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GIUNTA REGIONALE DELLA LOMBARDIA

ASSESSORATO ALLA SANITA'

DECONTAMINATION

OF THE DIOXIN-CONTAMINATED AREAS

Coordination and development of the decontamination program approved by the Regional Council on August 24, 1976

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Prof. A. Giovanardi

December 4, 1976

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1. Deliberation of the Regional Council concerning the decontamination of the B area and the southern part of the A area, October 7, 1976.

The Regional Council has recently approved the following guidelines for decontamination of the B area and the southern part of the A area, proposed by the Regional Committee on Seveso:

- a) A layer of topsoil will be removed from all parts of the B area where the dioxin concentration is higher than 5 $\mu\text{g}/\text{sq.m.}$
- b) The removal of topsoil around sampling points where the concentration is over 5 $\mu\text{g}/\text{sq.m.}$ will extend over the area within a 100 m. radius.
- c) The removal of topsoil must begin within 30 days from the date of the deliberation in at least four points, and may be interrupted if, in the meantime, other effective techniques for soil decontamination in situ are developed.
- d) The procedure for the southern part of the A area will be that described in points (a) and (b) above.
- e) All gathering places (schools, factories, public meeting halls, etc.) and their appurtenances (gardens, lawns, courtyards, etc.) will be decontaminated.
- f) Final treatment procedures will be decided by the Regional Council in conjunction with the Regional Committee on Seveso upon completion of the experimentation with different techniques. An experimentation program will be present-

ed by the Regional Council on the basis of the proposals of the Decontamination Commission.

- g) Decisions regarding private homes and their appurtenances will be made by the Council together with the Regional Committee on Seveso, after their level of contamination has been determined.
- h) Indoor surfaces will be decontaminated where the concentration of dioxin is over $0.01 \mu\text{g}/\text{sq.m.}$
- i) For ground surfaces of the appurtenances the threshold value will be $0.750 \mu\text{g}/\text{sq.m.}$
- j) Decontamination procedures will be set down by the Regional Council in conjunction with the Regional Committee on Seveso, on the basis of recommendations of the various scientific commissions.¹

The threshold values for decontamination treatment - $5 \mu\text{g}/\text{sq.m.}$ for ground, 0.750 for appurtenances, 0.01 for indoor surfaces - have been adopted following the recommendations of the Medical-Epidemiological Commission, so that schools and factories in the B and "respect" areas can be made safe for use (cf. reports of the Medical-Epidemiological Commission, September 27 and October 11, 1976).

¹ The Regional Committee's program includes a series of environmental studies to determine the amount of dioxin present in varying depths of soil, in surface and ground waters, and in different organisms, and to assess any toxic effects of dioxin on these organisms.

2. Data

TABLE 1. Contamination in the B area

TABLE 2. Contamination in the "Respect" area

TABLE 3. Contamination in sectors A₆ and A₇

TABLE 4. Contamination in the A area

TABLE 5. Distribution of dioxin in the contaminated areas

TABLE 6. Extent of topsoil removal following the criteria suggested in this report

TABLE 1. CONTAMINATION IN THE B AREA (APPROX. 255 HA)

Dioxin µg/sq.m.	Area (in ha.)		
	rural	urban (1)	total
5	92.8	76.8	169.6
5 - 15	33.6	27.2	60.8
15 - 50	12.5	12.5	25
50
	138.9	116.5	225.4

- (1) Courtyards, squares, streets, etc. account for 35% (approx. 41 ha) of the total area; lawns, gardens, etc. for 45% (approx. 53 ha).

TABLE 2. CONTAMINATION IN THE RESPECT AREA

Total area: 1400 ha; contaminated area: 416 ha.

Dioxin µg/sq.m.	Area (in ha.)		
	rural	urban (1)	total
5	216.0	193.6	409.6
5 - 15	4.8	1.6	6.4
15 - 50
50
	220.8	195.2	416.0

- (1) Courtyards, squares, streets, account for 40% (approx. 78 ha) of the total area; lawns, gardens, etc. for 40% (approx. 78 ha).

