reasons given above. The most disconcerting fact to those aware of the problem of risks in connection with industrial plants is that our legislation, although providing reasonably adequate regulations for dangerous plants such as nuclear installations, has no specific provisions for other plant which is at least equally dangerous.

We can find historical evidence of this when we remember that during the war, although information was available on the damage and disasters which could be caused by the use of nuclear energy (sic), populations were not warned of the no less serious risks due to other apparently less harmful plants.

On the other hand, the realistic point has been made that the production process cannot be analysed and described in every aspect, even though it is theoretically predictable and therefore subject to control. It is important to remember that, even apart from problems associated with industrial secrecy, it is impossible to subject the

whole process to a form of regulation and in consequence safety is achieved not only by legislation, but also by various specific forms of intervention, which will be indicated below.

It is reasonable to say in general, that the views of operators are concentrated on the following points, which obviously constitute the frame of reference for a future legislation:

- (a) location and planning of plants,
- (b) production technology and operation of plants (reliability),
- (c) rationalization of the production environment,
- (d) costs of safety in plants,
- (e) costs of "non-safety".

2. Costs of safety incurred by firms and the public

One of the most delicate aspects, which has to be taken into account when considering regulations in regard to industrial risks, is obviously the costs which are liable to be incurred by the public authorities, private operators and the community resident in the vicinity of industrial plants. The costs of safety have therefore to be considered as active costs and viewed in relation to the risk, which it is intended to eliminate, and to the greater productivity of the safety system (and the further point of improving relations of the firm with the public).

From the point of view of the firm the subject of the costs of safety is obviously linked with that of the market for the firm's products, in particular the European market. It has to be pointed out in this connection that the inadequacy in some sectors of Italian regulations by comparison with those obtaining in other countries of Europe (with in certain cases correspondingly more strict regulations for Italian production) necessitates a close examination in all aspects of the problem of the relations between the costs of safety and the values of goods on the international market, since it is important to ensure that we do not have in Italy a situation of lower safety, resulting in the introduction of high-risk industries, the relative costs of which will be borne exclusively by the environment and the local community.

The determination of who should bear the costs of safety is a complex problem, but one which has been openly discussed. It is not possible to indicate here who should bear these burdens and to what extent. The Commission suggests, however, that this aspect should not be considered in isolation, but in close association with a general - and more fully coordinated - examination of public measures in support of industrial activity.

Particular attention should be paid in this context to the effects which the costs of safety may have - bearing in mind the existing structures and economic situation of our productive system - on levels of employment. Consideration should therefore be given to small and medium-sized undertakings, in which the industrial plant represent a source of risk no less serious than plant of larger dimensions, but which will not be in a position to afford the costs of implementing an appropriate system of safety. It is nevertheless clear, if the problem is viewed from every angle and over a longer term, that the updating of safety systems can guarantee increased productivity and in consequence increased employment, and not only in those industrial sectors engaged on the production of safety equipment, plant and systems.

It is also necessary to draw attention to the different ways in which the problem of safety costs affects an existing plant or a new plant: whereas it is difficult from the technical point of view, and represents also an economic burden, to provide adequate safety measures in existing plant, it seems to be generally accepted that the costs of safety are very much lower, where action is taken during the planning stage of the new plant.

3. Professional cadres

The urgent importance of having a cadre of professionally trained safety officers, has been widely emphasized by all those whose views were heard by the working group; this applies also to the requirement, appreciable in our country, of organizations and institutions for personnel trained in institutional responsibilities. The requirement for trained personnel has been put forward both by public and private operators: from the draughtsmen to the plant fitter, all personnel should be technically capable of

performing the specific tasks within their competence.

This will involve, in addition to concrete measures already being put into effect in certain institutions, measures in the field of the professional training of personnel employed in the production process; this will require in turn an improvement in the levels of education in the schools and more particularly in the universities.

We should not however overlook some of the difficulties which will be met during implementation of such measures. It is only necessary to remember the difficulties encountered during the implementation of the provisions of Act No. 185 on nuclear plants over the register of experts for employment as safety officers in nuclear plants.

The aim is therefore to staff public administrations with technical personnel with proper qualifications and in sufficient numbers to perform the tasks entrusted to them.

4. Ground planning and safety

The selection of the site for an industrial plant is undoubtedly the fundamental stage in connection with the prevention of the associated risks. Since everyone is aware that it is insufficient alone to establish the plant in a "remote location", but it is also essential to prevent the associated risks, we obviously require a complete knowledge of the ground, in order to evaluate which types of plant may be installed on it and we also require to know to what extent the sequence of productive installations, located adjacent to each other, can constitute a subsequent source of risk.

An overall knowledge of the ground necessitates therefore the availability of all the relevant data, their storage and updating. Only in this way is it possible to prevent damage to the environment, involving a progressive and irreversible loss of terrain.

All this is perfectly easy in theory, but runs into appreciable difficulties in implementation, when account has to be taken of the different institutional levels primarily responsible for the administration of the terrain. A promising development

in this connection is perhaps the issue of a standard regulation at the national level, enabling local authorities to exercise their relative powers on the basis of unified principles, in order to ensure the necessary level of homogeneity in the particular discipline.

5. The "major risk"

The main subject of discussion in connection with the safety of production installations is certainly that of the "major risk". This is not the best place to analyse the "major risk", especially since it is now the subject of research and examination on an interdisciplinary basis by qualified experts from different sectors. We shall therefore confine ourselves, once again, to indicating a few points of reference which are relevant to the current debate.

Production plant must be conceived as a "system": the separate consideration of individual components should give way to an overall view, covering at the same time machinery, man and environment, in a new and dynamic approach.

Although any human activity involves a risk of damage, the problem is to calculate the nature and probability of the risk. Any reasonable study of major industrial risks has therefore to deal first of all with the problem of reducing the probability of damage and, in the second place, attempting to contain any possible harmful effects by the provision of adequate emergency plans. This is essentially a technical problem. The acceptable limit of the risk involved in any industrial plant (based on the cost-benefit ratio) is on the other hand a political choice, although obviously the decision – in the broad political sense – can only depend on the extent to which technology, properly controlled by the community, can make proposals in regard to feasible safety levels, including the use of alternative systems of production.

Although all this is valid in principle for any industrialized society, a number of elements render the impact of the category of industrial risks known as "major risks" even more dramatic. In particular, the harmfulness of some production processes

or even of complete industries, in which the presence of industrial plant in high concentrations increases the number of persons liable to injury inside and outside the plant, the use of substances with a not fully known mechanism of reaction or interaction in the productive system, the consequent concentration, accumulation and synergism of these substances mean that the subject of the major industrial risk has to be dealt with as one in which the man-machine-environment relationship plays a predominant part. The complexity of the above elements is such, especially in view of their mutual interactions, that an effective level of safety can only be obtained by a far-reaching analysis.

6. Information

It has been stated several times in the course of the preceding observations, that the law is not a sufficiently effective instrument for the achievement of complete safety. The experience of other countries, coupled of course with factors in the field of anthropology and social psychology, have shown very clearly the great importance, in connection with problems of safety, of the provision of information to those employed in industrial plants and to populations in the neighbourhood.

It is of course obvious that a voluntary acceptance of risks is preferable to their involuntary imposition; we are therefore faced with the problem of obtaining the cooperation of the populations most directly concerned with the industrial installation. This has been further confirmed by recent popular measures in connection with nuclear installations in Italy. We have to remember also that the attempt to obtain the participation and involvement of the population is sometimes only motivated by the wish to have a sort of alibi for a choice which has already been made.

The subject of information is obviously a complex one, involving not only the public but also the undertaking. The latter is responsible for knowing every aspect of the plant and for placing this knowledge at the disposal of the public authority so as to

permit adequate emergency plans to be made, and also for providing information to the workers. The workers have in fact a privileged entitlement to information on the risks involved in the plant, since they are the first to have knowledge of any indications of a negative nature; it is obvious however, that they should not be the only ones to receive information and at the same time ^{only} the ~~the~~ objects of active encouragement and control. This applies equally in fact to the community in the area where the industrial plant is sited, who should be given the same knowledge and information, subject of course to the safeguarding of industrial secrecy.

7. Data banks

This is not the place to deal, even on a summary basis, with the subject of the use of computers, on which the Commission has received documents and proposals.

All those concerned with industrial safety certainly believe the use of computers to be indispensable, and indeed this has emerged clearly from what has been said above. It is equally clear, however, that the use of the computer for the collection of data relating to plants, systems of production and conditions of work raises problems once again in connection with industrial secrecy.

Section IV

Proposals

1. Principles and information criteria

It was emphasized in the introduction to this part of the report that the Commission intends, rather than providing detailed and specific proposals, to suggest a number of guidelines and to indicate fundamental aims for legislative action, since it is well aware – as a result of a very thorough examination of the material in question – that the subject of the effective prevention of risks due to industrial installations is a very complex one and has even wider implications.

The fact that some aspects of the material in question cannot be the subject of regulation brings out clearly the role and the responsibility in our country, as in other industrialized states, both of the public administration and the courts; employers and trade unions have at the same time a specific part of play in the achievement of industrial safety.

Although within these limits the task of the legislator appears fairly exact, it is also particularly demanding: the task is to provide a system of regulations which, taking into account the high degree of specialization and the rapid evolution of attitudes to safety in industrial plants, ^{is able} to specify the aims to be achieved and to indicate structures and methods for their achievement.

Another relevant problem is that this involves the addition of a new unit to the system of regulations: it would be a serious error to replace an existing fragmentary system of regulations by a new equally fragmentary system. The danger is aggravated by the present phase of the institutional reform of our system of law, in particular by the implementation of Act No. 382 and of a number of reforms, in particular those relating to health, which are at present under examination by Parliament.

Processes of standardization of the regulations of very great importance are at present being carried out in our country, which should be accompanied by a similar process in the field of safety, and, it is to be hoped a corresponding unification of the public structures responsible for the implementation of an effective safety system.

It is therefore desirable to make use of the dramatic and regretted incident of 10 July 1976 as a starting point for a far-reaching discussion on the subject of safety (including in particular that of major industrial risks), which should be brought to a successful conclusion within a reasonably short period, in order to ensure that our country is able to return the position of adequate industrial standards. Otherwise, although we speak of development, this development can by no means certainly be described as progress by man for man.

2. Procedure for establishment of regulations

The Commission, while reaffirming the impossibility of establishing a system of regulations before a far-reaching discussion has been held - with the participation of all the elements concerned in arriving at a solution - proposes the setting up in relation to Parliament and its Commissions, of a centre for contact and extension of the discussion, in order to verify the points which are already accepted and to permit a further and more far-reaching development. Profitable use could also be made of the contributions, experience and measures taken in other countries, of which the Commission has taken cognizance during its work, bearing in mind however the fragmentary nature of these, and in particular the absence of coordination.

Reference may be made to a number of points of reference in connection with the systematic revision of the safety regulations, namely the proposed regulations under study in the EEC, the bill for the reform of the health system, at present under discussion in Parliament, and the draft bill being prepared by the Ministry of Health.

The proposals currently under study in the EEC can be broken down into the following specific aspects:

(a) the definition of dangerous industrial activities,

- (b) the obligation on all industries defined as dangerous to undertake a documented study on existing risks, to determine and implement adequate safety measures in relation to these risks and to ensure that information is passed to the persons concerned,
- (c) the obligation on high risk industries to provide appropriate notification, with full documentation and supported by safety and emergency plans; the further obligation to provide adequate information to persons concerned and to the population,
- (d) measures by the authorities, restricted to verification that the documentation complies with predetermined criteria (without the inclusion of an authorization regime), subject obviously to the power to impose additional measures where necessary.

An important element in the legislative reform of the health service, at present under discussion, is the setting up of a Central Institute for Accident Prevention and Safety parallel to the Higher Institute of Health, which it is proposed to incorporate in the Ministry of Health.

The draft bill prepared by the Ministry of Health is aimed at a further development of the EEC directives in connection with the structures which are planned under the Italian legislation, including two levels of intervention, a political level consisting of an interministerial committee, coupled with a technical and administrative organ, and an operational level consisting of a regional committee with representation at the district level.

The aim is therefore to establish a system of regulations in principle which will take into account the requirements listed above, and will come into force gradually. This system of regulations will subsequently include technical provisions, emanating from the organizations, which it is proposed to establish, and capable of being rapidly brought up to date. This system will also be integrated in the regional legislation, so as to meet the requirement for a homogeneous group of fundamental directives.

3. Scope and aim of the system of regulations

The problem of safety and protection against industrial risks, it is necessary to emphasize once again, is particularly complex and affects at the present time, workers, the environment, the site in its socio-economic aspect and of course the system of production. All these different aspects have to be taken into account, if the system of regulations is to deal with the problem in an organic and complete fashion. It is therefore desirable that unified instruments should be used in implementation of the system and that there should be a unified structural level, which is institutionally suitable for modifying the activity in question to suit the evolution of the actual situation.

The system of regulations should therefore cover the complete field of industrial activity and its connections with life in general and non-industrial activities. It will also be necessary to examine the best way in which major risks and/or the previously defined plants, will be taken into consideration and made subject to the specific regulations.

This necessitates a permanent dialogue between political and scientific circles. In this field, more than any other, the legislator has to take note of information and proposals from the technical and scientific world.

4. Administrative functions and reference centres

A distinction has to be made between three levels at which the safety of industrial plants are handled, namely the political, technical and administrative levels. This does not mean, however, the creation of different bureaucratic machinery corresponding to each level and in consequence uncoordinated, but rather the definition of the functions to be performed by each.

It is desirable in fact to consider these functional levels in relation to the directives which are being elaborated by the Italian legislation. The guiding principle is

therefore to attribute to the national and regional level the political functions of guidance and, within constitutional limits, those of legislative output, while the district or interdistrict level will be responsible for administrative, technico-administrative and control functions. General responsibility for technico-scientific matters and research will be concentrated in a single centralized body.

The Commission, without intending to provide detailed indications, nevertheless feels bound to give some further guidance in regard to the bodies which will be responsible for the above functions.

At the central political level provision could be made for the setting up of an inter-ministerial committee in view of the complexity and variety of the fields of responsibility for safety (in particular those of the Ministries of Health, Industry, Labour, Internal Affairs, Public Works, Economic Affairs, Cultural Matters and Scientific Research). The Commission believes, however, that a more effective policy would be to allocate primary responsibility to the Prime Minister's office or to the Ministry of Health, in order to obtain a uniform policy and coordinated administration. It is also important to ensure a periodical exchange of information with Parliament and close colleagues in other countries, in particular those of EEC. Again within the framework of the "political" function, the desirability should be examined of setting up a regional committee which would provide, in relation to the powers constitutionally assigned to the Region, the necessary technical and scientific support for the exercise of the relevant regional functions, in agreement with the central organs.

For the technical and scientific functions, it will be necessary to set up the aforesaid Central Institute for Accident Prevention and Safety, the functions of which will have to be defined more clearly in the light of the problems under examination.

Responsibility for the technico-administrative and control aspects should therefore be vested, in the interests of a uniform administration and to ensure the necessary coordination, in the local administrative structures and those which will emerge from the

reorganization of the health service; it will also be necessary to ensure that these structures are capable of performing efficiently the functions entrusted to them. The Commission nevertheless believes that it would be desirable for the central administration to retain administrative responsibility, in order to ensure the homogeneity of the measures taken and to cover the case of major risks.

5. Means of effective safeguard

The points requiring to be discussed in this connection are in principle as follows: research activities, the choice between an authorization or notification regime, the formation of lists of substances and plants requiring notification, the establishment of emergency plans, the break-down of responsibility within the undertaking and the system of control and inspection.

An aspect of particular importance is safety research in connection with the risks resulting from industrial plants. Without going into the more general question of the level of scientific research in our country, there is no doubt whatever that, without an adequate development of technical and scientific research, it would be illusory to hope to formulate serious proposals in connection with safety, and to imagine that the system, once created, could adequately guarantee the safety which is its *raison d'être*. All the activities of the bodies defined above, presuppose a continuous and professional activity in the field of interdisciplinary research.

In regard to the "authorization regime", it is evident that the rigid application of such a regime would be liable to promote bureaucratization of the procedure, thus rendering it inefficient and insufficiently responsible. On the other hand, a system of notification - which imposes precise obligations and responsibilities on the undertaking - could prove more efficient, but only provided that the level of awareness and the capacity of the public authorities and their equipment were on a par with those of the undertakings. The Commission nevertheless considers it desirable, at least in relation to particularly

dangerous production processes, to adopt authorization procedures which, while retaining a characteristic flexibility (in the sense that, in common with other countries, the authorizations might be of a provisional nature or only partial or contain specific provisions) should not nevertheless modify the system of guarantees and liabilities which should accompany the notification procedure.

