Preliminary findings of SENTIERI Project in Italian National Priority Contaminated Sites characterized by the presence of PCBs

Marta Benedetti, Mario Carere, Pietro Comba and Amerigo Zona

Department of Environment and Primary Prevention
Istituto Superiore di Sanità, Roma

May 22nd, 2015
Brescia
SENTIERI is for surveillance of health status of residents in contaminated sites
SENTIERI Working Group – mortality, cancer incidence and hospital discharges in National Priority Contaminated Sites

Carla Ancona Dipartimento di epidemiologia del Servizio sanitario regionale, Regione Lazio
Valeria Ascoli Dipartimento di scienze radiologiche, oncologiche e anatomo-pathologiche - Sapienza, Università di Roma
Anna Bastone Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Eleonora Beccaloni Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
MaTea Benedetti Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Fabrizio Bianchi Istituto di fisiologia clinica - Consiglio nazionale delle ricerche, Pisa
Annibale Biggi Unità di biostatistica, ISPO, Firenze - Dip. statistica, informatica e applicazioni, Università di Firenze
Alessandra Biondi Dipartimento di medicina del lavoro - INAIL - Area di ricerca ex ISPESL, Roma
Caterina Bruno Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Ennio Cadumi Epidemiologia e salute ambientale, ARPA Piemonte
Nicola Caranci Agenzia sanitaria e sociale regionale, Regione Emilia Romagna
Cinzia Carboni Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Maria Carere Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Dolores Caleo Unità di biostatistica, ISPO, Firenze - Dip. statistica, informatica e applicazioni, Università di Firenze
Achille Cernigliaro Dipartimento per le attività sanitarie e osservatorio epidemiologico - Assessorato sanità - Regione Sicilia, Palermo
Pietro Comba Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Susanna Conti Ufficio di statistica - Istituto superiore di sanità, Roma
Marisa Cortiati Dipartimento di medicina del lavoro - INAIL - Area di ricerca ex ISPESL, Roma
Moreno Demaria Epidemiologia e salute ambientale, ARPA Piemonte
Marco De Santis Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Fabrizio Feltri Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Ludia Fazio Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Francesco Forastiere Dipartimento di epidemiologia del Servizio sanitario regionale, Regione Lazio
Carlo A. Goldoni Dipartimento di sanità pubblica - Azienda USL di Modena
Laura Grisotto Università di Firenze
Ivano Iacovone WHO Collaborating Centre for Environmental Health in Contaminated Sites, Roma / Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Marco Leonardo Dipartimento della protezione civile, Roma
Valerio Manco Ufficio di statistica - Istituto superiore di sanità, Roma
Ida Marcelli Centro nazionale sostanze chimiche - Istituto superiore di sanità, Roma
Alessandro Marinaccio Dipartimento di medicina del lavoro - INAIL - Area di ricerca ex ISPESL, Roma
Giovanni Marzio Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Marco Martuza Centro europeo ambiente e salute - Organizzazione mondiale della sanità, Bonn
Gianola Milneri Ufficio di Statistica - Istituto superiore di sanità, Roma
Fabrizio Minichilli Istituto di filologia clinica - Consiglio nazionale delle ricerche, Pisa
Francesco Mitts World Health Organization Regional Office for Europe, Copenhagen
Loredana Musmeci Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Roberto Pasquet Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Augusta Picardi Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Roberto Pirasta Dipartimento di biologia e bionotologie Charles Darwin - Sapienza, Università di Roma
Michele Santoro Consiglio nazionale delle ricerche, Pisa
Francesca Scaini Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Marla Eleonora Soggi Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Amerigo Zona Dipartimento ambiente e connessa prevenzione primaria - Istituto superiore di sanità, Roma
Mariantonia Autelitano Registro tumori di Milano
Lucia Benvenuto Registro tumori Regione Liguria
Ludovica Bonelli Registro tumori Regione Liguria
Fortunato Bianconi Registro tumori umano di popolazione
Ettore Biddoli Registro tumori del Friuli Venezia Giulia
Carlo Buzzoni Registro tumori della Regione Toscana
Giuseppe Candelà Registro tumori della Provincia di Trapani
Mario Cocchioni Registro tumori infantili e degli adolescenti - Regione Marche
Enzo Covelli Registro tumori ASL BT - Sezione Registro tumori Puglia
Ludovica D’Amore Registro tumori della Provincia di Salerno
Emanuele Croce Registro tumori della Regione Toscana
Angelo Paolo Del Due Registro tumori Veretto
Fabio Falco Registro tumori della Romagna
Massimo Federico Registro tumori della Provincia di Modena
Stefano Ferrari Registro tumori della Provincia di Ferrara
Mario Ficaro Registro tumori di popolazione - Regione Campania
Adriano Giacomini Registro tumori del Remonte, Provincia di Biella
Gianna Gola Registro tumori della Provincia di Como
Stefano Guzzanti Registro tumori Veneto
Francesca La Rocca Registro tumori umano al popolazione
Roberto Lillini Registro tumori Regione Liguaria
Andrea Madeddu Registro tumori della provincia di Sassari
Michele Magoni Registro tumori della ASL di Brescia
Lucia Mangone Registro tumori Reggio
Sergio Masperi Registro tumori della Provincia di Sondrio
Milena Manfè Registro tumori infanti del Piemonte
Guido Mazoleni Registro tumori Alto Adige - Tumoregister South Tyrol
Francesco Merletti Registro tumori infanti del Piemonte
Maria Michiara Registro tumori di Pavia
Sante Minerva Registro tumori ASL Taranto
Carmela Nicita Registro tumori della Provincia di Ragusa
Fabio Pannezzo Registro tumori della Provincia di Latina
Silvano Piffer Registro tumori di Tiento
Paolo Picoì Registro tumori della Provincia di Mantova
Carlotta Sacerdoti Registro tumori infantili del Piemonte
Salvatore Scaccia Registro tumori integrati delle province di Messina Catania
Orsola Sechi Registro tumori della Provincia di Sassari
Diego Serraiolo Registro tumori del Friuli Venezia Giulia
Fabrizio Stracci Registro tumori umano di popolazione
Antonella Sutera Sardis Registro tumori della Provincia di Catanzaro
Giovanna Tagliabue Registro tumori della Lombardia - Varese
Francesco Tisano Registro tumori della provincia di Saronno
Mario Usala Registro tumori della provincia di Nuoro
Marina Vercelli Registro tumori Regione Liguaria
Francesco Vitale Registro tumori di Palermo e Province
Susanna Vitarelli Registro tumori della provincia di Macerata
Paola Zambon Università di Padova
Preparazione della bozza di testo e tabelle per i 23 SIN a cura di G. Minelli, V. Manno, S. Conti.
A priori evaluation of the epidemiological evidence of the causal association of 63 causes of death with the environmental exposures in National Priority Contaminated Sites – NPCSs