TABLE 3. CONTAMINATION IN SECTORS A₆ AND A₇ (APPROX. 37 HA)

Dioxin µg/sq.m.	Area (in ha.)		
	rural	urban (1)	total
5	8.8	5.2	14.0
5 - 15	5.9	3.8	9.7
15 - 50	4.8	3.8	8.6
50	2.2	2.5	4.7
	21.7	15.3	37.0

- (1) Buildings account for 14% (approx. 2.1 ha) of the total area; courtyards, squares, streets, etc., for 43% (approx. 6.6 ha); lawns and gardens for 43% (approx. 6.6 ha).

TABLE 4. CONTAMINATION IN THE A AREA (APPROX. 37 HA.)

1. Area bounded by Carlo Porta Street, Vignazzola Street and the ICMESA factory (A_1 and A_2): approx. 23 ha, excluding the factory.
Dioxin concentration in approximately 3/4 of the area between 30 and 21,212 $\mu\text{g}/\text{sq.m.}$ (data from the "Istituto Superiore di Sanità," a special agency of the Italian Health Department).
2. Area bounded by Vicinale dei Boschi Street and Carlo Porta Street (A_3 , A_4 , A_5): approx. 36 ha.
Dioxin concentration in approximately 3/4 of the area, between 15 and 1043 $\mu\text{g}/\text{sq.m.}$ (data from the "Istituto Superiore di Sanità").
Because of its location, this would be the best place to station decontamination facilities (incinerator, vegetation deposit, soil deposit, etc.) Part of the area should be set aside for experimental purposes.
3. Area bounded by Vicinale dei Boschi Street (the continuation of Redipuglia Street) and the southern boundary of the A area (A_6 and A_7): approx. 37 ha.
Dioxin concentration in approximately 2/3 of the area between 15 and 475 $\mu\text{g}/\text{sq.m.}$ (data from the "Istituto Superiore di Sanità").
To be decontaminated within a short time in order to allow the residents to return to their homes (about 80% of the inhabitants were evacuated).
4. Area to the east of the highway (A_8): approx. 19.5 ha.
Dioxin concentration for 1/2 of the area between 5 and 34.2 $\mu\text{g}/\text{sq.m.}$ (according to the new gridding).
To be decontaminated along with the B area and sectors A_6 , A_7 .

8)

TABLE 5. DISTRIBUTION OF DIOXIN IN THE B AREA, THE "RESPECT" AREA,
THE SOUTHERN PART OF THE A AREA (SECTORS A₆ AND A₇), AND
THE NORTHERN PART OF THE A AREA (SECTORS A₁, A₂, A₃, A₄,
A₅, A₈)¹

DIOXIN µg/sq.m.	No. Sampling Points				
	B	Respect	A ₇	A ₆ ⁽²⁾	A-NORTH
0.750	25	249	10	2	20
0.750-5	53	128	14	17	0
5-15	19	2	30	10	7
15-50	6	-	17	18	10
50-100	-	-	6	7	13
100-500	-	-	-	3	16
500-1000	-	-	-	-	6
1000	-	-	-	-	14

¹ The maximum and average values are as follows:
 For the B area: max. 43.83 µg/sq.m., ave. 3.39 µg/sq.m.
 For sector A₆: max. 270.4 µg/sq.m., ave. 29 µg/sq.m.
 For sector A₇: max. 91.7 µg/sq.m., ave. 15 µg/sq.m.
 For A-North: max. 21.212 µg/sq.m.

² New gridding using a 0.25 sq.m. grid.

TABLE 6. EXTENT OF TOPSOIL REMOVAL FOLLOWING THE CRITERIA SUGGESTED
IN THIS REPORT

ZONE	SURFACE AREA IN HA.	SOIL	
		VOLUME (sq.m.)	WEIGHT (m. tons)
B ⁽¹⁾ 2 points: 22.8 and 43.8 µg/sq.m. of dioxin	7	7,000	11,200
A ₆ and A ₇ ⁽¹⁾	9.7	9,700	15,500
A ₁ and A ₂ ⁽²⁾ (between C. Porta St., Vignazzola St., and the ICMESA factory)	23	46,000	73,000
T O T A L	39.7 ⁽³⁾	62,700	99,700

(1) Depth of layer to be removed: 10 cm.

(2) Depth of layer to be removed: 20 cm.

