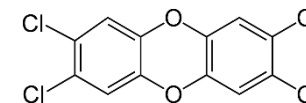
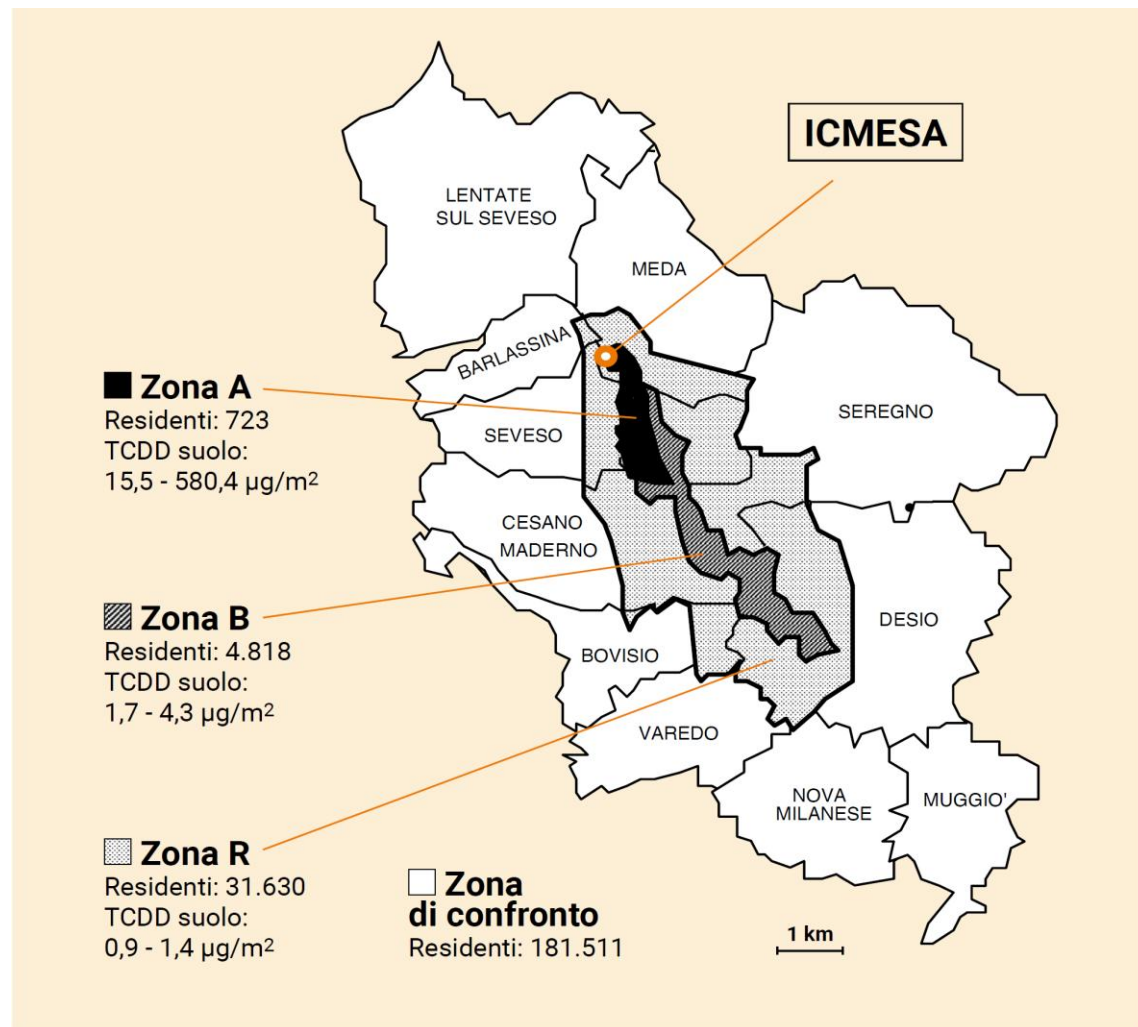