The Commission looks with favour on the procedure for drawing up lists of substances, plants and production processes, including a system for their rigorous and timely updating.

Any adequate safeguard system, intended to prevent the occurrence of incidents, should include, in addition to a clear specification of means of preventing the multiple causes of such incidents, adequate emergency plans to prevent or reduce the damage consequent on the incident.

It also appears desirable that provision should be made within the undertaking for a measure of technical responsibility in connection with safety control measures. The appointment in question will obviously have to be made in close relation with other bodies concerned in this field, in relation to the trade union organizations inside and outside the firm, and in relation to the firm itself.

All considerations relating to the costs of safety revolve round the central point of the distribution of the costs of safety between public and private operators.

The costs of internal and external safety should be included in the normal costs of production. The state may however, especially during the transition phase to a higher level of safety and during the implementation phase of new regulations which were not in existence at the time of installation of the relevant plant, make a contribution to meeting the requirements of the undertaking by means of technical / financial support, directed and specifically restricted to this end.

The Commission wishes to draw attention to the application of existing legislation (the Act on Industrial Conversion and the Midday Act, for example) and to the use of regional financial undertakings.

Reference has been made several times to the desirability of members of the public being involved in the problems of the risks resulting from industrial installations. There are a number of ways in which this can be achieved: adequate information, strengthening of the structure of local bodies and local authorities, an expanded participation in social organizations and increasing the technical capacity of local state organs. The experimental participation of workers in bodies concerned with safety and the protection of the environment may provide a positive model for popular participation and relations between the public, institutions, and scientific research centres. Examination should also be made, on the basis of experience in other countries, of the possibility of empowering any member of the public to apply to the courts in a form of popular action, which would not require proof of the specific and individual interests of the applicant in connection with the subject of the action, which could relate to a failure to comply with the regulations for the prevention of industrial risks.

It should be pointed out in conclusion that certain measures require to be given priority, with the aim of reducing the serious risks which are always associated with an industrial installation, and which the Seveso disaster has brought out clearly. The Commission wishes to emphasize the desirability of holding a census of dangerous industries and operations, based on the scheme in the draft bill prepared by the Ministry of Health.

Annexes

Draft Bill No. 615 proposed by Deputy Servello, Bollati, Tremaglia, D'Aquino, Palomby Adriana, Carquetti, Borromeo D'Adda.

Establishment of a Parliamentary Commission of Enquiry for the protection of the population and the environment in connection with the production of gases or other toxic elements

Sole Article

A Parliamentary Commission of Enquiry is hereby set up, consisting of 15 Deputies and 15 Senators, with the aim of determining, in relation to the incident at Seveso on 10 July 1976:

- (a) the responsibility for the incident, including the territorial siting of the ICMESA factory, the arrangement of the factory and the supervision of safety measures in the light of the dangerous nature of the plants in the factory,
- (b) who and under what conditions issued the necessary licences, permits and authorizations for the location and functioning of the factory,
- (c) who was responsible in the fields of industrial production and hygiene-health for the constant supervision and protection of the physical health of workers in the factory and residents in the surrounding zone,
- (d) what part was played, in connection with the incident, by the Region of Lombardy in regard to prevention, monitoring and timely intervention.

The Commission, after completing its investigation of the above circumstances, shall propose to the Government special measures to be taken under the current legislation in the relevant field, or under current administrative regulations, in order to ensure complete protection of the population and environment in relation to the production of gases and other toxic elements.

Draft Bill No. 231, proposed by Deputies Malagugini, Berlinguer Giovanni, Triva, Chiovini Cecilia, Quercioli, Tortorella, Peggio, Balbo, Baldassarri, Carra, Corradi Nadia, Calaminici, Leonardi, Margheri, Venegoni, Zoppetti.

Parliamentary Enquiry on the incident of 10 July 1976 in the ICMESA establishment located in the commune of Seveso (Milan) and on industrial activity involving the use and production of dangerous materials, methods or tools

Article 1

A Parliamentary Commission of Enquiry is hereby established with the aim of determining the causes and consequences of the incident of 10 July 1976 in the commune of Seveso (Milan), when contaminant substances, containing an appreciable quantity of dioxin, escaped from a reactor vessel, installed in the establishment of the company ICMESA.

The Commission is to determine in particular:

- (a) the licence and authorization, on the basis of which productive activity was installed and in operation up to the time of the incident in the establishment of the company ICMESA, ascertaining at the same time the holdings of share capital in the company owning the establishment,
- (b) the effective production of ICMESA and the purposes for which it was intended,
- (c) what control checks were carried out by the public authorities on the activities of ICMESA and whether any incidents involving contamination had occurred prior to 10 July 1976 and what were the consequences thereof,
- (d) what were the consequences of the incident of 10 July 1976, what immediate action was taken and what measures were adopted for the protection, immediate and future, of the safety and health of the residents of the zone and for the restoration of the balance of the natural environment,

- (e) what measures have been taken or should be taken for the compensation of members of the public who suffered damage as a result of the incident of 10 July 1976, to obtain reimbursement for these losses from those responsible and to ensure the return of the zone to a state of economic normality.

Article 2

The Commission, on the basis of its findings and taking into account the present state of industrial installations on Italian territory and the regulations in force in regard to the installation, management and control of productive activity, including the use or production, either in the intermediate or final stages of the production cycle, of materials, processes or equipment, which may be dangerous or harmful to the health of workers and members of the public or prejudice the balance of the natural environment, shall formulate proposals for a better and more effective protection.

Article 3

The Commission shall be composed of 15 Deputies and 15 Senators, selected by the President of the Chamber and the President of the Senate respectively, so as to correspond to the proportions of the different parliamentary groups. The Commission shall elect its own chairman, vice-chairman and two secretaries.

The Commission shall make use of the services of suitably qualified scientific and professional staffs of its own appointment.

Article 4

The Commission shall sit in public session.

The Commission may decide, by a majority of three quarters of its members, to which sessions or parts of sessions the public may not be admitted.

Article 5

The Commission shall submit to the Chambers of Parliament, within three months of its establishment, a first report on the subjects specified in Article 1 of the present Act.

The Commission shall complete its work and submit a final report to the Chambers of Parliament within eight months of its establishment.

Article 6

The Commission shall undertake all investigations and examinations with the same powers and the same limitations as the judicial authorities, in the sense of Article 82 of the Constitution of the Republic.

Article 7

The costs of the Commission are to be borne half on the internal budget of the Chamber of Deputies and half on the internal budget of the Senate.

Article 8

The present Act shall come into force on the day following its publication in the Official Gazette.

Draft Bill No. 538, proposed by Deputies Aniasi, Colucci, Gorla, Massari, Bonino Emma.

Parliamentary Commission of Enquiry on the causes and consequences of the disaster of 10 July 1976 at Seveso (Milan), caused by the dioxin contamination due to the incorrect functioning of a reactor in the establishment of the company ICMESA

Article 1

A Parliamentary Commission of Enquiry is hereby established to investigate an report to Parliament on the causes of the escape of contaminating substances, which occurred on 10 July 1976 in the commune of Seveso (Milan) from a reactor installed by the company ICMESA.

Article 2

The Commission shall be required to determine:

- (a) the measures which have been adopted or are in course of adoption in the health, economic and social fields and their suitability, in terms of quantity and quality, to deal with the present and future losses, sustained by persons and property,
- (b) the measures of protection, adopted against the contamination, in order to establish their suitability for restricting the danger area,
- (c) what other establishments, which present actual or potential dangers to their junior staffs and populations resident in the area, are in existence on Italian territory,
- (d) whether the current legislative regulations in this field contain gaps, what relevant indications may be made to the organs of government and what proposals may be advantageously submitted to the competent parliamentary commissions,

- (e) what means of control are available to the central and local authorities to ensure at all times a compatible relation between production and the protection of public health and safety,
- (f) the direct and indirect losses sustained on the economic level by agriculture, industry, light industry, commerce and individual members of the public,
- (g) the adequacy, in quantitative and qualitative terms, of compensation measures, tax facilities, credit grants and social provision for employees in categories which do not enjoy the benefits of the integrated social insurance fund (Cassa integrazione e guadagno),
- (h) the liability, in the most rigorous terms, at every central or local level, for the installation, its safety, its harmful production processes, controls and any other measure necessary for averting the disaster,
- (i) the actual production of ICMESA, its destination and the clientele for which it was intended,
- (l) the appropriate timing, consistency and efficiency of production measures, and the assistance afforded in order to restrict and circumscribe the damage caused and protect the present and future health of the persons concerned,
- (m) the existence of any liability in reporting or in the measures taken, which has given rise to delay or inadequate measures to limit the damage to persons and other things.

Article 3

The Commission shall consist of 15 Deputies and 15 Senators, selected in such a way as to guarantee each parliamentary group at least one member from one of the two Chambers.

The Commission shall make use of the services of scientific personnel appointed by it.

The Commission shall elect from amongst its members one chairman, two vice-chairmen and one secretary.

Article 4

The Commission of Enquiry shall complete its work within six months of its establishment, submitting its conclusions to the President of the Chamber of Deputies and the President of the Senate of the Republic.

The Commission is to submit a report on the most urgent measures to be adopted, within 90 days of its establishment.

Article 5

The Commission of enquiry shall undertake its investigations and examinations with the same powers and subject to the same limitations as the judicial authority.

Article 6

The expenses of the Commission shall be divided half and half between the Chamber of Deputies and the Senate of the Republic and shall be charged against the respective budgets.

Article 7

The present Act shall come into force on the day following its publication in the Official Gazette.

Report of the combined Commissions XII and XIV (Industry and Trade - Light Industry - Foreign Trade - Public Health and Hygiene) of the Chamber of Deputies on the draft bills proposed by Deputies Servello, Bollati, Tremaglia, D'Aquino, Palomby Adriana, Carquetti, Borromeo D'Adda (Establishment of a Parliamentary Commission of Enquiry for the protection of the population and the environment in connection with the production of gases or other toxic elements); proposed by Deputies Malagugini, Berlinguer Giovanni, Triva, Chiovini Cecilia, Quercioli, Tortorella, Peggio, Balbo, Baldassarri, Carra, Corradi Nadia, Calaminici, Leonardi, Margheri, Venegoni, Zoppetti (Parliamentary Enquiry on the incident of 10 July 1976 in the ICMESA establishment, situated in the commune of Seveso (Milan) and on industrial activity involving the use and production of dangerous materials, processes or equipment); proposed by Deputies Aniasi, Colucci, Gorla, Massari, Bonino Emma (Parliamentary Commission of Enquiry on the causes and consequences of the disaster of 10 July 1976 at Seveso (Milan), caused by dioxin contamination due to faulty functioning of a reactor in the establishment of the company ICMESA).

Distinguished colleagues,

After thorough and far-reaching discussion, the Commissions of Industry and Health have jointly formulated and approved a draft bill providing for the establishment of a Parliamentary Commission of Enquiry on the escape of toxic substances, which occurred on 10 July 1976 in the ICMESA establishment, and the resulting potential risks to health and the environment caused by industrial activity.

The seriousness of the incident has caused very great losses to the population of the affected zones, losses and difficulties so great that it is not possible to estimate, even with the greatest care and attention, all the possible implications in the social, moral and economic fields.

Several months after the incident, free of any possible immediate emotions but aware of the serious and exceptional nature of the circumstances under examination, we can only study the problem as deeply as possible in an attempt to clarify certain aspects and the possible liability.

Even today in fact, in spite of the measures which have been taken, the proposals which have been formulated and the assumptions which have been made, losses are being revealed, affecting persons and the environment.

No. 1 The results of continuous health controls have recently revealed the presence of chloracne in 337 out of every 2000 children among the 25,000 children living in the contaminated zone. 447 early dermatology cases including erythema due to fumes of material during 1978-1980 1732 of 185 children were

As far as the contamination of the environment in the communes in question is concerned, the peculiar nature of the losses caused, the absence of technical and scientific knowledge on means of restoring the inhabited zone to normality and safety have meant that, in spite of the efforts made by the local and regional administrations, no final decisions have yet been taken.

It should not be forgotten that the populations, although warned of the danger, have several times attempted to force the barriers and gain entry to their houses and return to the environment to which they were attached and from which they felt keenly their separation.

This human and social aspect cannot be considered in isolation from the activities of the various organizations dealing with the problem after the disaster. The district, provincial, regional and state organizations have made every effort within their fields of competence to clean up the zone and return it to normal life. There has been widespread participation and no lack of discussion and contacts at the highest national and international levels, in an attempt to find concrete measures to deal with the harmful effects of the incident.

There has been no underestimation of the difficulties among all those who have been working during these months on systematic assistance to the affected populations, meeting the dramatic nature of the situation with no great certainty of their ability to deal with the exceptional and unforeseeable quality of an event such as that which has occurred.

When we look at the interpretation of unprecedented circumstances, the drawing up of a pattern of behaviour from the time of the occurrence of the disaster, the impact on the administrative structures responsible for the protection of public health and finally, at

possible thoughts directed toward better guarantees of safety in the future, it may be claimed that this situation of extreme emergency has been faced with dynamic effort, efficient capacity and optimal coordination by all the elements of the institutions responsible.

Subsequent circumstances have done nothing to detract from the overall dramatic nature of this incident which can never be too greatly deplored.

Parliament has already received information on the activities and measures taken by the Region of Lombardy, by the province of Milan and by the district authorities concerned; it is also aware of the measures taken by the Government and the different ministries. It would therefore be superfluous to go into this complex and fully discussed matter in greater detail and we shall therefore confine ourselves to a few considerations of a general nature.

Awareness of the exceptional nature of the event and the conviction that such dramatic happenings should not be ignored or underestimated by Parliament, the central and most sensitive element in our democratic society, has driven us on to prepare a concrete legislative bill, a legislative bill which will be able, by the quality of its content, to contribute to our knowledge of the phenomena and actions in question, so that any future risks can be prevented and the relevant situations corrected in advance.

The draft bill under examination has come into being as the result of this requirement and these intentions on the part of Parliament. The terms of reference of the Commission which is to be set up, will not be easy nor will the outcome be certain in view of the absence of knowledge of this phenomenon, but the results of its work may greatly improve the regulations on control, safety and the protection of health and the environment, since it will include a panoramic view on the regulations at present in force and their adequacy in connection with new and varied forms of industrial production.

One thing which has emerged clearly and forcibly is the need for a new national legislation in regard to the protection of the quality of life and of the environment, which will be directed at dangerous situations and will be able, based on the interests of the community, to safeguard our environmental heritage and preserve it from the type of manufacturing installation which other countries definitely do not look on with favour.

The implementation of the draft bill under examination will enable technically appropriate new regulations to be proposed in the light of the particular problems of safety, which will lead to a uniform and overall evaluation of the interests requiring protection, so as to constitute one of the fundamental guarantees, but not the only one, of a solution of the problem.

Safety in any type of industrial activity necessitates a systematic relationship between industry and the environment, in which our legislation has clearly laid down the limits of the measures which may be taken to safeguard persons and properties, and a casual and exceptional relationship arising out of circumstances such as those to be examined by our enquiry, where evaluation of the probability of damage requires knowledge, non-sectorial technologies and multidisciplinary control criteria.

This is why we require an effective instrument, which will enable us to adapt the means of prevention to the continuous developments of technology and be capable of taking action on the basis of a coordinated evaluation of all the implications and all the fields of competence concerned, over the wide range of factors involved.

What is required is a conclusive evaluation of all the aspects of safety, in order to ensure maximum reliability in the performance of industrial activities and to define solutions capable of ensuring the continuance of production and the protection of health in worksites and the surrounding areas, affording the necessary guarantees to the population and the necessary confidence to the undertaking. This is the spirit in which we have formulated the draft bill under discussion. These and other considerations have given rise to the wish to establish a Commission of Enquiry. We have seen in our country on various occasions acquittals, which have not always been deserved and have resulted from a number of factors in connection with joint liability. Faced with the dimensions of this dramatic incident, Parliament is rightly concerned with guaranteeing the respect for the rights and duties of all concerned, in order to ensure in the future a more attentive and professional compliance with private and public responsibilities at various levels, in order to ensure that similar disasters do not occur in the future.