(3) An additional 3 ha of the A₃ sector and 2.5 ha of the A₈ sector, where the concentration of dioxin is over 15 µg/sq.m., must be added to the total area requiring topsoil removal.

3. Coordination and development of the decontamination program approved by the Regional Council on August 24, 1976

I think that the facts and evidence which have come to our attention since the accident in no way affect the validity of the program, but rather underline the need to develop the program along the same lines and with the same criteria that were at its origin.

The most recent findings point out the following:

a) Dioxin, being strongly adsorbed by certain substances in the soil, migrates very little, if at all, from the top layer of soil. This has been clearly demonstrated by the results of repeated tests carried out in Seveso, made public on November 16.

In the latest series of tests, carried out in the B area and the sectors of the A area designated A₆ and A₇, after the recent heavy rains, over 95% of the dioxin was found to be in the top 15 cm. of soil, while 90-95% is concentrated in the top 8 cm.

This confirms the original findings of Kearney and his group (1970, 1973)¹ and is in line with those of Young and

¹ Heiling C. S. : "Pesticide Mobility in Soil: Application of Soil thin-layer Chromatography". Soil Sci. Soc. Ameri. Proc., 35, 737, 1970

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coll. (1976)². From the latter investigation, carried out out over a long period of time, as well as from our own studies, one may infer that dioxin in soil similar to the type found in the Seveso region should not be found at depths below 30-40 cm.

- b) Dioxin in soil that has been contaminated by herbicides disappears naturally at the rate of 50% per year. The previously cited field investigations carried out by Young and collaborators thus confirm the earlier studies of Kearney and his group, and leave no doubt as to the validity of the results. It is probable that the various natural agents (ultraviolet light, sublimation, microorganisms, etc.) participate in natural degradation to differing extents, according to the environmental conditions; Young and collaborators feel that the role of microorganisms is now a demonstrated fact.

¹ con't

Kearney P.C.: "Chlorinated Dioxin Research." Joint Meeting on Pesticides, United Kingdom, Canada, United States, Washington D.C., November 5, 1970.

Heiling C.S., Isensee A.R., Woolson E.A., Ensor P.D.J., Jones G.E., Plimmer J.R. & Kearney P.C.: "Chlorodioxins in Pesticides, Soil and Plants." J. Environ. Quality 2, 271, 1973.

²

Young A.L., Talken C.E., Arnold E.L., Cupello J.M., Cocherham L.G.: "Fate of 2,3,7,8 tetrachlorobenzop-dioxin (TCDD) in the environment: summary and decontaminations recommendations," Department of Chemistry and Biological Sciences, USAF Academy, Colorado 80840, October 1976.

It is therefore my conviction that the role of the natural degradation of dioxin in the decontamination program, until recently so difficult to evaluate, can now be much more clearly and profitably defined.

Would we then be justified in speaking about a new decontamination strategy? I would be tempted to answer yes. This strategy should in any case work simultaneously on two fronts: first, to make living and working conditions safe in all the residential areas affected by the disaster; and second, to extend and intensify the process of reclamation from a medical, ecological and sociological standpoint. This is not an easy task, since it requires the constant and careful separation of reclaimed sectors from those in the process of being reclaimed, without endangering the population's safety. This, however, is the only way out of the present uncertain situation, and it is in the hopes of achieving an acceptable and progressively better solution to the problem that the measures described in the following pages have been proposed.

- 3.1. Immediate, intensive decontamination of the residential areas of the B area and sectors A₆ and A₇, involving decontamination of homes and their appurtenances, according to the recommendations of the Medical-Epidemiological Commission, and removal of topsoil where the concentration of dioxin is over 15 µg/sq.m.¹

¹ This measure may later be applied to areas where the concentration of dioxin is between 5 and 15 µg/sq.m., if alternative measures prove ineffective.

- Decontamination of homes (interiors and furnishings): using methods developed or being tested under the auspices of the regional authorities.¹
- Decontamination of adjoining gardens, lawns, etc.: as above.
- Decontamination of squares, courtyards, streets, etc.: to be "vacuumed" and then covered with asphalt, bitumen, or other durable material.