NPCSs are defined on the basis of health, environmental and social criteria (Decree 152/06)
### Environmental exposures in IPS

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>Chemical plant*</th>
<th>Petrochemical plant &amp; Refinery</th>
<th>Steel plant</th>
<th>Electric power plant</th>
<th>Mine and/or quarry</th>
<th>Harbour area</th>
<th>Asbestos or other mineral fibers</th>
<th>Landfill</th>
<th>Incinerator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All ages</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malignant neoplasms of trachea, bronchus and lung</td>
<td>I</td>
<td>L</td>
<td>I</td>
<td>L</td>
<td>I</td>
<td>I</td>
<td>L</td>
<td>I</td>
<td>I</td>
</tr>
<tr>
<td>Malignant neoplasms of pleura</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td></td>
<td>S+</td>
<td>L</td>
<td>S+</td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>Diseases of the respiratory system</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>I</td>
<td>L</td>
<td></td>
<td>I</td>
<td>I</td>
</tr>
<tr>
<td>Asthma</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td></td>
<td>I</td>
<td>I</td>
</tr>
<tr>
<td><strong>Up to 14 years old</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td></td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

### Legend

- **S** = sufficient to infer the presence of a causal association
- **L** = limited but not sufficient to infer the presence of a causal association
- **I** = inadequate to infer the presence or the absence of a causal association
Mortality study (63 causes of death, 1995-2002), males and females

