Portuguese experience on

Environmental Health Surveillance

related to USW incineration

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Workshop on "*Urban solid waste incinerator plants: technical aspects and health impacts*"
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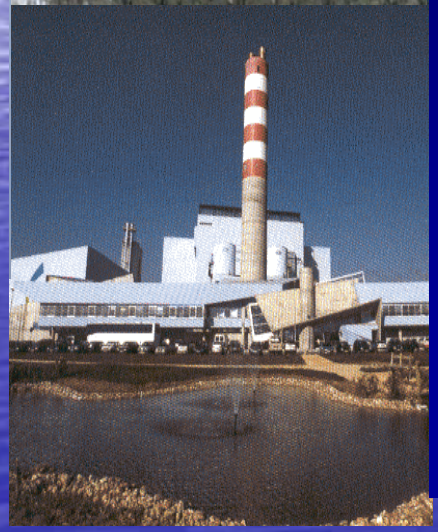
Structure



Environmental Health Surveillance

1. Context
2. Objectives /strategy
3. Results
4. Conclusions

Late 90´s...

Waste issue in Europe

Strategy ➔ Did not produce expected results!

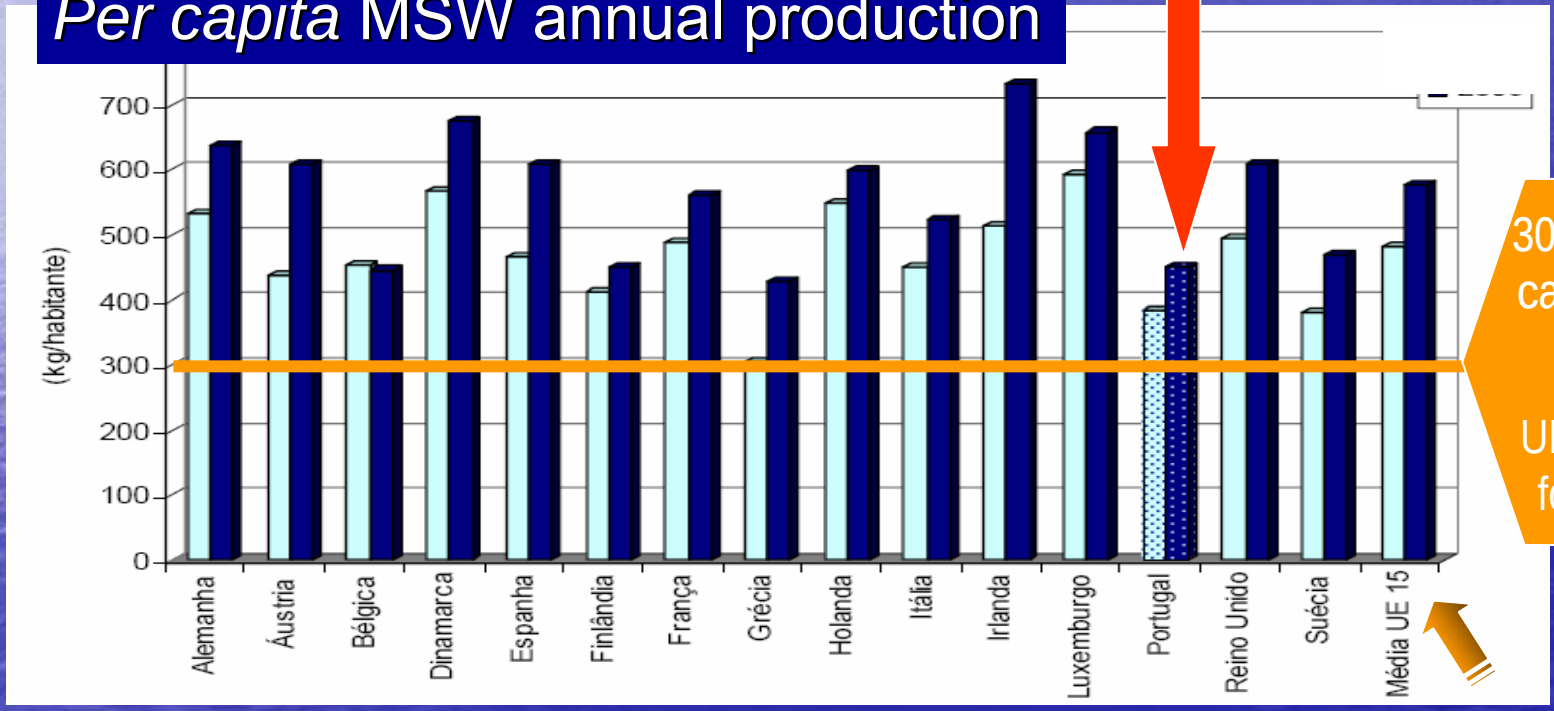
- **Increasing** SW production (exponential in some countries)
- EU' target for 2000 ➔ "***300 kg / per capita . per year***"