3.2. Removal of topsoil in the highly contaminated areas designated A₁ and A₂ (bounded by Carlo Porta St., Vignazzola St., and the ICMESSA factory)², where the concentration of dioxin in 3/4 of the area is between 30 and 21,212 µg/sq.m. A layer of 20 cm. or more will be removed, according to the amount of dioxin present on the surface. In this area, there is a real danger of dioxin's spreading into the environment and leaching into the soil.

3.3. Storage of the removed soil: The soil will be accumulated in heaps in the central part of the A area near the incinerator and the soil and vegetation deposit; the heaps will be separated from the ground by an impermeable cement or plastic bed. The leach will be collected and eliminated following depuration.³ The heaps will be covered by means of a shed or other device, which would allow for inspection, sampling and possible treatment of the soil to promote the natural degradation of dioxin.

¹ The effectiveness of this and all other operations will be checked as indicated in the program approved in August.

² Topsoil will also be removed in a 3ha section of the A₃ sector, where concentrations are analogous to those in A₂.

³ That dioxin may be carried by run-off water has been proven by the fact that the toxic substance has been found in the sediment of the Seveso River and in mud in the depuration plant of Varedo. This accounts for the necessity of removing the topsoil in highly contaminated areas, especially sectors A₁ and A₂.

- 3.4. Destruction of the dioxin in the removed soil by means of combustion: Applicable where the concentration of dioxin in the soil is extremely high. Natural degradation would in this case take too long (at least 10-12 years) and the continued presence of dioxin would present too many risks.
- 3.5. Immediate and total "rebuilding" of the topsoil from a physical, chemical and biological standpoint, following procedures developed by experts in the field, in order to re-establish its protective, as well as agricultural, functions. The upper layer of soil contains numerous microorganisms and adsorbent substances which retain and often degrade contaminants.
- 3.6. Treatment of agricultural areas where the concentration of dioxin is from 5-15 $\mu\text{g}/\text{sq.m.}$, to promote the natural degradation of dioxin: The purpose of this treatment is not so much to dilute the concentration of dioxin on the surface, thereby reducing the risk of poisoning (in these areas all farming is prohibited¹), as to make the dioxin more susceptible to natural degradation by natural agents such as light, temperature, and microorganisms. Those procedures which are known to produce no harmful effects - for example, periodic tilling of a 3-5 cm. layer of topsoil (if a deeper layer were tilled, this might reduce the effectiveness of the natural agents), the addition of certain fertilizers (am-

¹ This measure should be enforced for at least a year after treatment begins, in order to facilitate the checks described in point 3.9.

monium and nitrogen salts, compost, manure, domestic wastes), could be field tested and then extensively applied if found effective. (Agents and methods whose safety has not yet been completely demonstrated will be tested by the appropriate Commissions.¹)

3.7. Intensification of the testing of decontamination techniques in the laboratory and the ad hoc area set aside within the A zone; reconfirmation of the allocation of at least 20 ha to be made available to Italian and foreign experimenters; inclusion of several research projects connected with the "Program for Surveillance and Study of the Dioxin Contaminated Areas During and After Decontamination."

3.8. Immediate application of the "Program for Surveillance and Study of the Dioxin Contaminated Areas During and After Decontamination", whose aims were indicated by the Decontamination Commission at the time the program was proposed: monitoring of soil, water, vegetation and all possible vehicles of dioxin; assessment of the effects of decontamination operations on the concentration of dioxin in the environment; gathering of data to be compared with the clinical and epidemiological findings concerning the exposed population; etc.

3.9. One year after decontamination operations have begun: assessment of the situation in regard to the level of contamination

¹ As will be explained in point 10, it would be advisable to extend the above treatments to areas where the concentration of dioxin is under 5 µg/sq.m., and therefore to the "respect" area.

in each of the environmental substrates:

- In the soil and on the ground: possible remapping of the areas with respect to the boundaries of the different zones.
- Underground: ascertainment of possible leaching.
- In surface and ground waters, vegetation, underground and overland animals, homes (inside and out), lawns, streets, squares, courtyards, etc. where decontamination operations have been carried out.

An evaluation of the progress made from a hygienic and ecological standpoint will indicate any modifications to be applied to the program, taking into account the results of the tests which will in the meantime have been carried out.