Standardized Mortality Ratio regional reference population

SMR: crude and adjusted for an ad hoc deprivation index (SENTIERI DI)

44 NPCss
Mortality update (63 causes of death ICD-10, 2003-2010), males and females, regional reference rates, SMR

Cancer incidence (35 cancer sites, ICD-10, 1996-2005), males and females, macro-area reference rates, SIR

Hospital discharge records (46 discharge diagnoses, ICD-9-CM, 2005-2010) males and females, regional reference rates, SHR

SMR, SIR and SHR adjusted for an ad hoc deprivation index (SENTIERI DI)

18 NPCss
Results

Emanuele Crocetti,¹ Roberta Pirastu,² Carlotta Buzzoni,¹ Giada Minelli,³ Valerio Manno,³ Caterina Bruno,⁴ Lucia Fazzo,⁴ Ivano Iavarone,⁴,⁵ Roberto Pasetto,⁴ Paolo Ricci,⁶ Amerigo Zona,⁴ Susanna Conti,³

Abstract

Of the 18 National Priority Contaminated Sites (NPCSs) analysed in this Report, some have a single source of environmental contamination (such as fluoro-edenite in Biancavilla). In most cases, however, we are looking at multiple heterogeneous sources of contamination. In this respect, the a priori causal evaluation of the association between diseases and environmental exposures in NPCSs, based on epidemiological evidence, can help trace the health impact back to specific types of environmental exposure.

To properly evaluate the population’s health profile, we must also observe whether results remain consistent for all three health outcomes or in both genders. The first is the case of excess mortality, cancer incidence and hospital discharges for bladder cancer (men) in Porto Torres and diseases of the urinary tract in the Basso bacino del fiume Chienti NPCS. Gender consistency is observed, for instance, for all cancer in Bolzano, Porto Torres, Venice, Litorale Domizio Flegreo, Priolo, and Taranto, for all causes in Taranto, Litorale Domizio Flegreo and Trieste.

The health impact in the various NPCSs needs to be considered carefully and used as a springboard for further analytical research that could confirm and explain causal links to specific environmental exposures. The observations can, however, already be considered as a basis for mandatory primary prevention measures.
NPCSs’ municipalities distribution by quintile of SENTIERI deprivation index

- Less deprived: 12.2%
- Quintile 2: 11.9%
- Quintile 3: 16.6%
- Quintile 4: 21.7%
- More deprived: 37.6%

Overall: 113
## Global burden of mortality in NPCss
### Mortality 1995-2002

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>Observed</th>
<th>Expected</th>
<th>SMR</th>
<th>Obs-Exp</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall mortality</strong></td>
<td>403692</td>
<td>393723</td>
<td>102.5</td>
<td>9969</td>
</tr>
<tr>
<td><strong>All neoplasms</strong></td>
<td>116075</td>
<td>111766</td>
<td>103.8</td>
<td>4309</td>
</tr>
<tr>
<td><strong>Diseases of the circulatory system</strong></td>
<td>169750</td>
<td>167863</td>
<td>101.1</td>
<td>1887</td>
</tr>
<tr>
<td><strong>Diseases of the respiratory system</strong></td>
<td>25785</td>
<td>25158</td>
<td>102.4</td>
<td>627</td>
</tr>
<tr>
<td><strong>Diseases of the digestive system</strong></td>
<td>21452</td>
<td>19845</td>
<td>108.0</td>
<td>1607</td>
</tr>
<tr>
<td><strong>Diseases of the genitourinary system</strong></td>
<td>5698</td>
<td>5506</td>
<td>103.4</td>
<td>192</td>
</tr>
</tbody>
</table>
Cancer incidence in Italian contaminated sites

Pietro Comba\(^{(a)}\), Paolo Ricci\(^{(b, c)}\), Ivano Iavarone\(^{(a)}\), Roberta Pirastu\(^{(d)}\), Carlotta Buzzoni\(^{(c, e)}\), Mario Fusco\(^{(c, f)}\), Stefano Ferretti\(^{(c, g)}\), Lucia Fazzo\(^{(a)}\), Roberto Pasetto\(^{(a)}\), Amerigo Zona\(^{(a)}\), Emanuele Crocetti\(^{(c, e)}\), for ISS-AIRTUM Working Group for the study of cancer incidence in contaminated sites* 