# La salute degli addetti alla bonifica

Paolo Mascagni

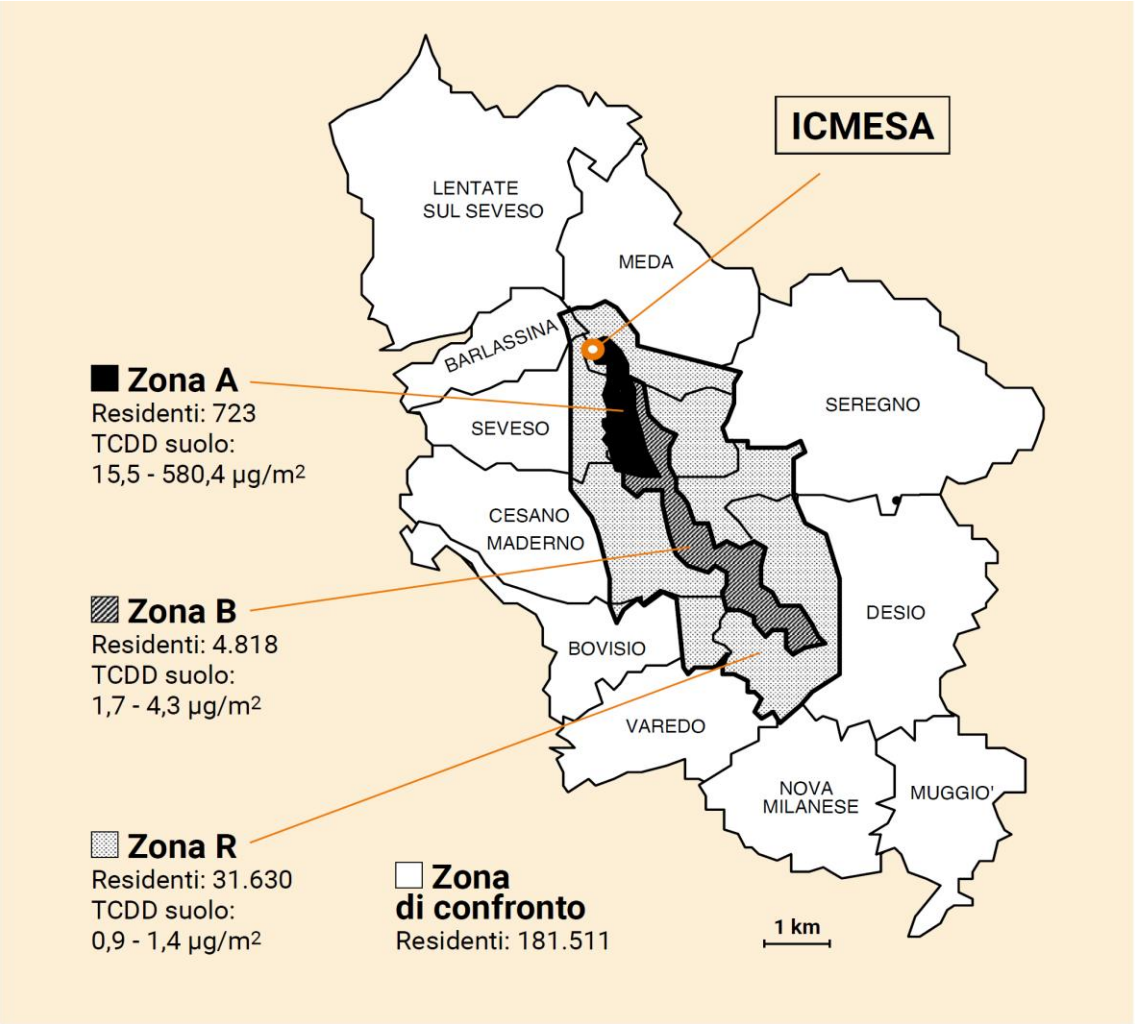
S.C. di Medicina del Lavoro e Igiene e  
Tossicologia Professionale e Ambientale  
Ospedale di Desio – ASST della Brianza





**10 luglio 1976**





Monitoring of the area covered by the toxic cloud (photo by Dino Fracchia).