It is necessary to eliminate as far as possible all uncertainty in regard to the causes of the incident and to guarantee the future of those who have suffered its tragic consequences.

The casting of light on the responsibility for the disaster will also restore the confidence of residents in the affected zones, thus representing a relationship of renewed mutual confidence with the state expressed in a factual collaboration between members of the public and administrative institutions.

To complete the picture, it should not be forgotten – and it is our duty to inform our distinguished colleagues thereof – that a further study, at present in its final phase, has been made by the Ministry of Health, resulting in a draft bill on the production, use and storage of dangerous circumstances, the salient features of which are, apart from the listing of substances and preparations liable to produce dangerous effects and cause irreversible damage to man, animals and the environment, to lay down minimum safety standards and to provide the necessary emergency measures. The regulations in question will subsequently require quantitative returns on the production, use and storage of the substances in question, which will require the preventive authorization of the district authority and prior notification of the activity in question.

We should also remember, however, even when such measures are implemented in the future, this cannot detract from the responsibility of the undertaking itself, which is alone capable of knowing adequately its own process of production resulting from the combination of method and personal competence, acquired by research on the optimization of the results achieved.

In the light of the above circumstances, Article 1 of the text under examination makes provision for the establishment of the Commission and indicates the objects and subjects of major concern in relation to the incident.

Article 2 indicates the scope of the enquiry and gives a number of guidelines for the performance of its task.

Article 3 completes the terms of reference in regard to the investigations to be carried out and the aims to be pursued, so as to contribute to the formulation of more effective regulations for the protection of health and of a balanced environment.

Article 4 contains information on the composition of the Commission and indicates criteria for the election of officers, while Article 5 details methods for the conduct of sessions.

Article 6 lays down the tasks to be performed and the datelines, while Article 7, 8 and 9 establish the powers of the Commission, the allocation of funds and the date of coming into force of the Act.

CUMINETTI, Rapporteur of Commission XII
GIOVANARDI, Rapporteur for Commission XIV

Text submitted by the Combined Commissions

Article 1

A Parliamentary Commission of Enquiry is hereby set up to investigate and report to parliament on the causes and liability for the escape of contaminating substances, occurring on 10 July 1976 from a reactor installed in the establishment of the company ICMESA, affecting predominantly the communes of Meda, Cesano Maderno and Desio in the province of Milan.

Article 2

The Commission is to determine:

- (a) what licence was issued and what manufacturing activity installed and in operation up to the time of the incident in the establishment of the company ICMESA,
- (b) what was the effective output of ICMESA, to which customers was it despatched and for what use was it intended,

- (c) who was responsible at every level, central or local, in relation to the installation, for the safety or harmfulness of production, for control checks and any other measure necessary for aversion of the disaster,
- (d) what are the consequences of the incident of 10 July 1976 on the health of members of the public, on the environment, on the land and on the economy of the zone,
- (e) what measures have been taken or should be taken to compensate members of the public who have suffered damage as a result of the incident of 10 July 1976 and to obtain reimbursement of these damages from those responsible.

Article 3

The Commission, based on the results of its investigation and taking into account the present state of industrial installations on Italian territory and the regulations in force, shall collect the necessary elements for an evaluation of the potential risks resulting from industrial activity over the whole range of production processes, so as to formulate proposals for a more effective system of regulations for the protection of the health of workers and members of the public, for the maintenance of a balanced natural environment and to ensure adequate services and effective controls.

Article 4

The Commission shall consist of 15 Deputies and 15 Senators, nominated by the President of the Chamber of Deputies and the President of the Senate respectively, selected in such a way as to correspond to the numbers of the different parliamentary groups. The Commission shall elect from among its members one chairman, two vice-chairmen and one secretary.

The Commission shall make use of the collaboration of experts appointed by it.

Article 5

The Commission shall decide by majority vote on whether individual sessions are to be held in public.

Article 6

The Commission shall complete its work and present its final report to the Chambers within six months of its establishment.

The Commission shall notify the President of the Chamber of Deputies and the President of the Senate of the state of its work every two months.

Article 7

The Commission shall carry out its investigations and examinations with the same powers and subject to the same limitations as the judicial authorities, in the sense of Article 82 of the Constitution of the Republic.

Article 8

The expenses incurred on the operation of the Commission are to be met half from the internal budget of the Chamber of Deputies and half from the internal budget of the Senate.

Article 9

The present Act shall come into force on the day following its publication in the Official Gazette.

Draft Bill No. 94, proposed by Senators Luzzato Carpi, Pittella, Catellani, Polli, Colombo Renato, Viviani, Cipellini, Carnesella, De Matteis, Minnocci, Dalle Mura, Lepre, Labor, Scamarcio, Fabbri, Fabio, Finessi, Ferralasco, Di Nicola.

Establishment of a Parliamentary Commission of Enquiry to determine the liability for the disaster caused by the toxic cloud in the province of Milan.

Article 1

A Parliamentary Commission of Enquiry is hereby established to investigate and report to Parliament on the disaster caused by the toxic cloud in the province of Milan.

The Commission shall consist of 15 Senators and 15 Deputies, nominated jointly by the President of the Senate of the Republic and the President of the Chamber of Deputies, so as to correspond to the proportions of the parliamentary groups. In the case of resignations, or cessations of parliamentary mandate, the Presidents of the two Chambers shall take steps to appoint replacements.

The Commission shall elect from among its members one chairman, two vice-chairmen and one secretary.

Article 2

The Parliamentary Commission of Enquiry shall have the following terms of reference:

(1) to determine:

- (a) what authorizations were granted for the installation of the firm ICMESSA in Meda and the validity of the grounds accepted in justification of the authorization,
- (b) the working cycles, the products used, the productive output and its destination,

- (c) the causes of bursting of the reactor which gave rise to the release of the toxic gas,
 - (d) the proper implementation of the control regulations and the efficacy of safety measures for the protection of the health of persons and the environment,
 - (e) the liability at all levels,
- (2) to propose measures to guarantee the prevention of incidents endangering workers in chemical industries and the populations of the areas concerned.

Article 3

The Commission of Enquiry shall complete its work within four months from the date of its establishment, submitting its report to the Presidents of the Chamber of Deputies and the Senate of the Republic for publication.

Article 4

The Commission of Enquiry shall carry out its investigations and examinations with the same powers and subject to the same limitations as the judicial authorities.

Article 5

The costs incurred during the work of the Commission shall be borne half by the Chamber of Deputies and half by the Senate of the Republic and their respective domestic budgets.

Article 6

The present Act shall come into force on the day following its publication in the Official Gazette.

Draft Bill No. 220, proposed by Senators Merzario, Bellinzona, Bollini, Ciacchi, De Simone, Garoli, Mafai De Pasquale Simona, Milani, Petrella, Piscitello, Ruhl Bonazzola Ada Valeria, Romeo, Squarcialupi Vera Liliana, Venanzi.

Parliamentary Commission of Enquiry on the incidents occurring in the ICMESA establishment at Seveso (Milan) and ANIC at Manfredonia (Foggia), on the state of contamination in the industrial zone of Priolo-Melilli (Syracuse) and on industrial activity involving the use and production of dangerous or contaminating materials, processes or equipment

Article 1

A Parliamentary Commission of Enquiry is established with the aim of determining the causes, consequences and responsibility for incidents occurring:

in the commune of Seveso (Milan), where contaminating substances, containing an appreciable quantity of dioxin, escaped from a reactor installed in the establishment of the company ICMESA,

in the commune of Manfredonia (Foggia) as a result of the bursting of an ANIC plant with the escape of a cloud of arsenic,

in the industrial zone of Priolo-Melilli (Syracuse) as a result of the general state of contamination due to a number of industrial plants.

The Commission is to determine in particular:

- (a) the licence and authorization, on the basis of which productive activity was installed and in operation up to the time of the incident in the establishment of the company ICMESA, at ANIC in Manfredonia and in the industrial zone of Priolo-Melilli (Syracuse), ascertaining at the same time the holdings of share capital in the company owning the establishment,

- (b) the effective production of ICMESA and the purposes for which it was intended,
- (c) what control checks were carried out by the public authorities on the activities of ICMESA and whether any incidents involving contamination had occurred prior to 10 July 1976 and what were the consequences thereof,
- (d) what were the consequences of the incidents, what immediate action was taken and what measures were adopted for the protection, immediate and future, of the safety and health of the residents of the zone and for the restoration of the balance of the natural environment,
- (e) what measures have been taken or should be taken for the compensation of members of the public who suffered damage as a result of the incidents, to obtain reimbursement for these losses from those responsible and to ensure the return of the zone to a state of economic normality.

Article 2

The Commission, on the basis of its findings and taking into account the present state of industrial installations on Italian territory and the regulations in force in regard to the installation, management and control of productive activity, including the use or production, either in the intermediate or final stages of the production cycle, of materials, processes or equipment, which may be dangerous or harmful to the health of workers and members of the public or prejudice the balance of the natural environment, shall formulate proposals for a better and more effective protection.

Article 3

The Commission shall be composed of 15 Deputies and 15 Senators, selected by the President of the Chamber and the President of the Senate respectively, so as to correspond to the proportions of the different parliamentary groups. The Commission shall elect its own chairman, vice-chairman and two secretaries.

The Commission shall make use of the services of suitably qualified scientific and professional staffs of its own appointment.

Article 4

The Commission shall sit in public session.

The Commission may decide, by a majority of three quarters of its members, to which sessions or parts of sessions the public may not be admitted.

Article 5

The Commission shall submit to the Chambers of Parliament, within six months of its establishment, a first report on the subjects specified in Article 1 of the present Act.

The Commission shall complete its work and submit a final report to the Chambers of Parliament within eight months of its establishment.

Article 6

The Commission shall undertake all investigations and examinations with the same powers and the same limitations as the judicial authorities, in the sense of Article 82 of the Constitution of the Republic.

Article 7

The costs of the Commission are to be borne half on the internal budget of the Chamber of Deputies and half on the internal budget of the Senate.

Article 8

The present Act shall come into force on the day following its publication in the Official Gazette.

Report of the Combined Commissions X (Industry, Trade and Tourism) and XII (Hygiene and Health) of the Senate of the Republic on the draft bills, proposed by Deputies Servello, Bollati, Tremaglia, D'Aquino, Palomby Adriana, Carquetti, Borromeo D'Adda, Malagugini, Berlinguer Giovanni, Triva, Chiovini Cecilia, Quercioli, Tortorella, Peggio, Balbo, Baldassarri, Carra, Corradi Nadia, Calaminici, Leonardi, Mergheri, Venegoni, Zoppetti, Aniasi, Colucci, Gorla, Massari, Bonino Emma (Parliamentary Enquiry on the escape of toxic substances on 10 July 1976 in the ICMESA establishment and the potential dangers to health and the environment resulting from industrial activity); proposed by Senators Luzzato Carpi, Pittella, Catellani, Polli, Colombo Renato, Viviani, Cipellini, Carnesella, De Matteis, Minnocci, Dalle Mura, Lepre, Labor, Scamarcio, Fabbri, Fabio, Finessi, Ferralasco, Di Nicola (Establishment of a Parliamentary Commission of Enquiry to determine the liability for the disaster caused by the toxic cloud in the province of Milan); sponsored by Senators Merzario, Bellinzona, Bollini, Ciacci, De Simone, Garoli, Mafai De Pasquale Simona, Milani, Petrella, Piscitello, Ruhl Bonazzola Ada Valeria, Romeo, Squarcialupi Vera Liliana, Venanzi (Parliamentary Enquiry on the incidents occurring in the ICMESA establishment in Seveso (Milan) and ANIC in Manfredonia (Foggia), on the state of contamination in the industrial zone of Priolo-Melilli (Syracuse) and on industrial activity involving the use and production of dangerous or contaminating materials, processes or equipment).

First Part

Distinguished Senators,

Widely reported in the information media and discussed at considerable length in the two parliamentary chambers, the seriousness of the incidents in question have given rise to draft bills No. 94 and No. 220, the former submitted on 5 August 1976 by Senators Luzzato Carpi and other members of the Socialist Group and the second submitted on 8 October 1976 by Senators Merzario and other members of the Communist Group. The aim of these draft bills was to cast light on the causes, liability, consequences,

remedial and preventive measures in relation to the disaster at Seveso and also in relation (only in the case of draft bill No. 220) to the incident at Manfredonia and the state of contamination in the industrial zone of Priolo-Melilli. These bills both proposed the establishment of a parliamentary Commission of Enquiry.

In order to avoid simultaneous and non-productive discussions of draft bills of similar content presented to the two Chambers of Parliament, this material has been submitted to the Combined Commissions X and XII together with the text of draft bill No. 665, approved by the Chamber of Deputies on the basis of the unification of three proposed bills, each directed at the establishment of a parliamentary Commission of Enquiry.

Among the favourable opinions expressed by the different Commissions of the Senate on draft bills Nos. 94, 220 and 665, particular reference should be made to that of the Special Commission on Ecological Problems, which recommended the unified coordination of the three texts, particular attention being paid to examination of the problems of the overall and progressive contamination of the areas in question.

Draft bill No. 665 regards the Seveso disaster as a subject of special investigation, but makes provision for the future Commission to collect - on the basis of the results of its investigations (Article 3) - elements for evaluation of the potential risks, in general, relating to industrial activity, and to propose adequate and effective regulations, services and controls, contrary to what occurred broadly speaking at Seveso. The Combined Commissions X and XII have therefore examined the material in question on the basis of this text, as effectively including the other two, both in connection with a more rapid passage of this bill into law, and in connection with the most pressing questions of a general and specific nature arising out of the incident at Seveso. It should be further borne in mind that the Chamber of Deputies, after an exhaustive examination in the competent Commissions, has approved in Assembly draft bill No. 665 with a very large majority (320 out of 356 Deputies present). It has also to be borne in mind when considering the more

general aspects of the problem, that draft bills Nos. 94 and 220 (and indeed the three legislative proposals combined in draft bill No. 665) originated in a period somewhat earlier than the discussion in the Chamber of Deputies which approved draft bill No. 665, a discussion which provided a more profound knowledge of the facts and information on the measures taken by the public authorities at different levels. Reference should also be made here to the legislative measures which were passed to meet the immediate requirements: Legislative Decree No. 537 of 3 August 1976, passed with amendments as Act No. 615 of 19 August 1976, Legislative Decree No. 542, passed with amendments as Act No. 688 of 8 October 1976, both concerned with urgent measures or arrangements in favour of the populations of zones affected by contamination with toxic substances. Numerous measures have been subsequently taken by various public organizations, coordinated by the Region of Lombardy and the Ministry of Health. Reference should also be made to the efficient work of the Commission set up by the Ministry of Labour and also that the incidents at Seveso are at present the subject of judicial proceedings, in which the local public administration is participating as civil party, in respect of the losses sustained.

In view of the numerous measures which have been taken, it is my duty to emphasize the requirement for the future Parliamentary Commission of Enquiry to coordinate its work with those of the above organizations, taking into account also the contributions and findings which have emerged from their activities.

When we come to consider the essence of the problem, we find that there is no question of an absence of legislation and regulatory standards in regard to dangerous industries, as some have claimed, since there is the unified text of the Health Act (Articles 216 and 217) in conjunction with the list of unhealthy or dangerous industries, brought up to date as at November 1967. There is also Act No. 615 of 13 July 1966 against atmospheric pollution and finally the well known Merli Act, which consists of a general regulation to combat the contamination of waters. In my personal view, although it is necessary to undertake a careful and properly considered revision and integration of the legislation on

dangerous and unhealthy industries, it is even more essential to pursue energetically the effective observance and application of existing regulations.

In view of the above, and taking into account the need for a careful and considered examination of the facts, of the existing regulations and of the realistic possibilities of remedying the present losses and preventing future disasters, I would personally reiterate that the most appropriate and effective measure - as a means also of preparing for future legislative work by Parliament - would be the organization of an extensive and exhaustive fact-finding investigation in the competent Commissions, rather than the establishment of a Parliamentary Commission of Enquiry. I am aware, nevertheless, of the need to bring a measure of calm to the populations of the affected zones, who have been tormented by this sudden dramatic incident, the effects of which are still being felt, and by the continuous alternation of contrasting information. It is therefore an absolutely necessary and urgent requirement to set up a Parliamentary Commission of Enquiry, a body which will certainly be capable of calming public opinion and that of Parliament itself, which will prepare an exhaustive report and come to incontestable conclusions. The Combined Commissions on Industry and Health have expressed views of this nature in connection with Draft Bill No. 665.