\(^{(a)}\) Dipartimento di Ambiente e Connessa Prevenzione Primaria, Istituto Superiore di Sanità, Rome, Italy
\(^{(b)}\) Registro Tumori di Mantova, Mantua, Italy
\(^{(c)}\) AIRTUM, Associazione Italiana dei Registri Tumori, Italy
\(^{(d)}\) Dipartimento di Biologia e Biotecnologie “Charles Darwin”, Sapienza Università di Roma, Rome, Italy
\(^{(e)}\) Unità di Epidemiologia Clinica e Descrittiva, Istituto per lo Studio e la Prevenzione Oncologica, Florence, Italy
\(^{(f)}\) Registro Tumori di Napoli (ASL Napoli 4), Naples, Italy
\(^{(g)}\) Registro Tumori di Ferrara, Dipartimento di Chirurgia e Medicina Sperimentale, Università degli Studi di Ferrara, Ferrara, Italy

* the Working Group members are cited before the References
Figure 1.
Italian National Priority Contaminated Sites: Geographical distribution
Abstract
Introduction. The incidence of cancer among residents in sites contaminated by pollutants with a possible health impact is not adequately studied. In Italy, SENTIERI Project (Epidemiological study of residents in National Priority Contaminated Sites, NPCSs) was implemented to study major health outcomes for residents in 44 NPCSs.
Methods. The Italian Association of Cancer Registries (AIRTUM) records cancer incidence in 23 NPCSs. For each NPCSs, the incidence of all malignant cancers combined and 35 cancer sites (coded according to ICD-10), was analysed (1996-2005). The observed cases were compared to the expected based on age (5-year period, 18 classes), gender, calendar period (1996-2000; 2001-2005), geographical area (North-Centre and Centre-South) and cancer sites specific rates. Standardized Incidence Ratios (SIR) with 90% Confidence Intervals were computed.
Results. In both genders an excess was observed for overall cancer incidence (9% in men and 7% in women) as well as for specific cancer sites (colon and rectum, liver, gallbladder, pancreas, lung, skin melanoma, bladder and Non Hodgkin lymphoma). Deficits were observed for gastric cancer in both genders, chronic lymphoid leukemia (men), malignant thyroid neoplasms, corpus uteri and connective and soft-tissue tumours and sarcomas (women).
Discussion. This report is, to our knowledge, the first one on cancer risk of residents in NPCSs. The study, although not aiming to estimate the cancer burden attributable to the environment as compared to occupation or life-style, supports the credibility of an etiologic role of environmental exposures in contaminated sites. Ongoing analyses focus on the interpretation of risk factors for excesses of specific cancer types overall and in specific NPCSs in relation to the presence of carcinogenic pollutants.
SENTIERI Project: limitations

- **Ecological approach**
- **Multifactorial etiology of diseases**
- **Exposure**
  - time-bound event in a limited geographical area or progressive contamination by a heterogeneous mixture of pollutants
  - contamination of several environmental matrices leading to multiple sources of exposure
  - available exposure information is indirect and qualitative
  - no information on sources of exposure that can have a health impact, e.g. such as concurrent air pollution from road traffic
- **Confounding**
  - socioeconomic status, occupational exposures, lifestyles habits
SENTIERI Project: major strengths

- **Standardization**
  - Mortality, cancer incidence, hospital discharges analysis and classification of *environmental exposures in NPCSs*
  - *A priori* evidence evaluation to comment and interpret study results

- **Quality of data**
  - Mortality, cancer incidence, hospital discharges

- **Update**
  - Mortality, cancer incidence, hospital discharges analysis (other vital statistics data can be analyzed)
Contaminated sites and health

Report of two WHO workshops:
Sydney, Italy, 18 November 2011
Catania, Italy, 21-22 June 2012

http://bit.ly/1hv1mxsd

http://bit.ly/1mHnyUg

Health and environment: communicating the risks

http://bit.ly/19wFN7f

WHO Collaborating Center for Environmental Health in Contaminated Sites

http://www.iss.it/chis/
SENTIERI Project is a permanent surveillance system, so the main priority is to periodically update the findings.