| Zona          | Abitanti coinvolti | TCDD media nel suolo | Livelli mediani di TCDD nel siero         |     |                                           |    |
|---------------|--------------------|----------------------|-------------------------------------------|-----|-------------------------------------------|----|
|               | n.                 | (µg/m²)              | Campioni raccolti nel periodo 1976-1977   |     | Campioni raccolti nel periodo 1992-1996   |    |
|               |                    | min-max              | pg/g di lipidi o parti per trilione (ppt) | n.  | pg/g di lipidi o parti per trilione (ppt) | n. |
| A             | 723                | 15,5-580,4           | 447                                       | 296 | 73,3                                      | 7  |
| B             | 4.818              | 1,7-4,3              | 94                                        | 80  | 12,4                                      | 51 |
| R             | 31.630             | 0,9-1,4              | 48,                                       | 48  | Non misurata                              | —  |
| Non inquinata | 181.511            | Non misurata         | Non misurata                              | —   | 5,5                                       | 52 |

**Tabella 1.** Livelli di TCDD nel suolo e nei campioni di sangue degli abitanti nelle tre zone inquinate e nella zona esente da inquinamento (riferimento). Seveso.



## PROF. ITALO GHEZZI

**Medico del Lavoro, Docente Universitario,  
Fondatore e primo Direttore della  
Medicina del Lavoro dell'Ospedale di Desio  
dal 1977 al 1997**



Table 10. Exposure to 2,3,7,8-TCDD from Industrial Accidents

| Date    | Workers exposed | Location of accident                          | Remarks                                                                                                                                                                                                                             |
|---------|-----------------|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1949    | 250             | Monsanto plant in Nitro, WV                   | 122 cases of chloracne being studied; 32 deaths vs. 46.4 expected; no excess deaths from malignant neoplasms or circulatory disease                                                                                                 |
| 1953    | 75              | BASF plant in Ludwigshafen                    | 55 cases of chloracne, 42 severe; 17 deaths vs. 11 to 25 expected (four gastrointestinal cancers and two oat-cell lung cancers); most common injuries were impaired senses and liver damage                                         |
| 1956    | ?               | Rhone-Poulenc plant in Grenoble               | 17 cases of chloracne; also elevated lipid and cholesterol levels in the blood                                                                                                                                                      |
| 1963    | 106             | NV Philips plant in Amsterdam                 | 44 chloracne cases (42 severe) of whom 21 also had internal damage or central nervous system disturbances; eight deaths (six possible myocardial infarctions); some symptoms of fatigue                                             |
| 1964    | 61              | Dow Chemical plant in Midland, MI             | 49 cases of chloracne; 4 vs. 7.8 expected deaths; 3 cancer deaths vs. 1.5 expected; one a soft tissue sarcoma                                                                                                                       |
| 1965-69 | 78              | Continuing leaks in Spolana plant near Prague | 78 cases of chloracne; five deaths; many of the 50 workers studied for more than 10 years have hypertension, elevated blood levels of lipid and cholesterol, prediabetes; significant amounts of severe liver and neurologic damage |

Source: Tschirley, 1986.

# The Seveso accident: A look at 40 years of health research and beyond<sup>☆</sup>

Brenda Eskenazi<sup>a,\*</sup>, Marcella Warner<sup>a</sup>, Paolo Brambilla<sup>b</sup>, Stefano Signorini<sup>b</sup>, Jennifer Ames<sup>a</sup>,  
Paolo Mocarelli<sup>b</sup>

[Environment International 121 \(2018\) 71–84](#)

## 5.3.7. *Neurologic function*

Initial neurologic screening of zone A residents in 1977 indicated signs of subclinical neurologic damage such as reduced nerve conduction velocity ([Pocchiari et al., 1979](#)). In addition, about 4% of 200 ICMESA plant workers were found to have damage to nerve fibers of multiple (unspecified) nerves ([Pocchiari et al., 1979](#)).