3.10. Decontamination of the ICMESA factory: to be carried out either prior to, or concurrently with, the decontamination of adjacent areas (sectors A_1 and A_2), due to the great quantity of dioxin present. The continuing removal of chemical reagents and other products still inside the factory, the restrictions imposed by the judicial authorities, and the need for special decontamination techniques in certain cases have raised problems to which the Commission is paying particular attention.

The sequence of operations described above, to be carried out in a very short period of time, will be completed by final decontamination of the central part of the A area (sectors A_1 , A_2 , and A_3), that is, the part set aside for all decontamination facilities and experimentation. The most suitable

techniques will be decided upon on the basis of experimental testing; topsoil may be removed in the most highly contaminated areas. Considering the time it should take to build the incinerator and burn all the removed soil and vegetation, the final decontamination operations for the A₁ and A₂ sectors should begin in approximately three years.

4. Priorities

As previously noted, decontamination operations will begin in the unevacuated B area and sectors A₆ and A₇, to which the population should be able to return as soon as possible. Next to be decontaminated will be sectors A₁ and A₂, that is, the northern part of the A area bounded by Carlo Porta Street, Vignazzola St. and the ICMESA factory. The massive concentration of dioxin in these areas represents a serious hazard, in that the dioxin may leach into the ground or be dispersed above ground by run-off water, river overflows, wind, etc.¹ In each individual sector, the operations should begin with the rural area (defoliation, removal of vegetation and soil), and then proceed to the residential areas. Within the latter, the first targets for decontamination will be the appurtenances of homes (gardens, courtyards, and squares), then the homes themselves, first on the outside (roofs, balconies, walls), then inside (walls, floors, furnishings). The streets will be decontaminated last. Since the removal of topsoil is the operation which may cause the greatest dispersion of dioxin

¹ Actually, the removal of topsoil in the A₁ and A₂ sectors appears to be as urgent as in the B area and sectors A₆ and A₇.

during collection and transportation, it should be the very first operation performed. The streets should not only be frequently treated during the operation but should undergo a final, intensive treatment upon completion of the decontamination work.

The above-mentioned order of operations is obviously only a guideline; different operations in adjoining sectors, or within one sector, may be carried out simultaneously if this will hasten the total reclamation of the area and the return of its residents, and on condition that all necessary precautions be taken.

5. Fencing off of highly contaminated areas

The original proposal of the Technical Commission may now be modified to limit fencing off to the northern part of the A area, bounded to the south by Redipuglia Street. A lightweight fence would be sufficient for sectors A₆ and A₇, since decontamination should be carried out in these areas fairly soon, in order to allow the residents to return to their homes.

The Italian Department of Health should be informed of this modification.

6. Removal of topsoil

The problems involved in this operation are under careful study by the Decontamination Commission. However, I must comment on several of the most controversial aspects of the operation.

6.1. The area to undergo topsoil removal:

The level of dioxin chosen as a threshold value for topsoil removal is of fundamental importance, since it will determine the size of the area to be treated. If the value is too low - and this is probably the case for the 5 $\mu\text{g}/\text{sq.m.}$ value adopted by the Regional Committee on Seveso - then the area to be treated would be enormous, giving rise to tremendous practical difficulties. It is therefore absolutely necessary to determine the criteria for establishing a threshold value and to decide when and how this value should be used.

I believe we should reason in the following manner:

Where the concentration of dioxin is such that natural degradation may be reasonably thought to take place in a fairly short time - for example, in 2-3 years - then the topsoil should not be removed. To the contrary, where the concentration is so high that degradation could not possibly take place in less than 10-12 years - as is the case for sectors A_1 and A_2 - then removal of the topsoil is an absolutely essential measure.