Although some speakers in the Combined Commissions have drawn attention to defects and inconsistencies in the Bill, it was felt desirable to dispense with any attempt to improve the text, but rather to press on with its approval and not send it back to the Chamber for revision.

In inviting approval without amendment of Draft Bill No. 665, I feel bound in conclusion to refer to that aspect of the dramatic incident at Seveso which has, up to now, received little attention in Parliament, namely the enormous losses, both present and future, in the industrial production of a zone with a high concentration of factories, containing a large proportion of the total productive capacity of the Region of Lombardy. It is clear that the Parliamentary Commission of Enquiry will find serious difficulties in fulfilling its terms of reference in this connection. Nevertheless, I am fully confident that the

Commission will overcome every difficulty and will exercise responsibility in maintaining the necessary balance between an attitude of excessive alarm and a superficial optimism, which should certainly be deprecated when dealing with the drama of Seveso.

I therefore repeat my invitation to approve the Draft Bill originating from the Chamber of Deputies and accepted unanimously by the Combined Commissions of Industry and Health of the Senate and I foster the hope that even the imperfections and defects of a bill, which it was not easy to prepare and agree in the other branch of Parliament, can be overcome - during its practical implementation - by the good sense of the members of the future Parliamentary Commission of Enquiry, which will certainly operate with the serious and carefully considered attitude required by the dramatic nature of the incident in question, paying full attention to its social, economic and human implications.

VETTORI, Rapporteur

Second Part

Distinguished Senators,

The dimensions assumed with the passage of time by the Seveso disaster, the serious nature of which has become a matter of progressively increasing concern, has induced the Chamber of Deputies to approve in a unified text the proposal to establish a Parliamentary Commission of Enquiry, contained in Draft Bills 165, 231 and 258 (of the Chamber of Deputies) and have also induced the Combined Commissions of Industry and Health of the Senate to examine with the greatest care the text originating from the Chamber - in conjunction with Draft Bills 94 and 220 submitted to the Senate - thus concluding rapidly but with the necessary care and consideration our own work in this connection.

It should be pointed out that the general idea initially was to restrict the enquiry to a fact-finding investigation (without therefore the establishment of a Parliamentary Commission of Enquiry), intended to collect the necessary elements of information and assessment, with a view to revising and integrating the industrial legislation in general and more particularly the regulations affecting dangerous or unhealthy industries. However, the arrival of progressively more disturbing news on the extent of the area of contamination - with the well known tragic consequences for the population and for productive activity - has necessitated serious thought and reconsideration of the proposals to establish a Parliamentary Commission of Enquiry, put forward by more than one parliamentary group. With the succession of events and the succession of arguments on the scientific and politico-administrative levels, the conviction has grown that it is necessary to cast a clear and definite light on the chronological sequence of events and of the real mechanism which gave rise to the incident in which toxic substances escaped from the ICMESA establishment; the governing factor was, however, the greater operational efficacy of a Parliamentary Commission of Enquiry, which is capable of achieving a more energetic coordination of the action of the Government and a more effective collection of the elements of assessment with a view to revising and amending the relevant legislation at present in force.

It should be emphasized in the first place that no proposal has been put forward in Parliament, either in the Chamber of Deputies or in the Senate for an enquiry into the actions of the local authorities, which have displayed throughout the Region of Lombardy their ability for radical and energetic measures, measures which have generously attempted, within the limits of the possible, to satisfy the requirements of the affected populations and which are rightly concerned with the renewal of productive activity. It is clear that everything possible has been done within the limits of the dramatic conditions imposed by the nature and scope of the incident, which caught everyone unprepared on the scientific and technological levels. It is therefore necessary to repeat that all parliamentary groups in the Chamber have expressed their appreciation for the operations carried out by the Region and the local authorities and that in consequence the establishment of the Parliamentary Commission of Enquiry is principally aimed at re-establishing confidence in the residents of the affected zones and at ensuring that they have a clear and true picture of the facts of the incident and the liability for it, with the aim of restoring a calm and confident relationship with members of the public, who have felt the impact of the progressively more serious repercussions of the incident, are worried by unfounded suggestions and suppositions, and constantly alarmed by the uncertain prospects of their future. In view of the repeated attempts to break down the barriers which close off the contaminated zones, attempts originating in an easily understandable state of emotion, it is necessary to give a definite and exhaustive answer in regard to the possibility and precise means of reclamation of the affected zone, on the times and limits of a renewal of productive activity and on the restoration of social life in its entirety.

From this point of view also, it is obvious that only a Parliamentary Commission of Enquiry, with all that such a Commission involves, can satisfy the legitimate claim for a final clarification of the fate of the populations affected.

Again in the interests of reassuring the population, we are particularly pleased to see paragraph (e) of Article 2 of the text submitted by the Chamber, which requires the Commission to draw up an exact balance of what has been done and what remains to be done to compensate those who have suffered damage and to obtain reimbursement from those responsible for the losses.

In regard also to the collection of the necessary elements of assessment for the revision and integration of legislation on dangerous industries, and also of the regulations on urgent control checks and measurements in the case of incidental activities under Article 3 of the text submitted by the Chamber, it is obvious once again that a Parliamentary Commission of Enquiry will be a suitable instrument to exercise incisive control, stimulus and encouragement, more effective in this connection than a mere fact-finding investigation, especially in regard to the co-ordination of contributions from different levels of the public administration, which are not always able to adopt the unified attitude which is necessary for a satisfactory legislative draft.

This emerges also from the fact that although the Ministries of Health and Labour have initiated the preparation of new regulations, we are still far, as it would appear, from any final conclusion of their parliamentary examination.

A final point is that the Seveso disaster has raised in alarming fashion and rendered absolutely essential the protection of the environment which necessitates, over and above remedial measures relating to particular disasters, a wide-ranging policy to safeguard the environment and the balance of the environment for the future. We have to accept, in fact, that the repetition of incidents of contamination of different types over progressively wider areas is liable to prejudice the habitability and the production capacity itself of enormous areas of the country. No adequate safeguard against these serious dangers is in fact provided either by Act No. 615 of 13 July 1966 against atmospheric pollution or by the legislation on the contamination of waters, recently presented in systematic form in the "Merli Act". The text transmitted by the Chamber of Deputies appears, on the other hand, to contain precise indications in this connection: Article 3, which has already been quoted above, provides for the Commission to collect all useful elements of assessment "on potential risks deriving from industrial activity in the production process overall".

We should not fail to note the decisive importance of this formulation, which opens up the widest prospects for the Commission of Enquiry to exercise control, intervention and put forward proposals.

The Commission is required to investigate in detail all aspects associated with the activities of dangerous industrial installations and in particular - it should be emphasized - both during the experimental and finished product phases: only in this way will it be possible to establish clearly the risks affecting the environment and the health of members of the public. In the performance of the more general functions, entrusted to the Commission by the said Article 3, the Commission may also delegate, within the framework of a harmonious collaboration, to the Special Commission on ecological problems the examination of aspects requiring a more careful and far-reaching analysis, with a view to the preparation of legislative measures. This method of work is suggested by the significant observation, to which we give full support, contained in the opinion expressed by the Special Commission on Ecological Problems which, within the limits of the powers attributed to it by the motion which brought it into existence, has expressed qualified approval of the draft bill setting up the Parliamentary Commission of Enquiry.

The Combined Commissions on Industry and Health have carefully considered the alternative possibilities contained in Draft Bills Nos. 94 and 220 submitted to the Senate. It should be pointed out in this connection that Draft Bill No. 220, sponsored by a number of our colleagues from the Communist group, provides for the extension of the Parliamentary Commission of Enquiry to cover also the incidents at Manfredonia and Priolo. An obvious argument in favour of such an extension is the desire for a very complete investigation, covering all forms of contamination and all damage caused to the health of workers and members of the public, quite apart of course from reasons of objective justice in the sense of a complete and definitive determination of the liability for such incidents and phenomena.

Against this we have to set the requirement for the establishment of the Parliamentary Commission of Enquiry as soon as possible, bearing in mind the long period which has already passed since the tragedy of Seveso, which brooks no further delay and suggests

immediate acceptance without amendment of the text transmitted by the Chamber of Deputies.

The Combined Commissions on Industry and Health have selected the second alternative and I myself am fully confident in recommending approval without amendment of the text originating from the Chamber, Draft Bill No. 665, especially since consideration of the Bill appears to offer the concrete possibility of extending the investigation, if not the official enquiry, to the facts of Priolo and Manfredonia.

The need to speed up the establishment of a Parliamentary Commission of Enquiry, already one year after the incident, is obvious to all. Recent rather alarming news has to be borne in mind in this connection, namely that zone B is contaminated in the same way as zone A and that many other industrial establishments may have to close from one moment to the next, so that hundreds of workers may lose employment. At the same time the contaminated zone may extend further, since even today domestic animals are dangerous carriers of this terrible poison, which may even be carried by the uncontrolled spreading of contaminated soil. This is all the more disturbing when we remember the extremely small quantities of dioxin which are sufficient to cause irreversible damage to the human organism. We should remember that Dr. Ton That Tung of the Viet-duc Hospital in Hanoi publicly stated that the mortality rate in Vietnam (mainly due to cancer) was 300 out of every 1000 persons contaminated. The ILO in Geneva, located incidentally in the neighbourhood of the Swiss Group responsible for the installation of ICMESA in Italy, has a very full documentation - which is accessible to all - on the effects of dioxin, including proof that the consequences of intoxication reach their maximum intensity one or two years after contamination: striking effects are produced on the epidermis, on the hair and in particular on the frequency of abscesses and tumours.

In these dramatic circumstances we should give credit to the Ministry of Health for its prompt and energetic assistance to the affected zone, in cooperation with the work of the Region of Lombardy and of course in full agreement with the regional administration. The Ministry of Health has in particular, on the basis of a proposal submitted by the Cimmino Commission, convened in Rome a meeting of experts from different countries for the collection of further information of concrete use in this connection. These

meetings will provide information on the results of research and experiments on the effects of dioxin, carried out in other countries following the dramatic incident at Seveso. An important contribution has been made to all this documentation activity and to the preparation of decontamination measures by research workers from the Higher Institute of Health, officials of the Ministry of Health and technical advisers from the Region of Lombardy. We should also acknowledge in this connection a less substantial contribution than was expected from the European economic community.

It only remains for me to reaffirm the need for the Senate, bearing in mind the serious reasons for concern outlined above, to give the required approval to Draft Bill No. 665, on the assumption obviously that this will include also the substance of Draft Bills Nos. 94 and 220.

MINNOCCI, Rapporteur.

Act No. 357 of 16 June 1977

Parliamentary Enquiry on the escape of toxic substances, occurring on 10 July 1976
in the ICMESA establishment and on the potential risks to health and the environment
resulting from industrial activity

Article 1

A Parliamentary Commission of Enquiry is hereby set up to investigate and report to parliament on the causes and liability for the escape of contaminating substances, occurring on 10 July 1976 from a reactor installed in the establishment of the company ICMESA, affecting predominantly the communes of Meda, Cesano Maderno and Desio in the province of Milan.

Article 2

The Commission is to determine:

- (a) what licence was issued and what manufacturing activity installed and in operation up to the time of the incident in the establishment of the company ICMESA,
- (b) what was the effective output of ICMESA, to which customers was it despatched and for what use was it intended,
- (c) who was responsible at every level, central or local, in relation to the installation, for the safety or harmfulness of production, for control checks and any other measure necessary for aversion of the disaster,
- (d) what are the consequences of the incident of 10 July 1976 on the health of members of the public, on the environment, on the land and on the economy of the zone,
- (e) what measures have been taken or should be taken to compensate members of the public who have suffered damage as a result of the incident of 10 July 1976 and to obtain reimbursement of these damages from those responsible.

Article 3

The Commission, based on the results of its investigation and taking into account the present state of industrial installations on Italian territory and the regulations in force, shall collect the necessary elements for an evaluation of the potential risks resulting from industrial activity over the whole range of production processes, so as to formulate proposals for a more effective system of regulations for the protection of the health of workers and members of the public, for the maintenance of a balanced natural environment and to ensure adequate services and effective controls.

Article 4

The Commission shall consist of 15 Deputies and 15 Senators, nominated by the President of the Chamber of Deputies and the President of the Senate respectively, selected in such a way as to correspond to the numbers of the different parliamentary groups. The Commission shall elect from among its members one chairman, two vice-chairmen and one secretary.

The Commission shall make use of the collaboration of experts appointed by it.

Article 5

The Commission shall decide by majority vote on whether individual sessions are to be held in public.

Article 6

The Commission shall complete its work and present its final report to the Chambers within six months of its establishment.

The Commission shall notify the President of the Chamber of Deputies and the President of the Senate of the state of its work every two months.

Article 7

The Commission shall carry out its investigations and examinations with the same powers and subject to the same limitations as the judicial authorities, in the sense of Article 82 of the Constitution of the Republic.

Article 8

The expenses incurred on the operation of the Commission are to be met half from the internal budget of the Chamber of Deputies and half from the internal budget of the Senate.

Article 9

The present Act shall come into force on the day following its publication in the Official Gazette.

The present Act, bearing the Seal of State, shall be inserted in the Official Schedule of Acts and Decrees of the Italian Republic. All persons are obliged to comply and require compliance with the laws of the State.

Draft Bill No. 1948, proposed by Deputies Orsini Bruno, Agnelli Susanna, Borromeo D'Adda, Borruso, Chiovini Cecilia, Ferrari Marte.

Extension of the dateline laid down in Article 6 of Act No. 357 of 16 June 1977,
establishing the Commission of Enquiry into the escape of toxic substances on
10 July 1976 in the ICMESA establishment and on potential risks to safety and the
environment resulting from industrial activity

Sole Article

The dateline, laid down in the first paragraph of Article 6 of Act No. 357 of 16 June 1977, is extended by six months from the date indicated in the Act.

The present Act shall come into force on the date following its publication in the Official Gazette of the Italian Republic.

Act No. 12 of 24 January 1978

Extension of the dateline laid down in Article 6 of Act No. 357 of 16 June 1977,
establishing the Commission of Enquiry into the escape of toxic substances on
10 July 1976 in the ICMESA establishment and on potential risks to safety and the
environment resulting from industrial activity

Sole Article

The dateline, laid down in the first paragraph of Article 6 of Act No. 357 of 16 June 1977, is extended by six months from the date indicated in the Act.

The present Act shall come into force on the date following its publication in the Official Gazette of the Italian Republic.

The present Act, bearing the Seal of State, shall be inserted in the Official Schedule of Acts and Decrees of the Italian Republic. All persons are obliged to comply and require compliance with the laws of the State.