NOT achieved

Over **500** kg of MSW *per capita* are now being generated per year!

Portugal is not an exception!

Per capita MSW annual production



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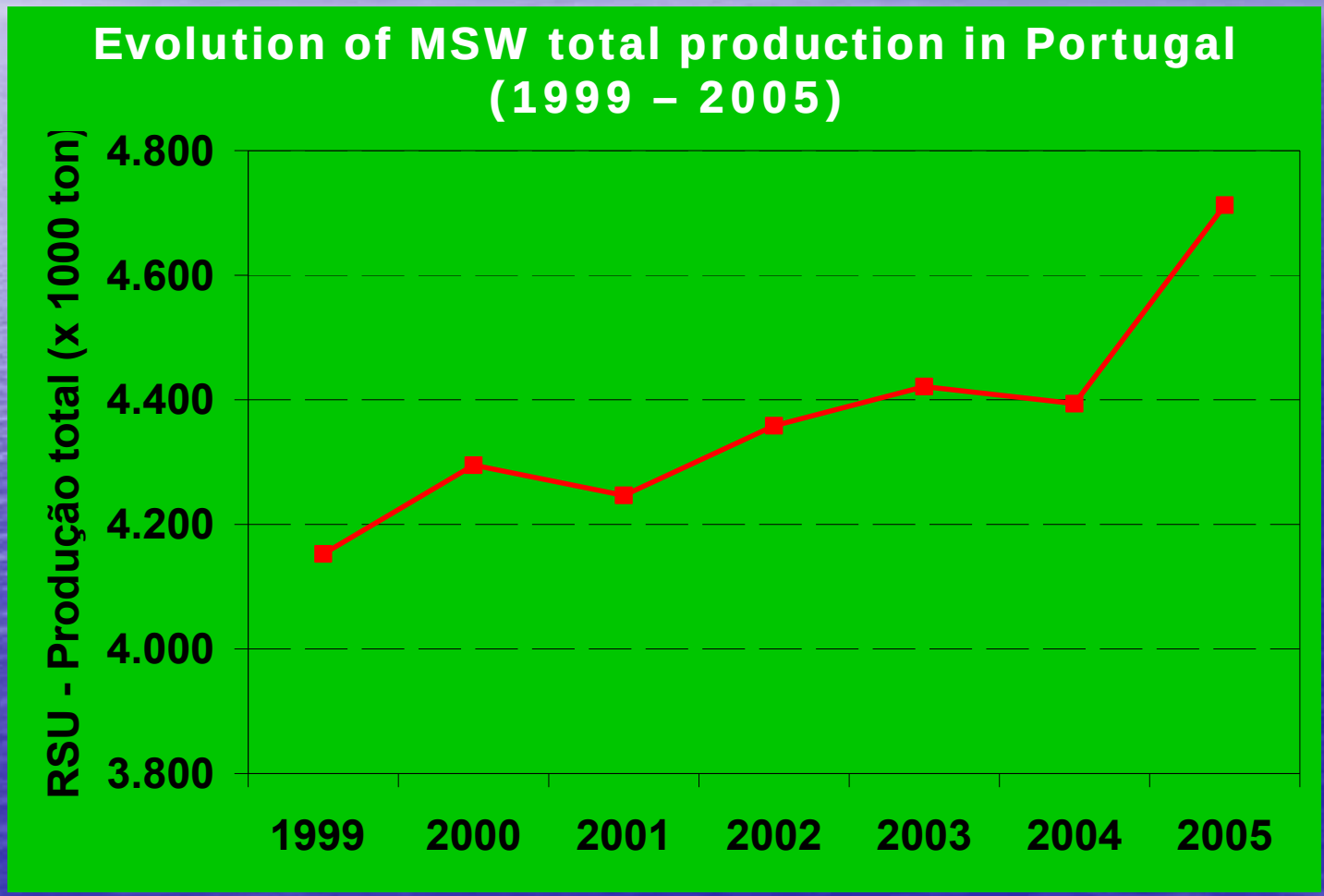
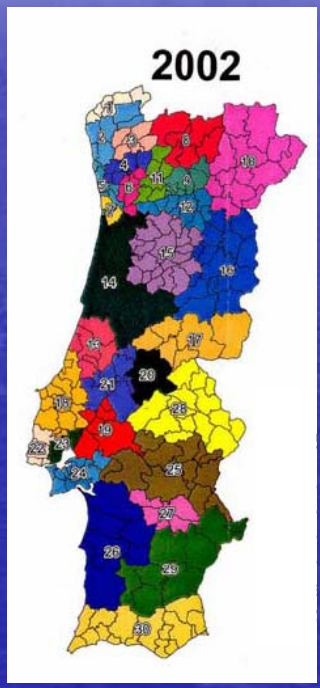
Portugal is not an exception!