# Criticità dell'epoca

- Elevata densità abitativa;
  - Comunicazione dell'emergenza poco strutturata;
  - Limitata pianificazione del rischio industriale;
  - Non esistevano ancora le ASL, né i moderni Servizi di Prevenzione e Sicurezza negli Ambienti di Lavoro (SPSAL). Nella prima metà degli anni '70 erano stati costituiti gli SMAL (Servizi di Medicina degli Ambienti di Lavoro);
  - Le attività di prevenzione erano limitate e poco coordinate tra sanità, enti locali e industria;
  - La sorveglianza sanitaria era svolta principalmente dai medici di fabbrica o medici competenti aziendali, senza un sistema uniforme su tutto il territorio;
  - I controlli erano affidati anche agli Ispettorati del Lavoro e agli Ufficiali Sanitari comunali.
- 
- Scarsa conoscenza degli effetti della diossina;
  - Sistemi di monitoraggio ambientale quasi assenti.



*Recovery interventions (photo by Dino Fracchia).*



Inizio dei lavori di bonifica dei terreni delle aree più colpite: fine maggio 1980

## **OBIETTIVI**

Valutare l'efficienza e l'efficacia delle misure adottate per la protezione dei lavoratori nella bonifica delle sottoaree A1-A5 nella zona A di Seveso, le aree più pesantemente contaminate da TCDD.

Monitorare la salute dei lavoratori

# Potential 2,3,7,8-tetrachlorodibenzo-p-dioxin exposure of Seveso decontamination workers

## A controlled prospective study

by Italo Ghezzi, MD,<sup>1</sup> Pasquale Cannatelli, MD,<sup>1</sup> Giorgio Assennato, MD,<sup>2</sup> Franco Merlo, PhD,<sup>3</sup> Paolo Mocarelli, MD,<sup>4</sup> Paolo Brambilla, MD,<sup>4</sup> Franco Sicurello, PhD<sup>5</sup>

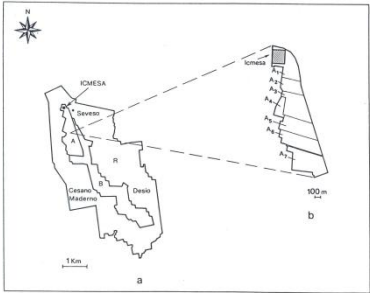


Figure 1—Map of the contaminated area by subzones (a) and detail of the highly polluted zone A (b).

- 1 Occupational Health Service, Desio Hospital, Desio, Milano, Italy.
- 2 Department of Epidemiology, Occupational Health Institute, Bari University, Bari, Italy.
- 3 Department of Epidemiology, National Institute for Research on Cancer, Genova, Italy.
- 4 Clinical Laboratory, Desio Hospital, Desio, Milano, Italy.
- 5 EDP Center, Ufficio Speciale, Lombardia Region, Desio, Milano, Italy.

Evaluating a possible TCDD exposure of the clean-up workers is difficult due to the lack of reliable biological indicators and, especially, indicators showing a good dose-response relationship. Therefore, it is cumbersome to evaluate whether protective devices actually prevent exposure to TCDD. The clean-up operation in the

**Table 1.** Results of various laboratory tests of the clean-up workers at the preemployment and last examination and of the reference group at the last examination.

| Laboratory tests                               | Exposed group                      |       |                            |       | Nonexposed group after six months (N = 31) |        |
|------------------------------------------------|------------------------------------|-------|----------------------------|-------|--------------------------------------------|--------|
|                                                | Preemployment examination (N = 36) |       | After nine months (N = 33) |       | Mean                                       | SD     |
|                                                | Mean                               | SD    | Mean                       | SD    |                                            |        |
| Total urinary porphyrin (μg/g crea)            | 90.90                              | 43.61 | 70.75                      | 24.28 | 71.77                                      | 27.82  |
| Serum glutamate-oxalacetate transaminase (U/l) | 16.36                              | 3.77  | 14.22                      | 4.42  | 16.03                                      | 14.02  |
| Serum glutamate-pyruvate (U/l)                 | 18.64                              | 5.49  | 16.06                      | 6.12  | 18.52                                      | 11.03  |
| Alkaline phosphatase (U/l)                     | 28.42                              | 8.64  | 29.72                      | 7.01  | 31.19                                      | 8.82   |
| Gamma glutamyl transferase (U/l)               | 20.50                              | 12.18 | 20.28                      | 8.66  | 20.35                                      | 9.53   |
| Total bilirubin (mg/dl)                        | 0.67                               | 0.14  | 0.59                       | 0.16  | 0.56                                       | 0.14   |
| Thromboplastic partial time (s)                | 26.22                              | 2.30  | 29.13                      | 2.25  | 28.76                                      | 1.98   |
| Hemoglobin (g/dl)                              | 15.78                              | 0.75  | 16.28                      | 0.84  | 28.76                                      | 1.02   |
| White blood cells (× 10,000/mm <sup>3</sup> )  | 6.77                               | 1.30  | 6.30                       | 1.39  | 7.14                                       | 1.75   |
| Platelets (× 10,000/mm <sup>3</sup> )          | 199.61                             | 39.09 | 204.36                     | 38.93 | 194.45                                     | 42.71  |
| Albumin (g/dl)                                 | 4.70                               | 0.31  | 5.02                       | 0.22  | 4.95                                       | 0.30   |
| Gamma globulin (g/dl)                          | 1.17                               | 0.19  | 1.11                       | 0.18  | 1.04                                       | 0.19   |
| Cholesterol serum level (mg/dl)                | 190.51                             | 45.70 | 192.28                     | 37.44 | 197.90                                     | 39.75  |
| Triglycerides (mg/dl)                          | 113.66                             | 48.64 | 125.22                     | 52.71 | 141.93                                     | 107.41 |