Priority is also given to improvements in environmental characterization and in detection of health outcomes defined as “of a priori interest” because they recognize an ascertained or suspected etiologic role of environmental exposures occurring in Contaminated Sites.
Selected issues currently object of specific efforts are:

i. the study of mesothelioma incidence in Contaminated Sites (SENTIERI-ReNaM Project)

ii. the study of mortality, morbidity and cancer incidence among children and adolescents resident in Contaminated Sites (SENTIERI KIDS Project)
A sub-project on occurrence of endocrine disrupters in Contaminated Sites and incidence of cancer of hormone-dependent tissues has recently been started.

Preliminary findings have been presented at the 8th Copenhagen Workshop on Endocrine Disrupters (April 27-30, 2015).

In this phase, among else, data on the occurrence of PCBs in the 18 National Priority Contaminated Sites served by Cancer Registries have been collected and reviewed.
INCIDENCE OF BREAST, PROSTATE, TESTIS AND THYROID CANCER IN ITALIAN HIGHLY POLLUTED AREAS

Marta Benedetti, Amerigo Zona, Mario Carere, Pietro Comba

Istituto Superiore di Sanità

INTRODUCTION

- There is general consensus that the increased incidence of cancers of hormone-dependent tissues in the last decades may be partially related to exposure to environmental pollutants, some with endocrine-disrupting properties.
- A limited number of studies in data have examined associations between cancers of hormone-dependent tissues and environmental exposure to endocrine-disrupting chemicals (EDCs) in highly polluted areas.
- In Italy, epidemiological surveillance is ongoing for four of the National Regional Priority Contaminated Sites (CRP), 18 of which have been studied.
- In these CRPs, several environmental pollutants are present, some of which with endocrine-disrupting properties.

OBJECTIVES

- The aim of the present study was to investigate the incidence of breast, prostate, testis, and thyroid cancer in those CRPs served by cancer registries, where the presence of EDCs has been identified.
- Thyroid cancer was included even if its current understanding of its etiology does not clearly link it to an endocrine mechanism.

METHODS

- The study adopted an ecological design.
- Incidence rates were based on histologically confirmed primary malignant tumors in people of all ages.
- EDCs were selected on the basis of their evidence of carcinogenicity for tumors at a location, accepted by international scientific institutions.
- CRPs labeled in Table 1 were detected in 16 of 18 CRPs, that is, in different environmental matrices (e.g., soil, ground, and surface water, biota).
- Standardized Incidence Ratios (SIRs) were calculated. CRPs with 95% confidence intervals, were compared with the national estimate of the Italian Association of Cancer Registries (2015) with reference to the time period 1998-2013.
- Reference rates were those of the cancer registries from Northern Italy or from Southern-Central Italy (depending on the location of the study area).

RESULTS

- In several CRPs, the presence of EDCs associated with the cancer register study have been detected, increased incidence of one or more cancer sites were found.
- The study design and the analytical strategies of the considered tumors do not allow reaching conclusions in terms of causal role of the environmental contamination. However, in the light of the observation of some increases in EDCs, a further epidemiological surveillance and exposure assessment studies will be required.
- In conclusion, analysis of analytical epidemiological studies is warranted.

CONCLUSIONS

- We excluded from the study one CRP as the local Cancer Registry did not participate in the present study. The presence of CRPs listed in Table 1 is therefore still valid.
- Significantly increased SIRs were observed for breast cancer, prostate cancer, testis cancer, and thyroid cancer in 8 out of 14 CRPs, in 6 out of 14 CRPs in 2 out of 14 CRPs and in 4 out of 14 CRPs, respectively.

REFERENCES

- More information, and a detailed list of incidence ratios (SIRs) with 95% confidence intervals (95% CI) by site, period, and level of standardization.

Viale Regina Elena, 293 - 00181 Rome, Italy

www.iss.it
Methods

- The presence of PCBs was documented in 8 out of 18 NPCss, in different environmental matrices (air, soil, ground and surface water, biota). Human biomonitoring data and food monitoring data were also taken into consideration.