Late 90´s...
MSW management in Portugal

1996	Facilities	2002
5	Organic Resource Recovery	5
0	Energy Recovery	**3**
13	Landfills	37
341	Uncontrolled dumps	**0**



- Uncontrolled dumps: closed!
- Incineration: safe disposal of SW that cannot be recycled / reused

Late 90´s...

- Public and scientific concern
- New legislative frame (Europe & Portugal)

Entities responsible for incineration plants are obliged:

- To implement & evaluate measures to minimize impacts
- To demonstrate efficacy of implemented measures

Monitoring Programs

- Addressed to environmental quality & adverse health effects
- Developed according to regulatory frame (when applicable)

Late 90´s...

New waste management strategy

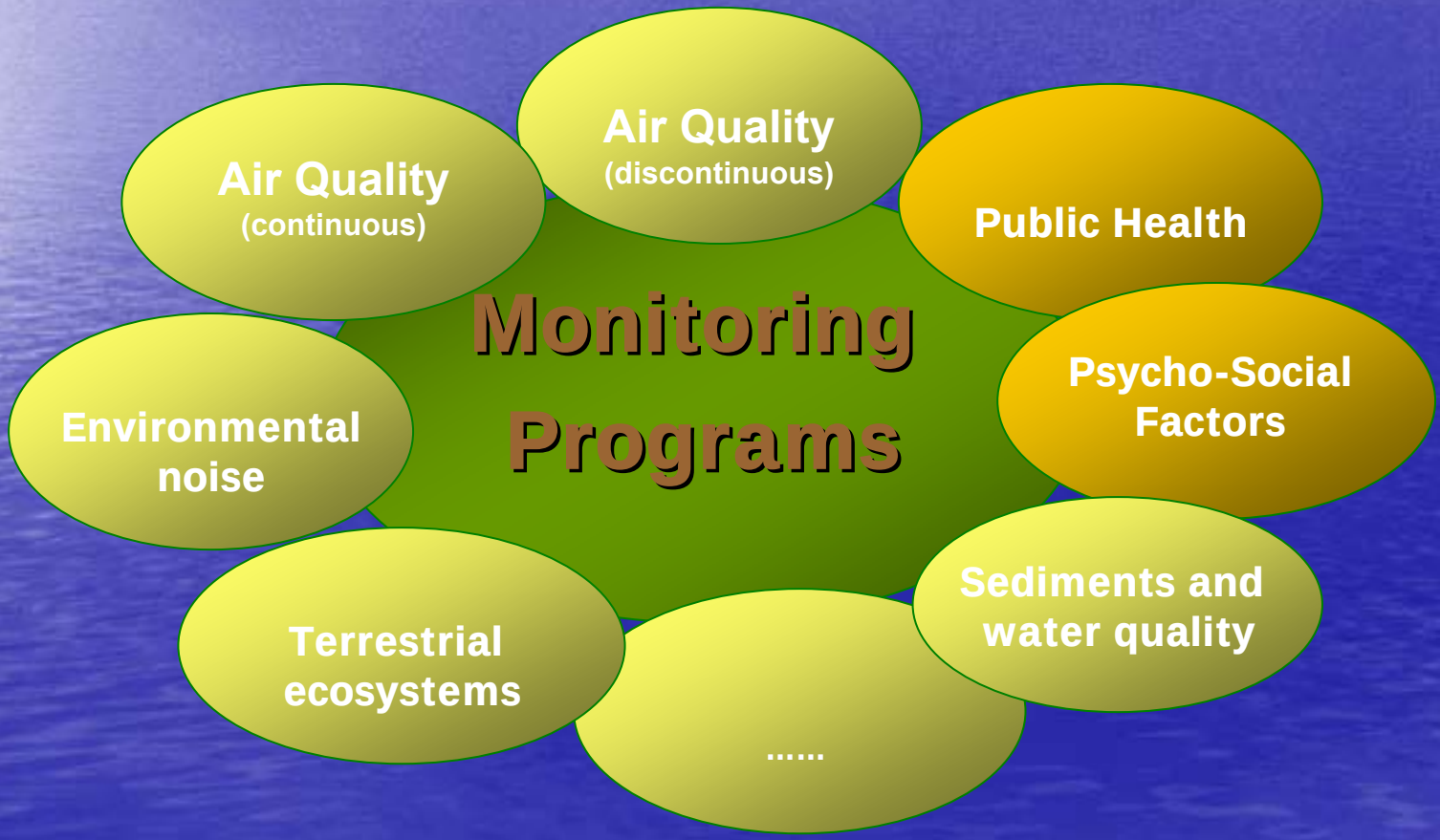
Overall objective of **Monitoring Programs**