## How much is one part per ...

million (ppm)  
milligrams/liter (mg/L)



= three drops added to a  
42-gallon barrel

billion (ppb)  
micrograms/liter ( $\mu\text{g/L}$ )

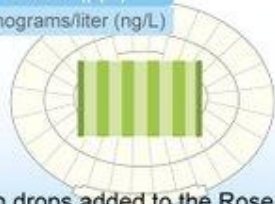


length = 35 feet, diameter = 8 feet

= one drop added to  
a large tanker truck

quadrillion (ppq)  
picograms/liter (pg/L)

trillion (ppt)  
nanograms/liter (ng/L)



= ten drops added to the Rose Bowl  
(filled with water)

= two teaspoons added to the  
Great Salt Lake of Utah



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## A controlled prospective study

by Italo Ghezzi, MD,<sup>1</sup> Pasquale Cannatelli, MD,<sup>1</sup> Giorgio Assennato, MD,<sup>2</sup> Franco Merlo, PhD,<sup>3</sup> Paolo Mocarelli, MD,<sup>4</sup> Paolo Brambilla, MD,<sup>4</sup> Franco Sicurello, PhD<sup>5</sup>

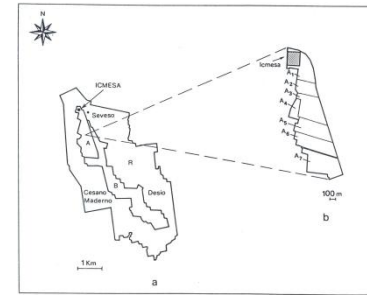


Figure 1—Map of the contaminated area by subzones (a) and detail of the highly polluted zone A (b)

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## Discussion

It is therefore possible to assume that the safety measures used during the clean-up operations were effective, also from the point of view of workers' compliance, reducing the absorption of TCDD to almost zero.

# Medical Monitoring of Dioxin Clean-Up Workers

G. ASSENNATO<sup>A</sup>, P. CANNATELLI<sup>B</sup>, E. EMMETT<sup>C</sup>, I. GHEZZI<sup>B</sup>, and F. MERLO<sup>D</sup>