Lately there has been talk of establishing 15 $\mu\text{g}/\text{sq.m.}$ as the threshold value for topsoil removal. Although I may be partially responsible for suggesting this value, I am now convinced that to establish a cut-off level is, in itself, a questionable procedure, since practical considerations could make it advisable to leave the topsoil in certain areas (for example, uncultivated rural areas) even where the concentration of

dioxin is 20-25 $\mu\text{g}/\text{sq.m.}$, or to remove the topsoil in other areas (for example, in rural areas located in heavily populated districts) where the concentration is under 15 $\mu\text{g}/\text{sq.m.}$ The idea of removing as much topsoil as possible in order to promote the process of degradation in the removed soil is also questionable, since the optimum conditions for natural degradation are probably those characteristic of soil in situ. I think it is much more reasonable to remove as little topsoil as possible and to eliminate it definitely by combustion. This would obviously not prevent us from removing more topsoil later, if in situ treatments proved ineffective or too slow.

6.2. Table 6 illustrates the extent of topsoil removal according to the criteria described in the previous paragraph (using 15 $\mu\text{g}/\text{sq.m.}$ as a threshold value). The corresponding parameters are 2/3 to 3/4 less than those resulting from the original proposal of the Regional Committee:

Threshold value:	5 $\mu\text{g}/\text{sq.m.}$	15 $\mu\text{g}/\text{sq.m.}$
Size of area to be treated	172 ha	40 ha
Volume of soil to be removed	172,000 cu.m.	63,000 cu.m.
Weight of soil to be removed	275,000 m.tons	100,000 m. tons

6.3. Decontamination of the appurtenances of homes (gardens and lawns, courtyards, squares, streets, etc.):

The best procedure for decontaminating gardens and lawns is probably that proposed by Givaulan: mowing of all vegetation and vacuum removal of 1-2 cm. of topsoil. These operations, carried out with special machines equipped with collecting bags, have a good chance of success if the soil is dry.

However, experts in the field advise final application of a small layer of peat mixed with sand, containing fast growing, low vegetation in order to reactivate the protective upper layer of soil.¹

6.4. Dust dispersion:

In order to prevent the formation and the spread of dust as the topsoil is being removed, it may be useful to wet the ground with a small quantity of water (to avoid deep infiltrations) or, better still, to apply a solution of Vinavil[®] just before the operations begin. This type of solution has already been successfully used in connection with the removal of vegetation.

¹ Technicians agree that reconstruction of a 10-20 cm. layer of topsoil would be much more difficult. In this case, the ground must be covered with peat, sand, clay, humus, manure, mushroom beds, gravel, etc; this material must be frequently tilled to promote maturation. In addition, rapidly growing trees such as poplars, willows and alders should be planted in the treated area.

6.5. Accumulation of the soil:

In my opinion, the removed soil should be deposited in the central part of the A area (sectors A₃, A₄, A₅), which has already been chosen as the future site of the incinerator, the vegetation deposit and the various buildings and facilities involved in the decontamination work. The accumulation of all the soil in one location which is easily accessible from all parts of the contaminated area, rather than in a number of different, less easily reached locations, will facilitate surveillance of the material and running of any tests.

7. The Incinerator

The huge quantity of material containing dioxin that, according to the Decontamination Program approved on August 24, 1976, should be destroyed by incineration, may be subdivided as follows:

- Vegetation: now in the process of being removed; presently awaiting incineration in silos located in sector A₅, or still in heaps and sacks in the accumulation area.
- Home furnishings coming from the homes in the process of being decontaminated in sectors A₆ and A₇. The material is being gathered in sector A₅.
- Clothing to be disposed of (work suits, masks, etc.), formerly used by decontamination workers, now being accumulated in sacks in the vicinity of the access zone.
- Small animals: now kept in temporary containers near the access zone.

The removal of dioxin in the highly contaminated areas (sectors A₁ and A₂) and the parts of the B area and sectors A₆ and A₇ where the concentration of dioxin is over 15 µg/sq.m., has not yet begun. This soil must, however, be incinerated.¹

The incinerator has been carefully studied in all its details, and the design has been ready for some time now. However, there has been no decision to begin construction, which will take at least 6 to 8 months.

What is of greatest concern at the moment is the possibility that, with the coming of warmer weather, the improperly stored, highly organic contaminated materials may start to putrefy, creating a fertile breeding ground for rats, mice, and insects. This would lead to dangers which go beyond that of the dispersion of dioxin.

In the meantime, the materials awaiting incineration will have to be "stabilized" and the deposits subjected to rat-killing and disinfestation.