[**New or updated** Solid Waste Incinerators]

- To guarantee quality of environmental media in SWI's area of influence
- To ensure safeguard of Public Health for people living in same area

Independent institutions and experts

(*Universities, Environment and Health Sectors*)



Independent institutions and experts

(*Universities, Environment and Health Sectors*)

Institute of Preventive Medicine

Model of Surveillance

ProVEpAs

- Air Quality (continuous)
- Air Quality (discontinuous)
- Environmental noise
- Psycho-Social Factors
- Terrestrial ecosystems
- Sediments and water quality
- .....

Late 90´s...

New waste management strategy

New Municipal Solid Waste Incinerator 1999

Updated Solid Waste Incinerator 2002

Municipal, hospital, slaughterhouse waste

Public Health perspective

Relevant pollutants from SW incineration

Macro-pollutants

- "*Classic*" pollutants
  - SO_2, HCl, HF — Acid pollution
  - Particulate matter
  - NO_x (Oxidant pollution)
  - CO — Volatile / Non-volatile

Micro-pollutants

- Heavy metals
  - Pb, Cr, Cu, Mn
  - Ni, As
  - Cd, Hg
- "Dioxins"
  - 7 PCDDs
  - 10 PCDFs
  - 8 PCBs

Public Health perspective

Pathologies/health conditions potentially associated

1. Asthma, allergies and respiratory problems
2. Cancer
3. Reproductive health disorders
   - Abortion, low birth-weight, infertility
   - Infant and perinatal mortality, foetal malformations
4. Neurodevelopmental disorders
   - Low birth-weight, psychological retardment
   - Learning disability
5. Mental health disorders
6. Alterations in global health and wellbeing

ProVEpAs

Environmental Health Surveillance Programs

Main goal

To monitor magnitude, spatial & time trends

- Indicators of exposure to environmental agents (area of influence)
- Indicators of potential adverse health effects (residents in area)

ProVEpAs

Hypothesis

(assuming incinerators under control)

Pollutants' body burden and associated health status of residents in the area of influence do not differ from those of similar residents at a greater distance from the plant

ProVEpAs

2 assumptions for Surveillance development (➔methodological implications)