Summary picture of the increase in capital and the changes in shareholdings of the company ICMESA between 1 July 1946 and 31 July 1976

ANNEXE XI

Serial number	DATE	CAPITAL			L. Givaudan & Co. S.A. Venier-Genève	L. Givaudan & C. S.A.I. Milano	F. Hoffmann La Roche & C.-S.A. Grenzacherstr. 124 – Basilea	Dreirosen A.G. Kleinhuniger- Anlage, 10 Basilea	Mastracchi Manes Salvatore Roma	Rezzonico Ugo Milano	Vignati Carlo Milano	Frodotti Roché S.P.A. Piazza Durante, No 11 Milano	Banca Pictet & C.-Rue Diday 6 Genève	Tannoja Jole, Nata a Roma, ivi dom., via Monti Parioli, no. 50	Rezzonico Fat- sto, nato Lugano dom via Rossi, 5 Milano	Soprano Enrico Napoli	Pennavaria Fi- lippo Roma	Parravano Giu- seppe Milano	Mastracchi Luigi Lecce	Banca Comm. It. sede Milano	Credito Ital. sede Genova	I.R.I.-Ist. Ri- cost. Industr. Roma
		Lire	Number	Value in lire																		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	1. 7.46	4.000.000	80.000	50	56.340	150	—	—	1.520	14.960	—	—	—	—	—	1.000	1.000	4.000	1.000	10	10	10
2	11. 8.47	48.000.000	96.000	500	67.608	4.392	—	—	624	21.964	1.000	—	—	—	—	—	—	400	—	—	12	—
3	26. 4.51	48.000.000	96.000	500	67.608	4.392	—	—	624	21.976	1.000	—	—	—	—	—	—	400	—	—	—	—
4	10.10.51	48.000.000	96.000	500	67.608	4.592	—	—	624	22.176	1.000	—	—	—	—	—	—	—	—	—	—	—
5	28.12.51	96.000.000	96.000	500	67.608	4.592	—	—	624	22.176	1.000	—	—	—	—	—	—	—	—	—	—	—
6	18. 6.58	192.000.000	192.000	1.000	135.216	9.184	—	—	1.248	44.352	2.000	—	—	—	—	—	—	—	—	—	—	—
7	21.10.61	400.000.000	400.000	1.000	281.700	19.133	—	—	2.600	92.400	4.167	—	—	—	—	—	—	—	—	—	—	—
8	14.11.61	400.000.000	400.000	1.000	184.867	19.133	—	—	2.600	92.400	4.167	—	96.833	—	—	—	—	—	—	—	—	—
9	22. 5.62	400.000.000	400.000	1.000	184.867	19.133	—	—	200	92.400	4.167	—	96.833	2.400	—	—	—	—	—	—	—	—
10	23. 5.63	400.000.000	400.000	1.000	184.867	19.133	—	—	—	92.400	4.167	—	96.833	2.600	—	—	—	—	—	—	—	—
11	26. 1.65	400.000.000	400.000	1.000	184.867	19.133	—	—	—	92.400	4.167	—	96.833	—	2.600	—	—	—	—	—	—	—
12	24. 1.69	400.000.000	400.000	1.000	184.867	19.133	—	—	—	—	—	99.167	96.833	—	—	—	—	—	—	—	—	—
13	6. 2.69	400.000.000	400.000	1.000	184.867	19.133	—	96.833	—	—	—	99.167	—	—	—	—	—	—	—	—	—	—
14	10. 2.69	400.000.000	400.000	1.000	184.867	—	118.300	96.833	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15	19. 7.71	600.000.000	600.000	1.000	277.300	—	177.450	145.250	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16	21. 6.72	1.000.000.000	1.000.000	1.000	462.170	—	295.750	242.080	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17	31. 7.76	1.000.000.000	1.000.000	1.000	462.170	—	295.750	242.080	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Notes on the table (with reference to the following serial numbers)

- Following discussion on 28.4.47, inscribed in the registry of the Court of Milan under entry No. 32634 5.8.47: increase in share capital.
- Following discussion on 30.10.51, an increase was made in the share capital, approved by the Court of Milan by Decree No. 9.363 of 16.11.51.
- Following discussion on 30.4.58 an increase was made in the share capital, recorded in the register at Milan, entry No. 41836, Mod. 1, Vol. 1207 of 10.5.58 in the Public Archives, approved by the Court of Milan by Decree No. 3063 of 21.5.58.
- Following discussion on 12.9.61 an increase was made in the share capital, recorded in the register at Milan as entry No. 8738, Mod. 1, Vol. 1354 of 14.9.61, approved by the Court of Milan by Decree No. 6057 of 19.9.61.
- Following discussion on 19.5.71, an increase was made in the share capital, approved by the Court of Milan by Decree No. 4131 of 17.6.71.
- Following discussion on 21.6.72, an increase was made in the share capital, approved by the Court of Milan by Decree No. 5109 of 20.7.72.

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Report of the Directorate General of the Public Health Services of the Ministry of Health
on the problem of contamination in the Priolo-Melilli zone

About 15 years ago an appreciable increase occurred in the number of industrial installations in the coastal belt between Augusta and Syracuse, including petrol refineries, petro-chemical industries, cement manufacturing plant and other minor industries, the emissions from which caused changes in the environment affecting both the state of the atmosphere and that of the marine waters in the coastal zone.

The principal undertakings in this industrial belt were Liquichimica in the area of Augusta, ESSO Rasiom, a subsidiary of Liquichimica, Montedison in the area between Augusta and Syracuse, ISAB, recently built between Montedison and Syracuse, the Pupillo cement factory, the new ENEL thermoelectric power station, which comes into operation during the present year, and a number of minor industries.

The special configuration of the various urban districts along the coast means that these industries occupy areas in different districts, Liquichimica and ESSO Rasiom being located in the area of Augusta, Montedison in the area of Syracuse, Augusta and Melilli and ISAB in the area of Melilli.

The inhabited zones immediately along the coastal belt, in which the above industries have been installed, are the seaside part of the town of Melilli and the urban centre of Priolo, which is a suburb of Syracuse.

Priolo is in fact very close to the Montedison establishment, at a distance of about 1000 metres.

On 7 August 1976 Dr. Buonocore, municipal medical officer of Priolo, reported in the newspaper, "L'Ora di Palermo" a situation of extreme seriousness in connection with the health of the inhabitants of Priolo, who were exposed to emissions from the industrial zone, involving serious consequences for their health. He referred in the same article to Order No. 167/76 by the Office of the Health Adviser of the urban district of Syracuse which laid down, "that no new buildings should be erected in the village of Priolo,

although normal maintenance would be permitted of existing buildings, and it would be necessary to make provision for the gradual transfer of the present population in view of the presence of industries emitting harmful gases".

The Municipal Administration of Syracuse in fact criticised Order No. 167/76 on the following grounds:

- (1) that the competent regional authority had failed to adopt similar measures in connection with the village of S. Foca in the commune of Melilli, the boundaries of which marched with Priolo,
- (2) that the territory of the urban district of Syracuse was included in zone A under Act No. 615 of 13.7.1966 for purposes of the control of atmospheric pollution and was in consequence subject to the appropriate control measures.

There was serious concern in regard to the deterioration in the environmental situation, furthermore, as reported in the same article, in view of plans by Montedison to install a new plant for aniline production and the coming into operation in the near future of the new ENEL thermoelectric power station, comprising two 325 MW units, each fired with heavy oil.

It should also be pointed out that only recently the competent municipal authorities have requested the inclusion of the districts in question in the zone subject to control under the Atmospheric Pollution Act. The Ministerial Decree of 14.10.1975 in fact included the urban districts of Augusta and Syracuse in zone A under Act No. 615 of 13.7.1976 for purposes of the prevention of atmospheric pollution and the Ministerial Decree of 26.7.1976 made the same provision for Melilli.

Prior to these dates, industrial establishments in areas forming part of the urban districts of Augusta, Syracuse and Melilli were not subject to the provisions of Act No. 615 against atmospheric pollution and were not in consequence required to submit to the competent authorities, in conjunction with their application for a building permit, details of the emissions of gas originating from the industrial plant.

This notification of gaseous emissions should however, in accordance with Presidential Decree 322/71, be submitted to the municipal authorities within six months of the date of publication of the Order including the district in the control zone; the municipal authorities are required to transmit the relevant files, within thirty days of receipt, to the Regional Committee Against Atmospheric Pollution (CRIA), which is competent to express an opinion and to formulate the measures to be taken by the municipal authorities. The provincial commission, for which provision was made in Royal Decree No. 147 of 9.1.1927 is competent in respect of industrial operations involving the use of toxic gases.

As a result of the information circulating in regard to the alleged atmospheric pollution in the zone, the Ministry of Health requested information by telephone on 7 August 1976 from the provincial medical officer of Syracuse. The latter, having made contact with the fire brigade, the magistracy and the Office of the Prefect, informed the Ministry that there was not a state of emergency.

The Ministry of Health obtained information through N.A.S. channels that on 11 July 1976 the mobile sampling station of the provincial hygiene and prophylaxis laboratory of Syracuse had recorded atmospheric pollution values below the limits laid down by the regulations in force.

In view of the breakdown of the mobile station of the provincial hygiene and prophylaxis laboratory, however, the Higher Institute of Health arranged to send out a mobile sampling station of its own.

On 8 August 1976, following a telephone request from the Ministry of Health, the provincial medical officer of Syracuse submitted detailed information on the situation, including every aspect of risk. The provincial medical officer had received confirmation of the absence of risk from the Office of the Prefect, from the fire brigade and from the office of public safety (?) of Priolo. The provincial medical officer also confirmed that the mobile sampling station of the provincial hygiene and prophylaxis laboratory (LPIP) of Syracuse had recorded during the preceding months atmospheric pollution values below the limits of the regulations in force. The mobile sampling station was however at the time under repair.

On 9 and 10 August 1976 Professors Ugolini and Cerquiglini of the Higher Institute of Health, on the instructions of the Ministry of Health, visited the zone to determine the situation in regard to the state of contamination.

On 10 August 1976 the Ministry of Health received a report from the provincial medical officer of Syracuse on the situation in the zone, which revealed no evidence of a state of danger. The provincial medical officer also reported that he had invited the Institute of Hygiene of Catania to undertake sampling in the zone, in view of the breakdown of the mobile sampling station of the LPIP.

In the meantime the Ministry of Health had received reports from the local authorities on the situation in the Region and on the state of the mobile laboratory belonging to the LPIP of Syracuse. The Ministry of Health also issued telegraphic instructions on 16 and 20 August 1976 in regard to measures to be taken in connection with atmospheric pollution, toxic gases and unhealthy industries.

The first telegram emphasized the desirability of stepping up the activities of the Regional Committee Against Atmospheric Pollution and the setting up of a technical unit within the Committee. It also pointed out the need for the provincial administrations to set up an antipollution service.

The second telegram brought to the notice of the local authorities and their technical and administrative organs, the need for a scrupulous compliance with the regulations in force in regard to toxic gases and unhealthy industries, requiring in particular:

- (A) a re-examination of authorizations for the use of toxic gases with a view to checking the safety systems in force,
- (B) implementation of the provisions of Article 102 et seq. of Royal Decree No. 45 of 3.2.1901,
- (C) a classification of unhealthy industries located in the municipal territories, which had not yet been classified.

(D) steps to determine whether unhealthy industries had the means of safeguarding public health and, in appropriate cases, the passing of the necessary measures.

On 23 August 1976 the Ministry of Health received a memorandum from the Ministry of the Interior stating that the Prefect of Syracuse, following a meeting held at the Prefect's Office on 10 August 1976, had reported that, although there was in fact a pollution problem in the zone, the values recorded were below the limits statutorily laid down and did not justify the state of alarm of the population and the campaign in the press.

A requirement was also put forward for the equipment of the provincial hygiene and prophylaxis laboratory of Syracuse with more effective means for control checks of atmospheric pollution. A request for sampling stations was also submitted by the municipal authorities of Melilli to the competent central and regional authorities. It should be pointed out in this connection that provincial administrations are required under Article 7 of Act No. 615 of 1966 to set up atmospheric pollution sampling services, making use of provincial hygiene and prophylaxis laboratories.

The problem under examination brings out clearly the need for persons responsible for the control of atmospheric pollution at the provincial level. In the specific case a large number of industries are concentrated in the adjacent urban districts of Augusta, Melilli and Syracuse (the suburb of Priolo) and furthermore the effects of the atmospheric pollution are felt well outside the bounds of these districts.

Further points which have to be considered in this connection are the desirability of a dispersion at urban district level of expensive sampling apparatus and in particular the shortage on the national scale of the technical personnel required for the correct operation of the equipment and interpretation of the results. There is a requirement in this connection for training courses for the staffs of provincial laboratories to be run by the Higher Institute of Health.

The Ministry of Health continued to pay close attention to the problems associated with sampling services and to the atmospheric pollution values recorded. On 1 September 1976, a meeting was held at the Ministry of Health under the chairmanship of the Director General of Public Hygiene with the participation of representatives of the ISS (Higher Institute of Health) and the principal industries located in Sicily to examine the situation in regard to atmospheric pollution in the industrialized zones and to find means of increasing the effectiveness of sampling measurements in the Region, using sampling equipment belonging to the industries themselves.

As a result of agreements reached at this meeting, the Ministry of Health invited the directors of the Industrial Consortium for Environmental Protection (CIPA), of the ISAB refinery, of the Montedison petrochemical establishment and of ENEL in respect of the future power station at Melilli to submit monthly records from existing sampling stations to the provincial medical officer and to the LPIP of Syracuse, with a copy to the Ministry of Health. CIPA was also requested to complete the equipment of its own mobile laboratory. The Higher Institute of Health promised full cooperation to ensure the best possible utilization of the data submitted.

In the meantime, two residents of Marina di Melilli were admitted to the Civil Hospital of Syracuse, but the diagnosis was negative. Sampling equipment from the Institute of Hygiene of the University of Catania was installed at Marina di Melilli and began to submit returns to the Ministry of Health, the Office of the Regional Adviser of Health, the Provincial Health Adviser, the Prefect and the Provincial Medical Officer of Syracuse on the results of sampling in the inhabited zone of Marina di Melilli between 1 and 9 September 1976.

The Institute of Hygiene also offered to continue sampling operations, extending the area to other points of contamination within the region of Syracuse. The recorded values were in all cases within the limits fixed by the regulations in force.

In the meantime the Higher Institute of Health, in close cooperation with the local authorities, offered to organize theoretical and practical courses of instruction in recording data on atmospheric pollution and to coordinate the relevant services. Various meetings on the problems involved were also held at the Institute.

On 9 October 1976, the Ministry of Health, in response to an earlier request from the Chairman of the Regional Board of Sicily, invited the Chairman to a meeting, to examine the situation and the problems arising in connection with atmospheric pollution in the Region. This meeting was held on 15 October 1976.

Following this, within the framework of the necessary close cooperation with the local authorities, and in order to keep all aspects of the problem under close consideration, the Vice Director General of the Directorate General of Public Hygiene in the Ministry of Health took part on 30 October 1976 in a meeting held at the provincial administration at Syracuse, to examine antipollution measures in the south western belt.

A further meeting was held at the Higher Institute of Health on 23 November 1976, attended by the President of the province of Syracuse, a representative of the University of Sicily and representatives of laboratories concerned with atmospheric and water pollution from the National Council Research, to review the situation in regard to pollution in the province of Sicily and to propose a programme of measures.

This meeting laid down the structures to be set up immediately in the context of a programme of measures to be taken in cooperation by the local authorities, the industries concerned, the Higher Institute of Health, the National Council of Research and other institutes from the University of Sicily.

The Ministry of Health continued to pay constant attention to the problem on the basis of information and data on atmospheric pollution, periodically submitted by the provincial medical officer and the industries concerned, with particular reference to possible clinical aspects affecting populations resident in the industrial zones. To this end, the provincial medical officer had established a medical team to undertake control checks on the state of health of the population of Marina di Melilli, especially those resident in the neighbourhood of contaminating industries.

A medical team was in fact set up in agreement with the Director of the Provincial Antitubercular Group and the medical superintendent of the Civil Hospital of Syracuse. In view of the conditions liable to occur as a result of atmospheric pollution, the team included specialists in tuberculosis, dermatology, ophthalmology, ENT, paediatrics and cardiology. This medical team carried out a clinical examination between 16 November and 14 December 1976, a measure which was favourably received by the population of Marina di Melilli.

The Ministry of Health subsequently took the opportunity of carrying out further clinical investigations, supplemented by additional forms of diagnosis, bringing in other bodies concerned with the problem, such as the insurance institutions and the provincial inspectorate of labour.

On 26 May 1977 the Higher Institute of Health, having examined the documentation submitted by the chairman of the provincial administration of Syracuse, in accordance with the agreement at the previous meeting on 23 November 1976, notified the chairman of the provincial administration that the Institute was prepared immediately to undertake the operative phase of its activity in the context of the programme of research on atmospheric pollution of industrial origin in the zone. Mention was also made of the measures to be taken by the local authorities, also agreed at the meeting in November 1976, to initiate the planned programme of research. Several requests were subsequently submitted to the local authorities from the Ministry of Health via the provincial medical officer of Syracuse to implement the programme of research. The competent local authorities were also requested to adopt measures within their fields of competence in connection with industries responsible for exceeding the legal limits of atmospheric pollution.

Several sampling stations in fact recorded in various months, levels of contamination exceeding the legal limits, although to no great extent either in terms of the level or duration, these excess values being recorded in connection with point-type concentrations (over a period of 30 min).

In this connection the Ministry of Health, in addition to requesting information on the measures taken, required the local authorities and the Regional Committee Against Atmospheric Pollution, to take the necessary measures within their competence. At the present time the Ministry of Health is continuing to follow closely all matters connected with the full implementation by the responsible local authorities of the current antismog regulations in the districts in question.

The many different aspects of the problem under examination, emerging from the above review, necessitate a number of observations of a general character. The antismog regulations, furthermore, relate only to some aspects of the very much larger range of problems affecting the operation of industrial plants.

It has to be borne in mind here that the limitation of risks and the prevention of accidents in the industrial fields extend far beyond the original aim of accident prevention, covering the essential requirements of safeguarding and protecting the environment and the health not only of workers but also of members of the public.