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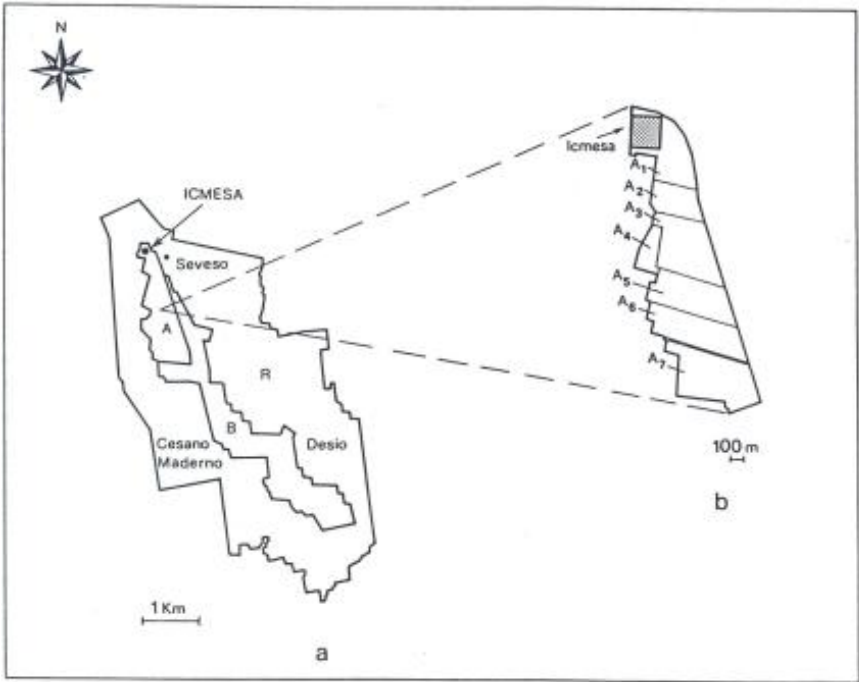


Figure 1—Map of the contaminated area by subzones (a) and detail of the highly polluted zone A (b)

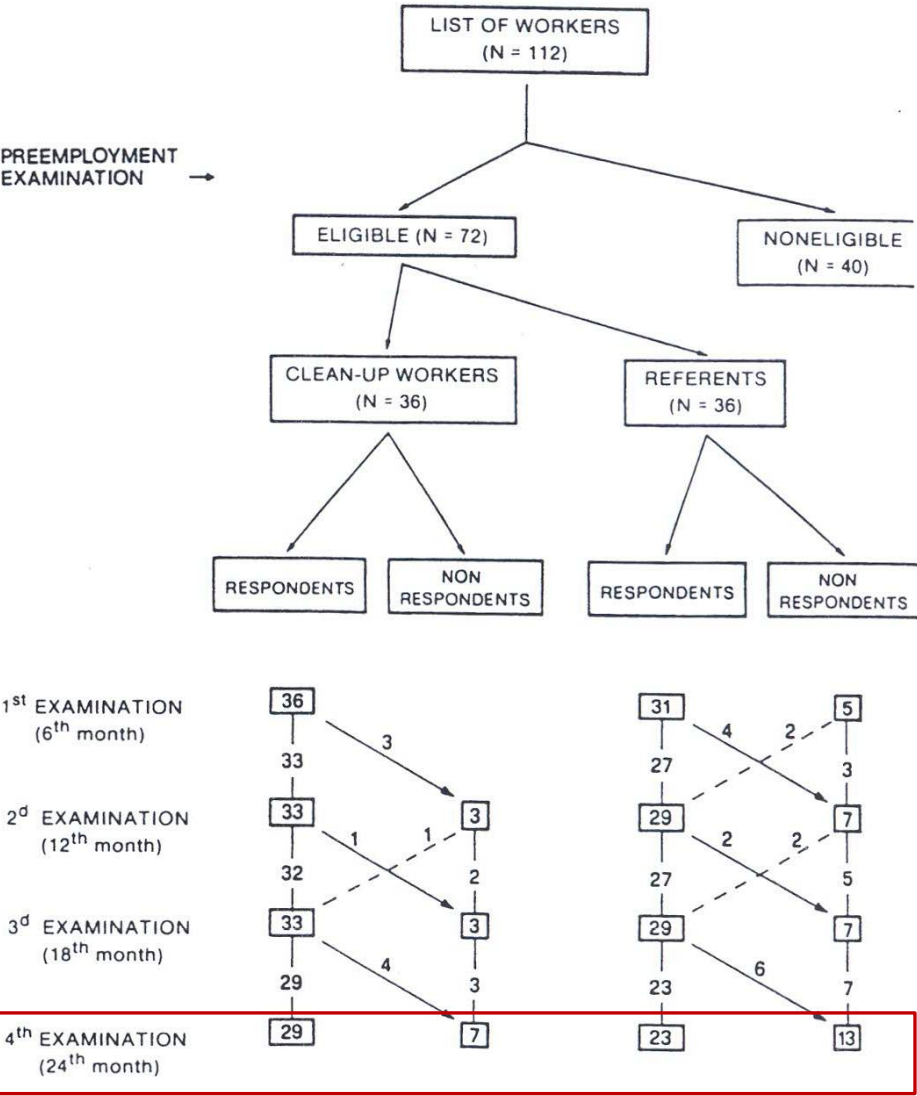


Figure 3—Outline of the study design and follow-up response among clean-up and reference workers