1. ≠ distances from SWIs ⇒ ≠ levels of exposure

Study groups: EXPOSED and CONTROLS

2. Levels of exposure may vary along time

Baseline and repeated observations

Surveillance Methodology

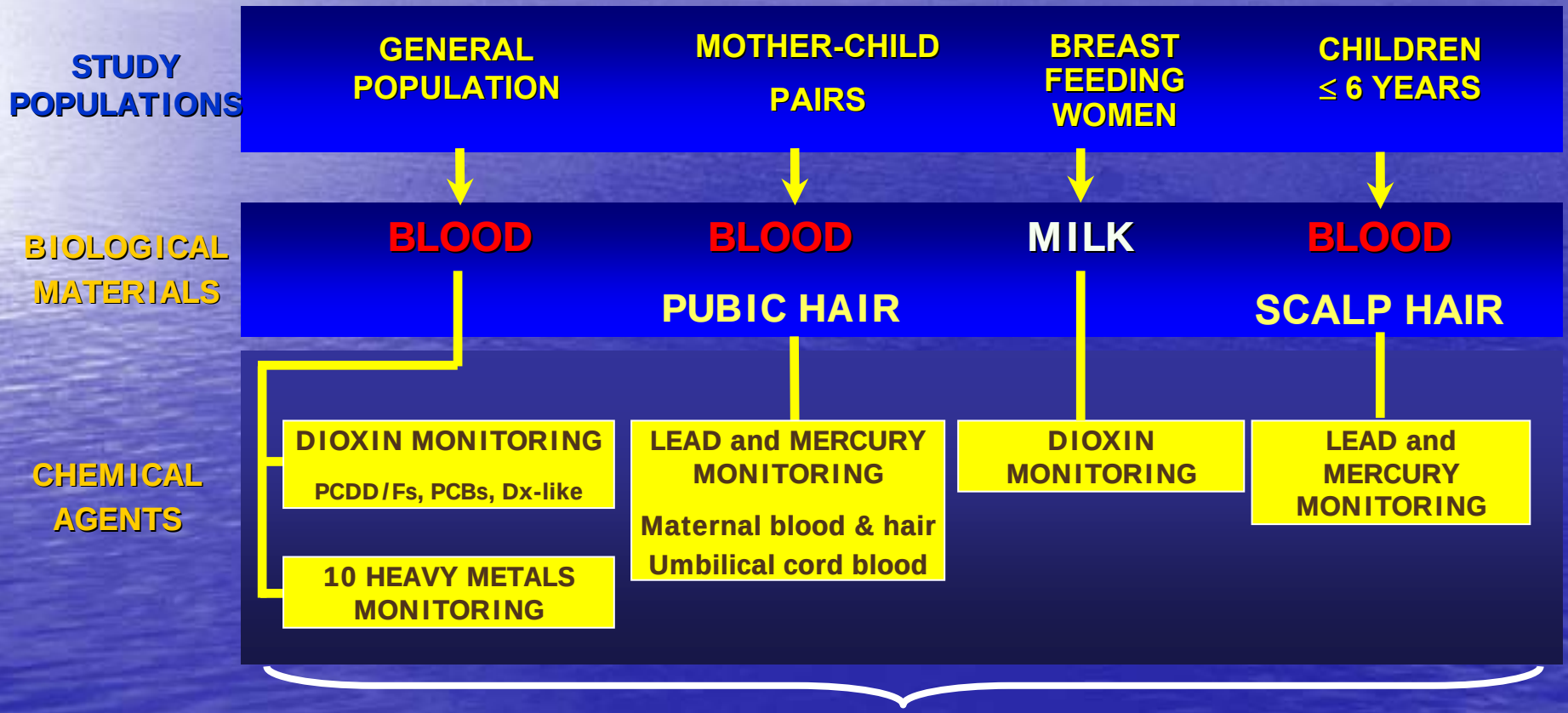
3 complementary components:

- Human Biomonitoring addressed to EXPOSURE
  of the most critical pollutants (**measurements in the persons**)

- Survey of identified ADVERSE HEALTH EFFECTS
  Epidemiology of pathologies/health conditions associated with critical pollutants