Among the different manufacturing sectors, the chemical industry involves by its very nature a high element of risk; the performance of a complete chemical cycle always involves a certain measure of danger, albeit potential, which is accentuated when the operative cycle develops with the simultaneous presence of high temperatures, high pressures and toxic, corrosive, explosive, flammable etc compounds.

The operation of such plants therefore involves a certain potential risk, both immediate in regard to the health and safety of workers and indirect in regard to the health of other employees in the plant and on occasions the population outside the plant and the surrounding environment.

It is necessary in this connection to examine first of all the regulations governing this sector of industry in Italy, starting with the regulations covering unhealthy industries. The relevant legal provisions are contained in Articles 216 and 217 of T.U.LL.SS. of 1934.

These regulations apply to all industries involving a potential risk to public health and are in consequence an important instrument for the prevention of hygiene nuisances of industrial origin.

Article 216 provides that manufacturing and production processes giving rise to vapours, gases or other insalubrious emissions, or processes which may in any other way endanger the health of residents, are listed in two categories: the first category includes those which are to be isolated in country districts at a distance from inhabited zones, unless the operator is able to show, by the introduction of new methods and by special precautions, that there is no risk of damage to the neighbourhood; the second category covers industries in which special precautions are taken for the safety of the neighbourhood. The same article states, furthermore, that any person intending to operate a manufacturing or production process included in the list is obliged to notify the mayor who, if he deems it necessary in the interests of public health, may prohibit operation of the process or permit operations on certain precautionary conditions. Article 217 provides that, where vapours, gases or other emissions, waste waters or solid and liquid effluents originating from manufacturing and production processes may constitute a danger to public health, the mayor is to lay down the relevant regulations for the prevention of damage or danger and to ensure their implementation and efficacy.

This legislation provides also for the issue by ministerial decree of the list of insalubrious operations, which is to be periodically brought up to date. The most recent updating in this connection was made by the Ministerial Decree of 23.12.1976.

In addition to the above, there are also other regulations, not directly affecting the same subject, but closely linked with the problem under examination. Presidential Decree No. 303 of 19.3.1956, for example, although principally concerned with the protection of the health of the worker, is not restricted to the confines of the factory or place of work in general, but extends also outside the industrial perimeter. The Presidential Decree in question provides inter alia in Article 48 that the Inspectorate of labour shall cooperate with the health and local authorities (provincial medical officer and sanitary inspector) to prevent the operation of industrial plant liable to cause damage to the neighbourhood. The

legislator was obviously concerned that a situation of danger might affect the environment of the factory also.

Atmospheric pollution is covered in Act No. 615 of 13.7.1966 and in relation to the industrial sector by Presidential Decree No. 322 of 15.4.1971. These regulations were based on the principle of the "best practicable means" in foreign legislation, i.e. the emission limits were based on the best possible means of detection available.

Protection against water pollution was also covered in Act No. 319 of 10.5.1976, a recent act dealing specifically with safeguarding the national water heritage and providing for relevant legislation at the regional level.

Reference should also be made, finally, to the special regulations relating to the use of toxic gases. This regulation covers the use, storage and transport of a series of toxic gases, officially recognized as such and included in a list attached to the regulation.

A few comments may be made on the above summary list of regulations, with a view to suggesting the lines on which, in the view of the present administration, integrative legislative measures and the updating of the current regulations may proceed.

It is certainly true that in the field of unhealthy industries the conditions, laid down by the legislator at a particular time, have to be reviewed and brought up to date in the light of the enormous progress made in the chemical industry both from the quantitative and qualitative point of view. It is obvious that the present enormous complexity both of working processes and finished and intermediate products, introduces an element of doubt into the precautionary measure of "isolation in the country", which nevertheless allows the possibility of installation in inhabited zones. There is also however the problem of determining valid preventive measures for production processes, which are liable to abnormal changes, which is a well known problem in the scientific world. In any case it is quite apparent that the analysis of the precautionary measures to be taken in relation to the degree of danger of industrial operations, often extremely sophisticated, is something which cannot be expected of the local mayor. The latter, especially in small communes, is unlikely to have technical staffs capable of providing the necessary elements for evaluation of the problem and it is clear that the safeguarding of public health requires some guarantee that timely and adequate measures will be taken.

This guarantee of the necessary preventive measures within the worksite itself, i. e. safety measures covering not only the workers but also the environment, is something which has to start inside the factory. It is therefore primarily and fundamentally in the planning stage of the plant (planning being understood to include also a study of the most suitable location) or in a possible subsequent modification or extension phase, that careful study has to be made of all precautions against possible incidents.

It has to be borne in mind that it is never possible to exclude the occurrence of an incident with absolute certainty, and emergency plans have to be made for the case where, in spite of every possible precaution, an accident occurs. This Ministry, after careful studies in conjunction with expert consultants, has prepared a draft bill, which was sent on 5 March 1977 to the other ministries concerned, incorporating radical changes in the regulations for this sector and including inter alia the principles referred to above. As a result of subsequent meetings with technical experts from other organizations concerned with this problem, a further draft bill was circulated at the beginning of the present year, incorporating some of the suggestions made during the above meetings. This draft bill No. 615 on atmospheric pollution, at present in course of revision, although it will produce positive effects overall in the field of atmospheric pollution, undoubtedly has a number of shortcomings which will restrict its operative scope. A severely restricting factor was that no financial provision had been made at the time for the necessary sampling and study structures in the field of atmospheric pollution. We may quote by way of example, the difficulties experienced by provincial administrations in setting up services for the sampling and measurement of atmospheric pollution (Article 7 of Act No. 615 / 1966) in view of the financial burdens involved, and the similar difficulties which arise over their subsequent operation (personnel costs etc). A further difficulty was the absence of knowledge of the basic pollution levels in different locations and the basic conditions required for the implementation of programmes of intervention and environmental clearance operations.

An attempt has been made in the revised version of the draft bill to overcome this difficulty by giving the bill the necessary incisive and concrete qualities to pursue

effectively the given aims.

The attempt has also been made in this revision of draft bill No. 615 to overcome other shortcomings which have come to light during the 10 years of application of the antismog legislation; the most important points incorporated in the new bill relate to the extension to the whole territory of Italy of the regulations affecting industry, the establishment of a new control zone (known as zone C), in which pollution is more intensive, and more effective regulations in regard to the control of vehicle emissions. The new bill will of course bring up to date the provisions in Act No. 382/1975 and Presidential Decree 616/1977 relating to the transfer of functions to the Regions.

In regard to various parts of the regulations relating to industry, the application of the Act will be extended to the whole national territory and not only, as at present, to control zones A and B, for which provision is made in the present legislation. The aim of this is to prevent and control incidents of contamination which, as recent experience of numerous cases has shown, may be due not only to industrial concentrations but also to individual establishments. The regulations will still require that industries, located in control zones, shall use only the prescribed fuels. The third control zone C introduced by the new legislation (which will initially comprise the cities of Milan and Turin) will cover areas of intensive atmospheric pollution, in which stricter requirements will be imposed in regard to the use of particular fuels.

Thermal plants belonging to public utilities will be subject to the Act if located in control zones, whereas in the case of industrial plant, as has been stated above, the scope of the legislation is extended to cover the complete national territory.

The obligations imposed on thermal plant in controlled zones to use only certain types of fuel results from the need to prevent pollution resulting from special local conditions (meteorological-climatic, urban planning, industrial and geographical) and in some cases (in zone C) from the high degree of pollution already obtaining. There are also restrictions on the use of fuels, based on the provisions of the EEC Directive which is to be issued shortly.

A further factor to be taken into consideration is the contamination due to vehicles, the control of which is subject to particular regulations. Reference may be made in this connection to the introduction of controls on mass-produced vehicles of an approved type, to ensure that the characteristics of the approved vehicle are complied with during mass production.

It may be pointed out that the need to update current legislation in this field applies not only to Italy but also to other countries of the EEC. Measures have in fact been taken at the Community level for an updating of the relevant legislations on an international level rather than piecemeal by individual nations. It may be pointed out in this connection that a useful contribution to the updating of legislation has been made by the EEC in the form of the utilization of a large quantity of data collected in a series of Community programmes. Reference may be made in fact to the near completion of the ECDIN programme (Environmental Chemicals Data and Information Network), which is a functional element of the International Referral System of the UNEP and CIDST (Committee on Information and Scientific and Technical Documentation), the "local agency" of which in Italy is the Ministry of Health. Reference may also be made, finally, to the Euronet programme which provides for direct cooperation between the principal information centres in the Community. This programme deserves support and should be implemented as soon as possible, in order to achieve as wide and as rapid as possible an exchange of all types of information. The speed and directness of information exchanged, not only between national and regional bodies, but also on the international level, are in fact essential features in ensuring the timely and efficient measures of intervention which emergency situations require.

The World Health Assembly at its meeting in May 1977, on a proposal submitted by the Italian Delegation, discussed this problem in depth and unanimously approved Resolution WHA 30.47 dated 19.5.1977, which provided for:

- (1) the study of the problem and the long-term strategy in these sectors and, in cooperation with appropriate national institutions and international organizations, the examination of the possibility of an international cooperation, including the financial and organizational aspects, with a view to:

- (a) accelerating the determination of the dangers to health resulting from exposure to chemical substances, promoting the use of experimental and epidemiological methods enabling a comparison of the results on the international level,
 - (b) exchanging information on the dangers to health of new chemical substances,
 - (c) assisting in a rapid and effective response to emergency situations and preparing the way for agreements on mutual assistance between Member States,
 - (d) providing the necessary personnel,
- (2) the reporting of the results of this study, together with the relevant recommendations, to the Executive Board and the General Assembly as soon as possible.

Attention has been directed to the problems involved in the control of dangerous industrial activities at the headquarters of the European Community also; the EEC Commission has prepared a draft directive which is at present under discussion between experts of the nine Member States. The EEC draft directive and the draft bill, prepared by the Ministry of Health, follow the same general lines.

Public health is moving forward in many directions, but this naturally requires a joint effort by scientists, research workers, technicians and operatives in the field of public health, and also of course by politicians themselves, in order to master a subject relating to so many different disciplines in accordance with the principles of advancing science, and with the need to protect man and his environment.

The Director General

Submitted to the Commission on 20 March, 1978.

Report of the Directorate General of Public Health Services of
the Ministry of Health on the incident at Manfredonia

On Sunday 26 September 1976 at 9.40 a.m. an explosion occurred in the iron cooling column NH 3 in the ANIC petrochemical establishment at Manfredonia, causing considerable alarm among the population of Manfredonia and Monte San Angelo.

According to statements by the management of the establishment, this incident resulted venting to the environment of the following substances:

60 t H_2O

10 t arsenic

18 t potassium oxide

These substances were spread over an area of about 10 km^2 : subsequent analyses yielded positive results for the presence of small quantities of arsenic.

Action was taken by the local authorities and the mayor of Manfredonia issued an Order (27.9.76) prohibiting the consumption of food products originating from the affected zone. Warning notices were also posted, addressing to the population concerned.

A further Order was issued on 28 September 1976 prohibiting pasturing and the keeping of animals in the affected zone. At the same time a health centre was set up in the Manfredonia hospital, to carry out health checks on the population of the complete zone. The population attended this health centre, where they were examined and appropriate treatment administered with arsenic antidotes. Persons requiring hospital treatment were admitted to the local civil hospital.

The collected data indicate that the results of the contamination were minimal outside the above zone.

A priority problem was of course that of reclamation. A decontamination committee was immediately set up, consisting of Professors Ambrosi, Marano, Lumare, Sebastio, Cotecchia, Polenio, Marino, Battelli, Zingrillo, Perna, Crupi, Nitti, Ugolini, Cerquiglini.

As soon as the incident was reported, the Ministry of Health took steps to despatch to the area technical staff from the Higher Institute of Health and from the Ministry, to obtain up to date information on the situation and on the measures or programmes adopted by the local authorities and to draw the attention of the Office of the Regional Adviser on Health, which was competent in this field on the basis of the delegation of state functions under Article 13 of Presidential Decree No. 4 of 14.1.72, to certain particular hygiene and health aspects of the situation; in addition to this direct contact on the spot with the local authorities, personal visits were made by officials of the Ministry of Health and by Deputy Zurlo, who had two meetings with the Regional Adviser of Health and with technical staff operating on the spot, and also with the mayors of the communes concerned.

On the basis of the above meetings, agreement was reached, in particular, on the following points:

- (1) the need for an immediate fencing off of the contaminated zones, including suitably located road blocks,
- (2) the need to ensure a strict control of the water supply and of the disposal of liquid wastes,
- (3) the need to equip the provincial laboratory of Foggia with two spectrophotometers in connection with the necessary investigations,
- (4) the setting up in Manfredonia of a control centre for all the exposed population and not only for persons exhibiting obvious symptoms,
- (5) the need for an accurate epidemiological survey, covering all persons attending for examination and admitted to hospital,
- (6) the need to ensure the availability of a sufficient number of beds for all possible hospital admissions,
- (7) the need for an intensified vigilance in the alimentary sector (an increase in the number of samples taken) and by the N.A.S., to reveal the possible presence of arsenic, for control checks of milk-producing animals exposed in the contaminated zone and for a prohibition on the consumption of milk products from these animals.

Of even greater importance were the following measures, which were taken in the veterinary sector:

- (a) control checks by the Institute of Animal Prophylaxis on farmyard animals, poultry, samples of milk, eggs, molluscs and rats.

These control checks, some of which yielded a positive result with a contamination index of 30-50 ppm arsenic, permitted the early detection of poison in some of the alimentary chains of animal origin.

On 5 October control checks on samples of milk, eggs and molluscs yielded negative results.

- (b) control checks, with appropriate documentation, on cattle, horses, pigs, sheep and goats from the contaminated zone and prohibition of the use of these animals in animal husbandry (numbers of animals present: cattle 150, including 54 milking cows, horses 7, pigs 200, sheep-goats 350).

These animals were transferred under veterinary supervision to areas free of contamination, which had been previously sprayed with iron perchloride, and were then treated with BAL and underwent laboratory examination of the urine and skin.

Milk consumption from these animals was prohibited.

- (c) slaughtering of small farmyard animals (1500 chickens and 50 rabbits),
- (d) measures prohibiting hunting over areas requiring reclamation,
- (e) control checks on animals and animal products, including fish products, by the Institute of Animal Prophylaxis.

At the same time, the responsible authorities (regional, provincial and communal) took the necessary measures for determination of the contamination and for reclamation of the area.

In specific terms the contaminating compounds were found to be sodium arsenites and arsenates, soluble arsenic salts, with the consequent risk of their collection in rain-water and the subsequent contamination of deeper layers of ground and the aquifer.

The following measures were proposed and implemented in this connection:

- (A) oxidation with calcium chloride or sodium hypochlorite,
- (B) rendering of the arsenic salts insoluble with calcium arsenate or preferably with iron salts, giving rise to the formation of insoluble ferric arsenate.

Basic treatment with iron sulphate was also indicated as an emergency measure (in case of rain). Although this did not cause oxidation of the arsenites and arsenates, it was able to render them sparingly soluble, if at all.

The Higher Institute of Health offered to coordinate technical measures and cooperate in the preparation of a decontamination plan. To this end, a meeting was held on 2.10.1976 at the provincial chemical laboratory of Foggia, attended by the directors of the provincial chemical laboratories in the region, at which agreement was reached on the following essential points:

- (1) the Higher Institute of Health would be responsible for sampling on the ground, so as to obtain a representative map of the extent of the contamination,
- (2) the Region of Puglia would undertake analyses, using local laboratories,
- (3) the Higher Institute of Health would also coordinate the necessary control measures, so as to establish the reliability of the analytical methods used and also coordinate the sampling programme and the collection of analytical data from the various laboratories.

The Ministry of Health indicated the following further requirements for gradual implementation:

- (1) the stepping up of operations to check contamination in the urban centre, to include mapping of the area with particular reference to rain-water and reservoirs in the zone,
- (2) continuous control checks of foodstuffs, both in regard to production and sale,
- (3) the provision of two spectrophotometers to the Institute of Industrial Medicine, to accelerate further the performance of analyses, and one spectrophotometer to the Institute of Animal Prophylaxis of Foggia for the control of foodstuffs of animal origin.

Problems relating to the decontamination and control of the environment were covered by the setting up of an operational group consisting of Professors Mario Polemio, Vincenzo Amicarelli, Baldassarre Pepe, Lorenzo Liberti, Giovanni Marrano, Costantino Battelli, Paolo Sequi, and a similar operational group, consisting of Professors Luigi Ambrosi, Adriano Marino, Leonardo Danatelli and Lorenzo Bonomo, was set up to deal with problems relating to the population, which had been exposed to danger and assistance to affected persons.