¹ The proposal to gather the contaminated soil in containers is unacceptable: aside from the problems concerning construction and choice of a location, isolation of the contaminated material in containers represents a means of preserving dioxin, rather than a means of eliminating it. Moreover, the solution is also a potentially dangerous one, considering, for example, the consequences of breakage of a container.

8. Buildings and facilities

In the decontamination program approved by the Regional Council on August 24, 1976, all buildings and facilities for decontamination operations (incinerator, impermeable beds for the accumulation of removed vegetation, offices, storerooms, etc.) were to be located in the central part of the A area.¹

I do not feel that there is any reason for changing this location; moreover, I would emphasize that to separate any of the facilities from the central location would only make the decontamination work more difficult.

9. Experimentation

I feel that it is time to reconsider the proposed criteria and procedures for experimentation, if such experimentation is to verify the effectiveness of the decontamination work and contribute to the development of better techniques.

There are basically three experimental approaches:

- a) In the laboratory: Basic experimentation concerning the possible role of microorganisms in the natural degradation of dioxin, the mechanisms by which known agents attack dioxin, the fate of dioxin in vegetation, etc.
- b) In the special experimentation zone set aside within the A area and in the vegetation, soil and other materials being accumulated there: Assessment of the effectiveness of decontamination agents and methods which have not yet been adequately tested, and evaluation of any possible

¹ The area occupied by the ICMESSA factory has also been considered as a possible site of the incinerator and soil deposits.

side-effects through constant, careful surveillance.

- c) In the rural areas with low or medium concentrations of dioxin, where the topsoil is not to be removed: Ascertainment of the effects on dioxin of agents and methods known to produce no harmful effects, under natural conditions. Where seen to be effective, these agents and methods may be used in adjoining areas.

Following reorganization of the experimentation as suggested above, a considerable number of projects would be carried out in connection with the "Program for Surveillance and Study of the Dioxin Contaminated Areas During and After Decontamination."

10. Possible extension of certain decontamination measures to include areas where the dioxin concentration is lower than 5 µg/sq.m.

In these areas, located within the B and Respect areas, where the population has not been evacuated, a set of health rules and behavioral norms issued by the Medical-Epidemiological Commission is now in effect. A full description of these rules may be found in the reports of the Commission dated September 27, October 8 and November 12, 1976.¹

The rapid and complete reclamation of these areas may be hastened by the application of some of the treatments used in rural areas (such as tilling the upper layer of soil) to the lawns, gardens, and open areas surrounding homes.

The most highly contaminated areas would naturally be the first to undergo treatment.

¹ Instructions concerning animals have been issued by the Veterinary Commission.

11. Conclusions

As one can see from the program approved by the Regional Council on August 24, 1976, decontamination of the Seveso area must proceed along three main lines. Their objectives, briefly, are as follows:

- a) To make living conditions completely safe for the un-evacuated populations in the B and "respect" areas, and to allow all civic and industrial activities to return to normal;
- b) To hasten the return of the evacuated population to the A₆ and A₇ sectors, where life should resume as before, in completely safe conditions;
- c) To promote and intensify the decontamination of the rural zones within the above-mentioned areas, so that all the land may be reclaimed within 2-3 years.

It is clear that the progress made toward achieving these objectives is contingent on the success of other related efforts, namely:

- the rapid and definitive elimination of material containing large quantities of dioxin, by means of incineration;
- experimentation with techniques to promote the natural degradation of dioxin in the soil;
- the physical and functional separation of the reclaimed areas - that is, the residential areas - from the areas still to be treated - that is, the rural areas.

It is nonetheless imperative that certain operations decided upon in August be correctly, and immediately, carried out:

- the A area must be fenced off and isolated, and entrance to the area strictly controlled;
- highly contaminated soil and vegetation must be removed;
- this material must be destroyed by combustion, obviously necessitating construction of the incinerator.

It is therefore essential to stop all the discussions and stalling, and take action in the direction indicated in this report. There seem, in fact, to be no valid alternatives to the measures herein proposed.

Let it be said once again that the Seveso accident constitutes a problem of public health, and must be faced as such, taking precedence over other problems; for it must be remembered that the effects of the measures taken now can only be fully evaluated much further on in the future.