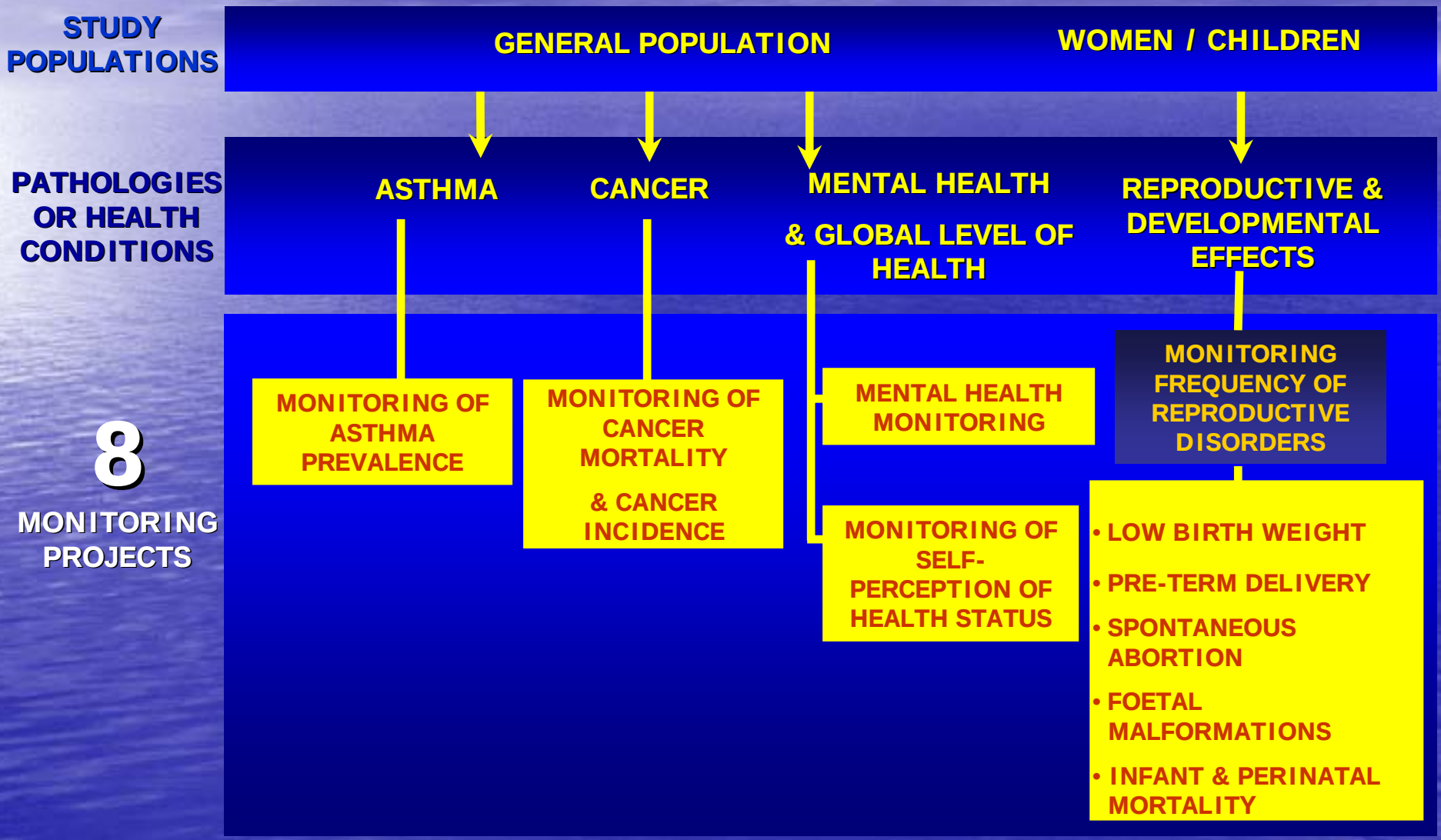
- Survey of identified RISK FACTORS
  Monitoring of potential confounding factors