- Standardized Incidence Ratios (SIRs), together with their 90% confidence intervals, were computed for each NPCS and cancer site with reference to the time window 1996-2005.

- Reference rates were provided by the pool of Cancer Registries from Northern-Central Italy or from Southern-Central Italy (depending on the localization of the study area).
**NPCSs’ INFORMATION**

<table>
<thead>
<tr>
<th>NPCSs</th>
<th>PLANTS/POLLUTION SOURCES</th>
<th>PCBS AND OTHER AGENTS DETECTED IN ENVIRONMENTAL MATRICES</th>
<th>PCBS - OTHER AGENTS</th>
<th>FOOD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brescia Caffaro</strong></td>
<td>Chemical plants, landfill</td>
<td>As, <strong>PCBs</strong>, PCDDs, chlorobenzene, other solvents</td>
<td>PCDDs/PCDFs (serum)</td>
<td><strong>PCBs</strong> (food of animal and vegetable origin) <strong>PCDDs/PCDFs</strong> (cattle’s meat and milk, forage)</td>
</tr>
<tr>
<td><strong>Fidenza</strong></td>
<td>Chemical plants, urban and hazardous waste landfills</td>
<td>AS, <strong>PCBs</strong>, PCDDs, benzene</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Litorale Domizio Flegre</strong></td>
<td>Urban waste landfills, illegal dumping sites, illegal burning of waste</td>
<td>As, <strong>PCBs</strong>, <strong>PCDDs</strong>, benzene, others solvents</td>
<td>PCDDs/PCDFs (breast milk)</td>
<td><strong>PCDDs/PCDFs</strong> (cow and buffalo’s milk)</td>
</tr>
<tr>
<td><strong>Laghi Mantova</strong></td>
<td>Metallurgic plants, paper plants, petrochemical plant, harbour area, industrial waste landfills, incinerator (hazardous waste)</td>
<td>As, <strong>Cd</strong>, PCDDs, ethylbenzene, other solvents</td>
<td></td>
<td><strong>PCBs</strong> (fruit, vegetables)</td>
</tr>
<tr>
<td><strong>Priolo</strong></td>
<td>Chemical plants, petrochemical plant, refinery, harbour area, asbestos, hazardous waste landfills</td>
<td><strong>PCBs</strong>, hexachlorobenzene</td>
<td>PCDDs, <strong>PCBs</strong>, HCB (breast milk and puerperae hair)</td>
<td><strong>PCBs</strong>, HCB, PAHs (clams), <strong>PCDDs</strong>, <strong>PCBs</strong> (sheep and cow’s meat and milk, clams)</td>
</tr>
<tr>
<td><strong>Taranto</strong></td>
<td>Refinery, steel plant, harbour area, cement plant, landfills, illegal dumping sites</td>
<td>As, <strong>Cd</strong>, benzene, xilene, PCDDs, <strong>PCBs</strong></td>
<td>As, <strong>Cd</strong>, PCDDs, <strong>PCBs</strong> (serum)</td>
<td><strong>PCBs</strong>, HCB, PAHs (clams), <strong>PCDDs</strong>, <strong>PCBs</strong> (sheep and cow’s meat and milk, clams)</td>
</tr>
<tr>
<td><strong>Terni-Papigno</strong></td>
<td>Steel plant, hazardous waste landfills</td>
<td><strong>PCBs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Venezia (Porto Marghera)</strong></td>
<td>Chemical plants, petrochemical plant, refinery, harbour area, illegal dumping sites</td>
<td>As, <strong>Cd</strong>, <strong>PCBs</strong>, PCDDs, solvents</td>
<td>As, <strong>Cd</strong>, PCDDs, PCDFs (shellfish)</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** The agents listed in this table represent a fraction of all those detected or monitored in the NPCSs
**Overall Standardized Incidence Ratios (SIRs) with 90% Confidence intervals (90% CI) between 1996-2005**