## Medical Monitoring of Dioxin Clean-Up Workers

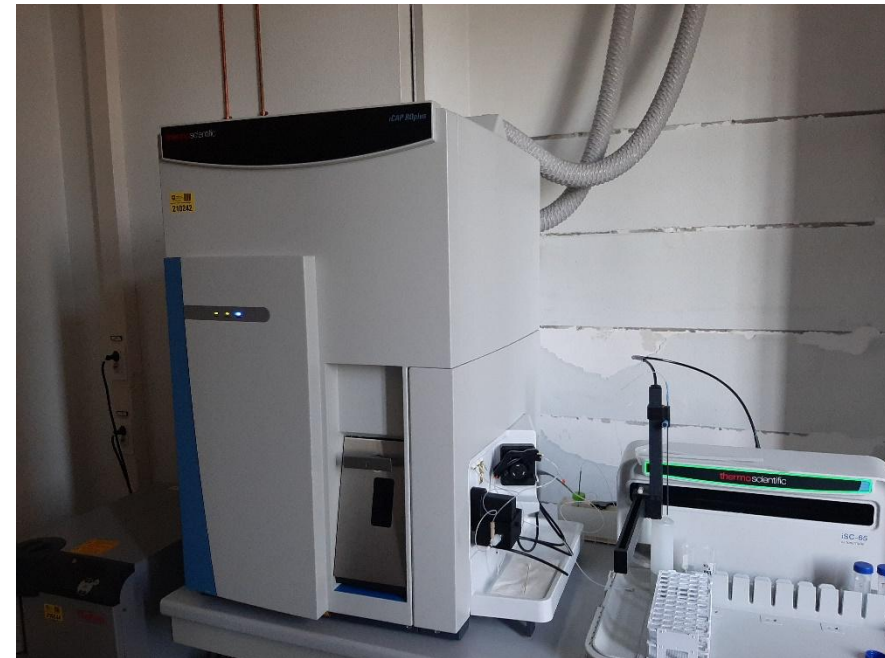
G. ASSENNATO<sup>A</sup>, P. CANNATELLI<sup>B</sup>, E. EMMETT<sup>C</sup>, I. GHEZZI<sup>B</sup>, and F. MERLO<sup>D</sup>

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### Discussion and conclusions

It then can be concluded that the safety measures that were taken together with workers' compliance during the clean-up operations in Subareas A1-A5 were effective in preventing acute effects of TCDD exposure, in contrast to adverse acute health experience reported in other TCDD clean-up operations. Therefore, the safety, industrial hygiene, and medical surveillance programs used here should be applied as a minimum in the future in similar situations.

## MDL DESIO – LABORATORIO HPLC MS, ICP MS





Sistema Socio Sanitario



ASST Brianza

Pratica 2024/840

Spett.



c.a.



**Valutazione della potenziale esposizione a diossine  
del personale [redacted] addetto alla sorveglianza  
bonifica terreni per cantiere Pedemontana**

# Quale eredità e quali sviluppi futuri?

L'incidente di Seveso ha cambiato la normativa europea. La Direttiva Seveso impone:

- valutazione del rischio industriale;
- piani di emergenza;
- informazione alla popolazione;
- controlli periodici degli impianti;
- **prevenzione degli incidenti rilevanti.**

*L'esperienza della bonifica di Seveso ha contribuito a definire alcuni principi oggi consolidati della Medicina del Lavoro e Ambientale:*

- collaborazione tra istituzioni, enti ambientali e sanità;
- classificazione preventiva dei livelli di esposizione;
- costituzione di registri epidemiologici per il follow-up a lungo termine
- ricerca scientifica e tecnologica.