The provincial medical officer of Foggia, in cooperation with Professor Luigi Ambrosi and the provincial chemical laboratory and making use, where necessary, of the advice of the technical and scientific committee on decontamination, and of the group of operational experts made available by the Higher Institute of Health, appeared therefore to be in a position to control the situation and to take such measures as were necessary. The Office of the Regional Health Adviser also offered assistance.

More recently on 19.1.1977 the provincial medical officer decided in conjunction with the technical and scientific committee on decontamination, to revoke the emergency order. He emphasized, however, the need to set up a health structure (Industrial Medical Centre) for the performance over a period of at least two years of health checks on workers and members of the general public in the districts of Monte San Angelo and

Manfredonia, in conjunction with frequent and systematic control checks of the ground, vegetation, animals, reservoir and marine waters and fish.

Regional Law No. 24 of 17.8.1977 allocated to the above district administrations 2000 million lire for use in connection with the financing of future programmes. In agreement with the regional administration, these two districts have made the civil hospital of Manfredonia responsible for the setting up and management of the Industrial Medical Centre.

A meeting was held on 10 and 11 October 1977, at the headquarters of the European Community Study Centre of Bari, of the Consultative Committee set up by the European Commission to follow the course of studies relating to the consequences of the exposure to arsenic of workers and members of the public, studies which were sponsored by the EEC Commission with the aim of evaluating the level of exposure to arsenic by means of appropriate biological supervision and to draw the necessary conclusions in regard to prevention and treatment in similar cases.

The Consultative Committee recognized at its meeting the soundness of the research which had been undertaken and of the timely measures in the health field, but emphasized the importance of further investigations, using clinical and laboratory methods capable of diagnosing also subclinical damage in the selected groups.

In regard to aspects of a general nature in connection with the incident in question, apart from those matters already set out by the Ministry in the full report by the Ministry of Health in relation to dioxin contamination at Seveso, attention may be drawn to the issue of the Ministerial Circular of 2.10.1976, addressed to the Ministers of Labour and Social Security and of Industry, to the Chairmen of Regional Boards and to provincial and local authorities concerned, calling for a fact-finding investigation on the conditions obtaining in industries producing chemical substances for use in medicine, medico-surgical preparations and phytopharmaceuticals.

In regard to the regulations relating to contaminating industries, already in force prior to the incident, the relevant measures were issued in two telegraph circulars dated 16 and 20 August 1976 respectively. The first of these emphasized the importance of stepping up the activities of regional committees against atmospheric pollution and incorporating a technical organ in these committees and requiring at the same time the establishment of an anti-atmospheric pollution service by provincial administrations. The second circular drew the attention of local authorities and technical and administrative organs to the need for a scrupulous observance of current regulations in regard to toxic gases and unhealthy industries. Particular requirements were:

- (A) a review of authorizations to use toxic gases, with a view to a careful check of the safety systems in force,
- (B) the implementation of measures under Article 102 et seq. of Royal Decree No. 45 of 3.2.1901,
- (C) the classification of existing unhealthy industries in the areas of urban districts, which had not yet been classified,
- (D) a check on the availability in unhealthy industries of means of safeguarding the public health, adopting where necessary measures to ensure this.

It should be pointed out in this connection that an interministerial working group has been set up to modernise current legislation on the protection of health both among workers and members of the public in the vicinity of industrial installations, and also for the protection of the environment. This working party, which is to prepare a bill for presentation to Parliament, is under the coordination of the Ministry of Health.

A first draft of the above bill, which will place certain dangerous industrial activities under specific control, has already been sent by the Studies and Legislation Division of the Ministry of Health to the ministries concerned for initial agreement.

The measure is extremely complex with a wide range of provisions, but it will require in broad terms firms engaged in industrial activities involving highly toxic and/or toxic and persistent and/or highly flammable chemical compounds to submit to the competent

authorities, before starting production, a detailed study on the physico-chemical and toxicological nature of the compound or compounds, a description of the technological process with justificatory grounds for the technical solutions adopted, a detailed analysis of the risks involved in the industrial operations and a description of the protective measures and systems which will come into operation in the event of an incident.

In regard to activities involving dangerous substances other than those referred to above, i.e. harmful, corrosive, irritant and flammable substances, firms are bound to prepare a similar technical documentation, which will not however be submitted but made available to the competent authority for any control checks that may be required.

It should be stressed in conclusion that the immediate cooperation between the central health authorities and the local authorities responsible for public health, and the rapid reclamation and control measures in relation to affected persons enabled measures to be promptly worked out and implemented in order to deal, during the emergency phase, with the complex problems arising in connection with the incident.

The Director General

Submitted to the Commission on 20 March 1978

Report of the Provincial Inspectorate of Labour of Syracuse on the hygiene/health
and accident-prevention situation in chemical and petrochemical establishments
in the Priolo zone

With reference to telegram No. 5415 of 9.8.1976 and 6770 of 20.8.1976, we hereby report, in amplification of previous report No. 5505/E/1 of 13.8.1976, the results of investigations carried out not only in the Montedison petrochemical factory, as requested in codesto Gabinetto, but also in the ISAB factory in the area of Marina di Melilli, engaged on oil refining, part of which is located in the area of Priolo in the administration of Syracuse.

The investigation included also the COGEMA factory, producing magnesium oxide in the area of Marina di Melilli, but control checks could not be carried out in this case in view of the disturbed attitude of the inhabitants of this area in connection with the request for the allocation of new accommodation in another zone. However, since this is a small firm, employing about 100 workers, the control investigation will be carried out as soon as possible and the results notified in subsequent reports. It may be pointed out that, whatever the result of these investigations, it will not greatly affect the control checks carried out on the two previous firms which make up the core of industrial activity in the Priolo zone.

The investigations were started immediately on 10.8.1976 and were continued with the required urgency up to 4.8.1976. The inspections were carried out, on temporary attachment from the Regional Inspectorate, by two engineer inspectors, one chemical inspector, one industrial inspector, one survey inspector, employed by the regional office for many years and particularly experienced in the inspection of firms in the sector in question, one medical officer and one expert chemist from ENPI, both attached for the period in question. The above inspectors availed themselves also of the services of ANCC engineers in the execution of their tasks.

Before visiting individual divisions of the factories, interviews were held in each firm with trade union representatives and individual workers in connection with possible risks of accident and shortcomings in the health/hygiene field. Control checks were then carried out in the divisions in question and samples taken of raw materials and chemical additives used. Examination was also made of the laboratory indices of contamination

in the individual divisions of the factory during the periods immediately preceding and following complaints, and requests were submitted, during the inspection, for further laboratory analyses, which were carried out with Dräger equipment either by chemical inspectors or by company personnel but in all cases in the presence of the inspectors.

Examination was then made of the aspect of worker health, direct enquiries being made from trade union representatives in regard to any recurrent occupational diseases in connection with the type of work done, and a check was made of the regularity of preventive and periodical medical visits and of the health cards of the workers concerned. Examination was then made of the situation in the factory in regard to accident prevention, occupational diseases and cases of poisoning (INAIL, as the interested party in connection with occupational diseases, was unable to supply information on this aspect), in order to establish the number of cases of poisoning recognized for purposes of compensation. This was followed up throughout the period of atmospheric pollution of the Priolo zone and an examination made of the data supplied by the provincial chemical laboratory, relating to the period immediately preceding and following the campaign launched in the press.

The results of this investigation may be summarized as follows:

MONTEDISON S.P.A. - Petrochemical Factory in Priolo

- (a) Area: 9 km^2 , extending along the coastline connecting Catania and Syracuse, 4.5 km^2 being occupied by manufacturing plants.
- (b) Raw materials used: carbon monoxide, acetone, isopropanol, methane, crude oil, phosphorites, chlorine, pyrites, mineral sulphur, potassium salts, ammonia, phosphoric acid, sulphuric acid, fuel oil, dichloroethane, ethylene and propylene.
- (c) Chemical additives used: arsenous acid anhydride, vanadium anhydride, oxygenated water, copper ammonium solution, antifoam, bromine, molybdenum, nickel, aluminium silicide, iron oxide, copper oxide, cobalt hydroxide, diethanolamine, dimethyl disulphide, dipropionyl peroxide, epichloridine, fossil flour, silica gel, mercury, monoethanolamine, copper, sodium phosphate, potassium carbonate.

(d) Number of employees: 6650.

Various worksites are in operation within the factory, on which about 2073 operatives are engaged. Having heard reports from trade union representatives and a number of operatives from individual divisions, as stated in the introduction, the inspectors visited groups concerned with the production of aromatics, petroleum compounds, olefins, sodium chloride, special organic products, perchloroethylene, dichloroethane, hydrochloric acid, ethyl chloride, chemical fertilizers, ammonium sulphate, nitrogen and oxygen, hydrogen, propylene oxide, glycols, alcohols, standard butyl alcohol, isobutyl alcohol, polyethylene and diethyl hexanol.

It was found in fact in the divisions in question that the deficiencies reported, consisting mainly in an absence of programmed handling of the equipment in the division, giving rise to losses of various products from the pipe systems and equipment, did in fact exist; these deficiencies were justified by the firm as being due to normal wear on the plant.

Instructions were given in regard to industrial accident prevention and industrial hygiene, relating in particular to the following items:

- (a) the elimination of toxic or generally dangerous gas or vapour losses,
- (b) the installation of suitable systems for the trapping, removal and destruction of toxic or generally dangerous gases, vapours and powders,
- (c) improvement of the environmental hygiene conditions in regard to temperature, humidity and noise,
- (d) the installation of automatic sensors to indicate when dangerous concentrations or dangerous conditions are reached,
- (e) the rectification of defects in the protective systems in the passages or worksites referred to above.

It was also found in an examination of the hygiene/health conditions, that in many cases the periodical medical visits, for which provision is made in the table attached to Presidential Decree No. 303 of 19.3.1956, had not been carried out, while at the same time workers had complained of occupational diseases associated with the specific tasks on which they were employed. This aspect is still under examination by a medical official from ENPI, appointed by the Catania headquarters for this purpose. This examination should be completed during the present week and details will be reported as soon as possible.

The most general complaints consisted of gastric pain, liver conditions, headaches, burning sensations in the eyes, hearing disorders and premature sexual impotence. Examination of the occupational diseases occurring during the period from January 1974 to June 1976 revealed a picture of no great seriousness, as indicated in the attached report.

The level of contamination of the worksite environment was not found to be disturbing on the basis of instrumental measurements made in the various divisions. The measurements performed consisted in fact of 47 Dräger measurements, 9 gas chromatographic measurements, 6 colorimetric measurements, 7 spectrophotometric measurements and 1 CO detection test using a portable MSA instrument. All the above measurements were carried out to determine the percentage values of the following contaminating compounds present in the worksite environment: toluene, xylene, ethylbenzene, benzene, chlorine, mercury, carbon dioxide, hydrogen sulphate, perchloroethylene, dichloroethane, acrylonitrile, hydrocyanic acid, hydrocarbons, ammonia and extraction petroleum.

The recorded values were below the lower toxic limit recommended by the American Conference of Governmental Industrial Hygienists in 1965.

The only levels of any concern were the H_2S and hydrocarbon concentrations around the maximum tolerance limit in the petroleum product division.

ISAB Petrol Refinery in Marina di Melilli

The company occupies an overall area of 4 km², in which industrial plant covers about 2.5 km². This includes buildings used for offices, social services and fire services, in which 524 persons are employed, including 338 manual workers.

The industrial equipment of the firm includes 38 items of plant, on which a total of 2206 persons are employed. Industrial activities were started on 15.12.1975; 7 divisions are at present in operation and the sulphur production division is in course of construction. The following raw materials are used: crude oil and chemical additives such as ammonia, hydrogen, hydrogen sulphate, m-ethanolamine and sulphuric acid.

No complaints were made by trade union representatives or operatives on the hygiene/health or safety conditions of the plant; since the items of plant were in fact new, only negligible problems had arisen. The hygiene/health and safety conditions were found on inspection to be satisfactory, and control checks and chemical analyses revealed no or only very minor contamination of the worksite environment. Twenty-eight samples were taken with the Dräger equipment to determine the percentage values of the following contaminating compounds in the worksite environment: sulphurous anhydride, mercaptans, ammonia and carbon dioxide.

No permanent continuous sampling system had been installed by the firm to indicate environmental contamination, and instructions were given by the inspectors that this should be done.

Very few instructions had been issued in regard to accident prevention in implementation of the Ministerial Decree of 31.7.1934 on the processing, storage, use and sale of mineral oils. Although instructions had been issued in connection with industrial hygiene, it was found that workers employed in the plant had not undergone preventive medical inspections.

No cases of occupational disease had been recorded. Although the accident record related only to the first six months of activity, the accident rate of 37 was regarded as satisfactory, especially since the accidents in question were all of a transient nature and due to causes unconnected with the activity of the plant.

The result of the above investigation has therefore confirmed the forecasts made in the previous report No. 5505/E/1 of 13.8.1976, to the effect that the campaign in the press has been out of all proportion to the real circumstances, and that in fact the situation was not so dramatic either in respect of workers in the industries in question, or for the population of Priolo, as was recognized by the CGIL-CISL-UIL Unified Federation in its meeting held on 10.8.1976 at the Office of the Prefect, a report of which was communicated to the press on the day following the meeting.

Nevertheless, the press campaign, although ill-considered in that it was not supported by any concrete evidence, has certainly had the effect for the umpteenth time of drawing the attention of the authorities to the vital need for the organs responsible for the implementation of regulations against pollution in general, and for the protection of workers in factories and the populations of adjacent districts to be staffed with sufficient qualified personnel and properly equipped to discharge their tasks.

The writer cannot refrain from emphasizing the point that although the recruiting of personnel and the provision of equipment requires considerable time, all the necessary control checks could nevertheless be carried out immediately, if appropriate legislative measures were taken to compel all chemical, petrochemical undertakings and those processing, handling or producing toxic substances or liable to cause dangerous emissions of powders or gases, to be equipped with a range of mobile equipment, previously determined by a commission of experts, and analytical laboratories, again to be fitted out in accordance with the requirements of the above commission, and that these facilities should be made available to officials of the Inspectorate of Labour when required for the performance of control checks.

This would merely mean converting into a coherent regulation what is current practice in a number of firms which have offered spontaneous and loyal cooperation with the inspecting authorities in full awareness that safety in the factory is an essential element and that industrial operations must be accompanied by proper attention to the physical well-being of the workers.

Implementation of the above proposal would make available on the spot (and therefore immediately) the complete equipment required for the immediate performance of the necessary analyses, and enable timely instructions to be issued for the elimination of deficiencies.

This would obviously not exclude the need for the services responsible for inspection to be staffed with qualified personnel and equipped with the necessary mobile equipment and analytical laboratories. This would in fact make it possible to discover any occasional deficiencies occurring for various reasons (wear and tear or absence of reagents) in the equipment of firms and would enable all types of sampling to be carried out, appropriate to the equipment of the firm under inspection, although it has to be borne in mind that the level of pollution in a factory may not be due only to the raw materials or additives used in the particular factory, but also to those used by other firms operating on the perimeter of the whole industrial zone. In this connection it was also stated in the previous report No. 5505/Ev/1 of 13.8.1976 that the concentration of gaseous materials in the atmosphere may at any time reach a high level of contamination, both in the establishment itself and in the surrounding area where centres of habitation may be located, as a result of meteorological factors (direction of wind, inadequate ventilation and high humidity). This applies in particular to the coastal belt including the urban districts of Augusta, Melilli, Priolo and Syracuse, in which are located some of the largest chemical and petrochemical establishments in Europe and other contaminating industries, especially if other establishments of the same type are to be installed in this already saturated zone.

The determination of the degree of atmospheric pollution of an enormous industrial zone, including also inhabited centres, although it may be of concern to the Inspectorate of Labour from the point of view of the protection of the health of workers in factories, and also to the Commission appointed by the Minister of Mercantile Marine pursuant to Article 48 of Presidential Decree No. 328 of 15.2.1952 (see also Articles 5, 45, 46, 47 and 49), still remains within the primary competence of the urban district and provincial authorities by virtue of Act No. 615 of 13.7.1966 and the subsequent regulation issued under Presidential Decree No. 322 of 15.4.1971, which does not exclude in any case the competence of the provincial health authorities.