<table>
<thead>
<tr>
<th>NPCss</th>
<th>Breast</th>
<th></th>
<th></th>
<th>Melanoma</th>
<th></th>
<th></th>
<th>NHL</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>females</td>
<td>males</td>
<td></td>
<td>females</td>
<td>males</td>
<td></td>
<td>females</td>
<td>males</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>SIR</td>
<td>CI (90%)</td>
<td></td>
<td>n</td>
<td>SIR</td>
<td>CI (90%)</td>
<td>n</td>
<td>SIR</td>
<td>CI (90%)</td>
</tr>
<tr>
<td><strong>Brescia Caffaro</strong></td>
<td>1187</td>
<td>125</td>
<td>120-132</td>
<td>98</td>
<td>127</td>
<td>106-150</td>
<td>100</td>
<td>119</td>
<td>100-140</td>
</tr>
<tr>
<td><strong>Fidenza</strong></td>
<td>403</td>
<td>102</td>
<td>94-111</td>
<td>28</td>
<td>86</td>
<td>61-118</td>
<td>30</td>
<td>86</td>
<td>62-116</td>
</tr>
<tr>
<td><strong>Litorale Domizio Flegreo</strong></td>
<td>1097</td>
<td>103</td>
<td>98-108</td>
<td>68</td>
<td>104</td>
<td>84-128</td>
<td>71</td>
<td>94</td>
<td>76-115</td>
</tr>
<tr>
<td><strong>Laghi Mantova</strong></td>
<td>472</td>
<td>113</td>
<td>105-122</td>
<td>37</td>
<td>111</td>
<td>83-146</td>
<td>37</td>
<td>102</td>
<td>76-134</td>
</tr>
<tr>
<td><strong>Priolo</strong></td>
<td>712</td>
<td>111</td>
<td>104-118</td>
<td>53</td>
<td>106</td>
<td>84-134</td>
<td>58</td>
<td>112</td>
<td>89-139</td>
</tr>
<tr>
<td><strong>Taranto</strong></td>
<td>497</td>
<td>145</td>
<td>134-156</td>
<td>55</td>
<td>225</td>
<td>178-282</td>
<td>46</td>
<td>152</td>
<td>117-195</td>
</tr>
<tr>
<td><strong>Terni-Papigno</strong></td>
<td>902</td>
<td>114</td>
<td>107-120</td>
<td>71</td>
<td>113</td>
<td>92-138</td>
<td>80</td>
<td>124</td>
<td>102-150</td>
</tr>
<tr>
<td><strong>Venezia (Porto Marghera)</strong></td>
<td>3045</td>
<td>110</td>
<td>107-114</td>
<td>283</td>
<td>125</td>
<td>113-138</td>
<td>263</td>
<td>111</td>
<td>100-123</td>
</tr>
</tbody>
</table>

Overall standardized incidence ratios (SIRs) with 90% confidence intervals (90% CI) are provided for various NPCss between 1996-2005.
MAIN FINDINGS

- A number of excesses in the incidence of neoplasms for which PCB exposure represents an ascertained (melanoma) or suspected (breast cancer, Non-Hodgkin Lymphomas) have been detected in several Contaminated Sites where the occurrence of PCB has been documented.

Significantly increased SIRs were observed for:

- Breast cancer (F) in 6 out of 8 NPCSs
- Melanoma (M) in 3 out of 8 NPCSs
- Melanoma (F) in 4 out of 8 NPCSs
- NHL (M) in 2 out of 8 NPCSs
- NHL (F) in 2 out of 8 NPCSs

- Excesses in melanoma incidence in both genders have been observed in Brescia, Porto Marghera and Taranto.
BRESCIA - Caffaro
TARANTO
PORTO MARGHERA (VENICE)
CONCLUDING REMARKS.

In light of the well-known limitations of geographic epidemiological studies, these figures do not provide causal clues, but rather suggest second generation studies, based on analytical epidemiological approaches, aimed at testing the etiologic role of PCB exposure in determining elevated risk of melanoma and, where appropriate/feasible, risk of Non Hodgkin Lymphoma and breast cancer.
The role of contamination of the different environmental matrices should be better ascertained (where it has not yet been taken into account) through exposure and risk assessment studies in order to gain a better insight in the causal link between contamination and the adverse health effects.
Both exposure assessment and analytic epidemiological approaches have been adopted in the context of Brescia, and they will be the object of the next presentations.
THANK YOU