For the reasons given above, therefore, although the situation was shown by the above inspection to be by no means disturbing, the inspectorate has nevertheless examined the analytical results produced by the environmental protection consortium made up of the undertakings Liquichimica and Montedison, which makes use of a fixed sampling network of five posts installed by Montedison and of the mobile laboratory of the Association of Industries. We have also examined the results obtained by the mobile laboratory from the Provincial Administration and the sampling network set up by the ISAB refinery located between Priolo and Syracuse.

These analyses, relating to the 15 days before the start of the inspection and several days after completion of the inspection, revealed no values in excess of the tolerance limits of the human organism and thus confirmed the situation found by the inspectors in divisions of the firm with the equipment referred to above.

These values cannot however be taken to correspond completely to the real situation for the following reasons:

- (a) The data relate to holiday periods, during which plant in all the undertakings located in the industrial perimeter will not have been operating at full strength. This was found to be true in the undertakings inspected, especially in Montedison where large fertilizer plants had been closed for several months and were only brought back into operation on the 20th of the present month.

- (b) The analyses carried out by the above sampling networks and mobile laboratories, although they revealed a number (very small) of contaminating substances as indicated in the Act, could not cover completely the very wide range of chemical additives used by the firms.

For these reasons the Inspectorate of Labour has found it necessary to continue the determination of pollution values, using more sophisticated equipment to determine the contaminating compounds, and carrying out analyses during periods of greater productive intensity over more prolonged periods, so as to record a wide range of values in relation also to different meteorological conditions. This should not hide the reassuring fact, referred to above, that analyses in the different divisions of the above firms, although carried out over a limited period of time, failed to find any values in excess of the maximum admissible concentrations for the contaminating substances used in the inspected undertakings. This determination, restricted to the zone on the perimeter of each factory, should also cover the interior of the industrial zone, in order to meet the requirements more fully, and this will in fact be done in conjunction with the health authority. If necessary, determinations will also be carried out of the raw materials and chemical additives used in the ESSO refinery, in the Liquichimica chemical establishment and in the ENEL "O.M. Corbino" thermoelectric power station, operating in the area of Augusta.

The results of the actions taken by the Inspectorate of Labour will be notified to the Prefect of the Province, by whom the writer was instructed by telephone to undertake the necessary determinations as a result of the intensive state of alarm generated by the press.

The Director
of the Provincial Inspectorate

7 September 1976.

Report of the Provincial Inspectorate of Labour of Foggia on the
hygiene/health situation in the ANIC-CHIMICA DAUNA complex
in Montesantangelo

Petrochemical Centre IV Puglie of ANIC S.p.A., covering an area of 180 hectares, is located in Macchia-Agro, Montesantangelo, at a distance of about 10 km therefrom and about 4 km from the inhabited area of Manfredonia.

The industrial complex manufactures anhydrous ammonia and urea for agricultural purposes. The Chimica Dauna S.p.A. factory, founded with capital from ANIC and SNIA, producing caprolactam for textile fibre manufacture, is located in the same area. The plant in these two industrial complexes, which employ overall about 1000 workers plus 350 persons employed on maintenance work and extension of the factories, are in the main installed in the open.

Around 9.40 a.m. on Sunday 26 September 1976 the washing column in plant No. 5 of the ANIC factory (ammonium plant) burst. The function of this plant was to absorb carbon dioxide during the synthesis of ammonia. This column was 37.33 m high with a variable cross-section (minimum diameter : 2.80 m; maximum diameter 4.45 m). The terminal part of the column, about 4 m in length and 3.60 m in diameter, was ejected violently by the force of the explosion and travelled a distance of about 200 m. The ceramic seating material of the column (Raschig rings) was also expelled from the damaged column and a cloud of process material escaped. The ceramic material consisted of the packing of the upper part of the column, covering an overall volume of 110 m³.

The processing cycle of the chemical compounds inside the column may be summarized as follows. The input gases - derived from methane desulphuration processes, reforming catalysis of methane with aqueous vapour, conversion of carbon dioxide, and consisting finally of hydrogen, nitrogen, carbon dioxide and a very small percentage of carbon monoxide - undergo countercurrent washing with a solution of potassium carbonate and arsenous anhydride which absorbs the carbon dioxide. The processed gas, consisting predominantly of hydrogen and nitrogen, with a small percentage of non-absorbed carbon monoxide and carbon dioxide, passes from the head of the column to the subsequent

stages of ammonia synthesis, is taken from the base of the column and passed to the regenerating tower, where the carbon dioxide is separated off and used for the production of urea.

The original patent for the absorption of carbon dioxide belonged to the company Vetro-Coke (Marghera-Venice), the plant was designed by the company SNAM PROGETTI (ENI Group) and constructed by the company CMI of Genoa.

The absorption column, in which the explosion occurred, operates at a pressure of about 27 atm and is therefore a pressure vessel under the control of ANCC.

The attitude of the management was rather puzzling immediately after the incident. On 27 September "La Gazzetta del Mezzogiorno", reporting the event, published an interview by the Vice-Director of the establishment, Dr. Guidi in which he stated, replying to questions by the interviewer in regard to the presence of arsenic in the column, "that it was present in very small quantities". Further on, when he was asked about the content of the cloud which rose after the explosion: "it contained nothing but water vapour and entirely harmless carbon dioxide". The truth only came to light very gradually during the afternoon of Monday, when people began to talk of several dozen tons of arsenic expelled from the column and falling to earth inside the factory and in the surrounding zone.

The serious nature of the incident should however have been immediately apparent to the technical experts of ANIC since, as soon as the top of the column had been blown off, the content was bound to escape at a pressure of about 27 atm and the content consisted not only of water and carbon dioxide, but also of hydrogen, nitrogen and a solution of potassium carbonate, potassium bicarbonate and arsenous anhydride. The reticence of ANIC aggravated the situation further, producing an atmosphere of distrust in relation to the undertaking itself. The first result of this distrustful atmosphere was the suspension of decontamination operations inside the factory, which had been undertaken by ANIC, since the works council did not consider that workers engaged on this task had been equipped with sufficient means of protection.

This Inspectorate, which obtained information on the incident only from the local press at 8 a.m. on the following day (Monday 27 September 1976), immediately arranged for an on the spot inspection to be carried out by Superintendent Inspector Telesca, Head of the Technical Division.

After an initial investigation, the inspector got in touch with the Standing Technical Committee for Toxic Gases, set up in accordance with Royal Decree No. 147 of 9.1.1927, and requested its collaboration, as laid down by Division VII of the Directorate General of Industrial Reports in letter No. 19373/27/8/7 RL of 28.8.1976.

The Commission, with appropriate attachments, discussed in conjunction with the works council and the ANIC management the course of development of the incident and the consequences liable to occur. The clear conclusion was drawn from this discussion that there was serious concern both for the safety of workers in the ANIC - Chimica Dauna complex and also for that of the population in the surrounding zone, which might also have been contaminated.

A report was issued by ANIC only on Monday afternoon, containing a first estimate by technical experts of the company and based on normal operation of the plant at 85 % rated load. This showed that the compounds escaping during the inadvertent opening of the equipment had been in gaseous, liquid and solid form. The same estimate showed the volume of gas released to be of the order of $35,000 \text{ N/m}^3$, including 1000 N/m^3 water vapour. The gas was stated to consist predominantly of carbon dioxide ($25,000 \text{ N/m}^3$) and the remainder of 24 % hydrogen and 1.8 % nitrogen. The escaping compounds were estimated to be around 60 t water, 10 t arsenic and 18 t potassium oxide, together with about 110 m^3 ceramic packing material. The Commission referred to above, in conjunction with Inspector Telesca, a number of representatives of the works council and ANIC management, then visited the site of the accident for an accurate examination of the situation and found, in addition to the details given above, limited damage to the urea shop and to the external structure of the control room of block 5.

After assuring the works council that all necessary steps would be taken, the inspector in company with the Commission visited on the same evening the mayor of Manfredonia, to offer his cooperation in any measures that might be taken in the meantime by the communal authorities.

On the following day the Inspectorate of Labour, having assessed the situation, notified the competent Regional Inspectorate of the situation by means of telephone message No. 9640 of 28.9.76, requesting the immediate assistance of the chemical inspector and suggesting the desirability of requesting from the central medical service the despatch of a medical inspector, to continue the research into the medical aspect initiated by Inspector Telesca. Pending implementation of this suggestion, Inspector Telesca continued to cooperate with the provincial medical officer, the medical adviser of the company and Professor Luigi Ambrosi, Director of the Institute of Industrial Medicine of the University of Bari, whose opinion had been sought in connection with hygiene/health aspects affecting the worksite environment, with a view to taking the necessary steps.

The inspector also maintained contact with a technical health committee, set up by the mayor of Manfredonia and consisting of the mayor himself, the mayor of Montesantangelo, the provincial medical officer, the provincial veterinary officer, sanitary inspectors from the two communes in question, the director of the Hygiene and Prophylaxis Laboratory of Foggia, the aforementioned Professor Ambrosi and a representative of the works council.

Late on the evening of 28.9.76 the committee approved the issue by the mayors of the two affected communes of an Order prohibiting absolutely any activity by firms in the Macchia-Montesantangelo industrial group (ANIC, Chimica Dauna etc.), except for decontamination and safety operations on the plants, having received information of the death of farmyard animals in the zone as a result of arsenic poisoning and of traces of poison on plant leaves. This decision was notified formally to all the firms concerned on the morning of 29.9.76 by the mayor of Montesantangelo, who was competent for the area.

In implementation of the prohibition and of orders within the competence of the sanitary inspectorate, the fire brigade and the police, Inspector Telesca accompanied by Inspector Bizzarri, making use of the powers granted to inspectors of labour by virtue of Article 66 of Presidential Decree No. 303 of 19.3.56, ordered the Director of ANIC to close immediately the company canteen, having ascertained that it was still in operation at 10.30 a.m. on 30.9.76 in spite of the issue of the above order.

It may also be pointed out that on Monday 27.9.76 Inspector Telesca made contact with Engineer Belligerante of the Bari Section of the ANCC, who visited the factory for the implementation of any necessary measures and established that the damaged plant, as has been stated above, was a pressure vessel and as such subject to the supervision of his organization. It was also established that the probable cause of the bursting of the column was the low resistance in the weld zone at the point of rupture. Examination of the pressure and temperature charts do not reveal any abnormality in these parameters, the values being 27 atm and 108°C at the time of bursting (the maximum operating temperature indicated on the ANCC seal was 31 atm).

On the same day the two inspectors took part in a meeting between the ANIC management and the works council with a view to agreeing the safety measures to be implemented immediately in connection with the decontamination of the factory, the number of workers to be employed on such operations and as guards on the ANIC factory, and finally for the gradual stopping of the plant in the Chimica Dauna factory.

In implementation of telephone instructions from the Deputy Head of the Office of the Minister of Labour, Professor D'Harmant, and on instructions from Dr. Vaiano, Head of the Office, in telegram No. 7062/S 6 of 30.9.76, Dr. Zeffiri, Head of the Regional Inspectorate of Labour for Puglia and on his instructions Dr. Pepe, Head of the Provincial Inspectorate of Labour of Foggia, constituted the investigatory team in accordance with Circular No. 48 of 14.9.76 of the Ministry of Labour, Directorate General of Industrial Reports, and called on the ANCC section and the Regional Office of ENPI in Bari to appoint an official to cooperate in obtaining fuller information on

the causes of the incident and determining the measures to be taken.

The investigatory team was therefore made up as follows:

Dr. Luigi Uva, chemical inspector of the Regional Inspectorate of Labour in Bari, coordinator,

Dr. Gaetano Fiorillo, medical inspector from the Regional Inspectorate of Labour in Naples,

Dr. Luca Sebastiano, senior inspector from the Inspectorate of Labour of Foggia,

p.i. Gianbattista Telesca, senior inspector from the Inspectorate of Labour of Foggia,

engineer Alfredo Corvino, official of ENPI in Foggia.

The ANCC had not yet appointed its technical expert.

On 1 October Inspectors Uva, Fiorillo and Telesca, accompanied by Inspector Bizzarri, visited the ANIC factory to continue their enquiries and the district of Manfredonia to obtain further information from the technical commission which, together with experts appointed by the Region of Puglia and officials from the Ministry of Health, were studying the problem of decontamination within the factory and outside.

A meeting was held on the same day at the headquarters of the Urban District of Manfredonia of the committee of university experts, to consider precautionary measures to be taken to safeguard the health of the population and for the decontamination of the contaminated zones. During the meeting the chemical inspector, Dr. Uva, stressed the vital need of undertaking reclamation measures inside the factory in accordance with the programme worked out on the previous day and agreed by the firm, the works council and the inspectors of labour. The validity of the programme was recognized by the commission of experts.

On the next day the investigatory team, with the addition of Dr. Sebastiano, continued direct investigations in the factory with a view to collecting further data required for a full definition of the problem. Two further inspectors of labour, Nicola Fiore and

Vincenzo Bizarri were also collaborating with the team, maintaining contact within the factory with the works council in order to supervise implementation of the measures for which instructions had been given by the investigatory team, which will be detailed below.

Supervision by the inspectors revealed an incomplete compliance with the measures laid down for the protection of workers employed on decontamination operations. Instructions were therefore immediately issued to those responsible for seven items of plant engaged on decontamination operations and employing a total of 326 workers.

The operational team also found that there was a lack of objective data on the extent of the contaminated zone and the degree of contamination within the factory and therefore requested the assistance of the industrial hygiene laboratory of the Central Medical Inspectorate. The provincial hygiene and prophylaxis laboratory was at this time fully engaged on analyses in zones outside the factory and was therefore unable to collaborate with the inspectorate of labour on analyses in the internal zone.

The three lines of inspection inside the factory continued to be pursued by Inspectors Fiore and Bizzarri.

The medical inspector, Dr. Fiorillo, has today (4.10.76) completed evaluation of the problems relating to the health of workers and issued instructions for prophylactic measures for the prevention of intoxication by arsenic compounds. These instructions have been issued by the operational team in clear terms to representatives of the ANIC management responsible for the seven items of equipment engaged on decontamination operations.

The epidemiological situation on 1 October, according to data supplied by the Institute of Industrial Medicine of the University of Bari, although not in any way alarming, gives reason for appreciable concern. Among 200 persons examined, 30 cases of "slight" arsenic poisoning have been found, including four ANIC employees, one employee from a firm engaged on decontamination of the factory and 2 employees from the firm Farsura, located about 1 km from ANIC.

Damage had been caused in 50% of the cases to the gastro-intestinal tract and the skin; there was evidence of neurological involvement in only one case.

On the day of the incident, which was Sunday, 120 operatives were working in the ANIC-Chimica Dauna complex, 20 of whom were engaged in block 5 (the ammonia plant). Of these latter, only one reported minor abrasions due to the bursting of the column, which were expected to have healed in seven days.

Reference should be made, finally to the results of a meeting held today at the headquarters of the urban district of Manfredonia, with the participation of parliamentary representatives from the Region of Puglia, regional advisers and political authorities from the communes, with a view to planning a programme of measures to be taken in the case of ANIC. The essentially political nature of this meeting should be emphasized.

In order to guarantee the active participation of the Inspectorate of Labour of Foggia in all matters affecting the incident, it was thought desirable for this meeting to be attended by senior inspector Dr. Palazzo, who was thus able to receive, at all levels, information on all problems, whether or not connected with the incident, and relating to the field of competence of the Ministry of Labour.

The basic argument, which has been voiced in all these political discussions, has been the very slight interest of the central authorities in this question.

In matters more directly affecting the Ministry of Labour, the mayors of Manfredonia and Montesantangelo have put forward the requirement for provision to be made not only for employees of ANIC and Chimica Dauna, but also in favour of all those employed in sectors which have been adversely affected and in some cases have lost their earning capacity, such as manual labourers on the land, fishermen, workers in cheese factories in the zone, those running transport businesses and workers in the field of tourism.

Speakers at the meeting hoped for special measures to be taken in this connection and for the immediate presence at Manfredonia of high officials of the Ministry of Labour and the National Institute of Social Insurance, who would be able to give the affected populations a real guarantee of economic assistance, so as to reassure them at least for the more immediate future which, in the words of the politicians, is seen in a tragic light.

The Inspectorate of Labour of Foggia continues to exercise constant supervision at the ANIC - Chimica Dauna complex and will immediately notify the Ministry of the final outcome of investigations carried out by the investigatory team.

The Investigatory Team

5 October 1976.