Human Biomonitoring addressed to EXPOSURE

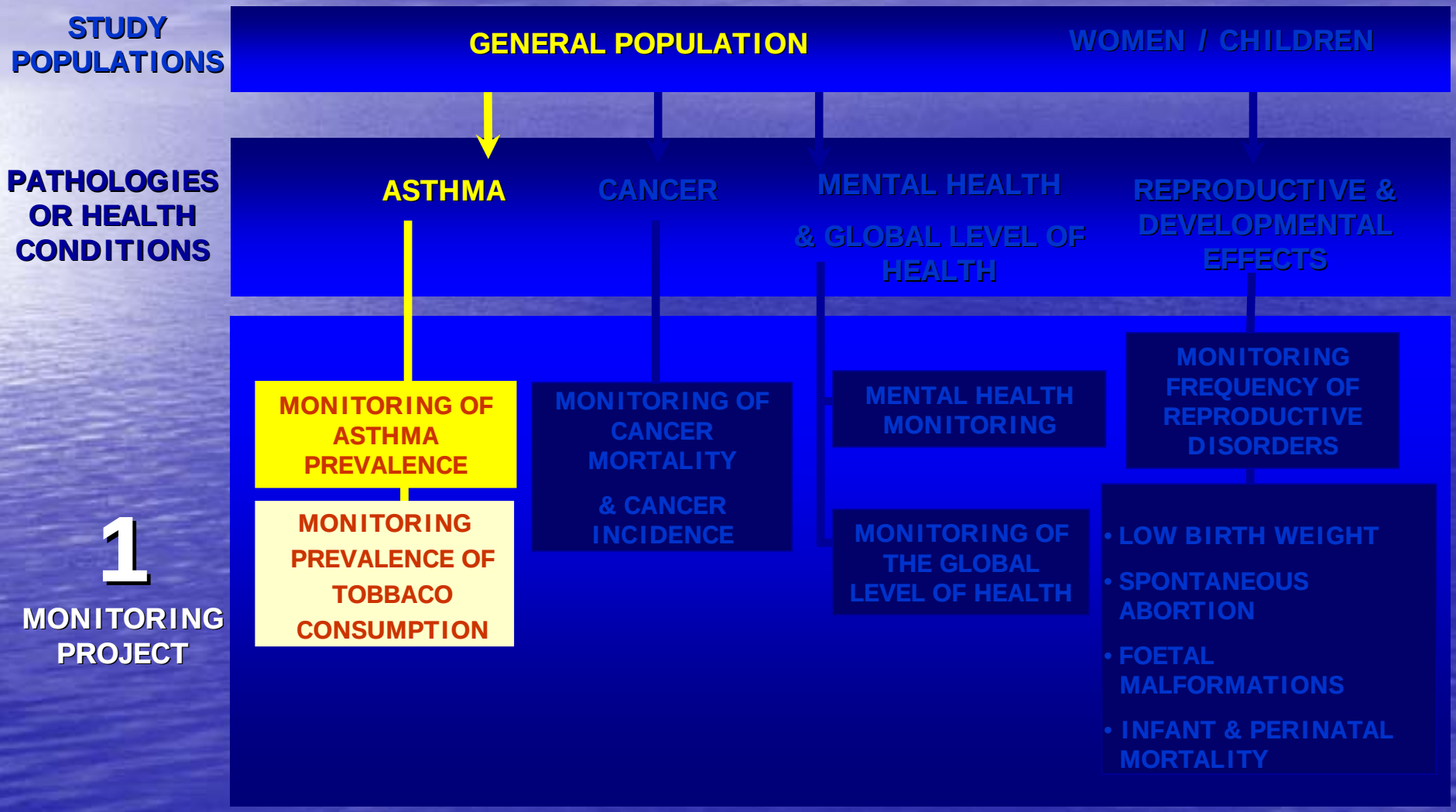


5 BIOMONITORING PROJECTS under development

Survey of identified ADVERSE HEALTH EFFECTS



Survey of identified ADVERSE HEALTH EFFECTS



ProVEpAs → **Surveillance Methodology**

- Human Biomonitoring Projects based on:
  - Serial cross-sectional studies (at least, every 2 years)
  - Starting point: baseline establishment before regular SWI operation
  - Administration of questionnaires (confounding control)
    - Anthropometric and sociodemographic factors
    - Lifestyle and behavioural variables
  - Special consideration to ethical and communication issues
  - Grafted research projects, whenever possible

ProVEpAs → **Surveillance Methodology**

Epidemiological studies based on:

1. Periodic analysis of health registries (**when** and **if available**)
   - Cancer mortality rates (morbidity **not available**)
   - Infant and perinatal mortality rates
   - Low birth-weight rate
   - Foetal malformations (**deficient** registry)
2. Self-administered questionnaires
   - Asthma and tobacco consumption
   - Mental health & self-perception of health-status
3. Grafted research projects
   - Spontaneous abortion (including **HBM** of exposure and pregnancy status)

What about results?

- **Regularly communicated**
  - To the owners of the SWIs ➔ abundant "*Gray literature*"
  - To local Environment and Health authorities
  - To participants (mainly if remediation is possible)
- **Disseminated to scientific community**
  - Mainly for the last couple of years
  - Through usual means

Some results

from ProVEpAs ...

suggesting

effective control of the SWIs

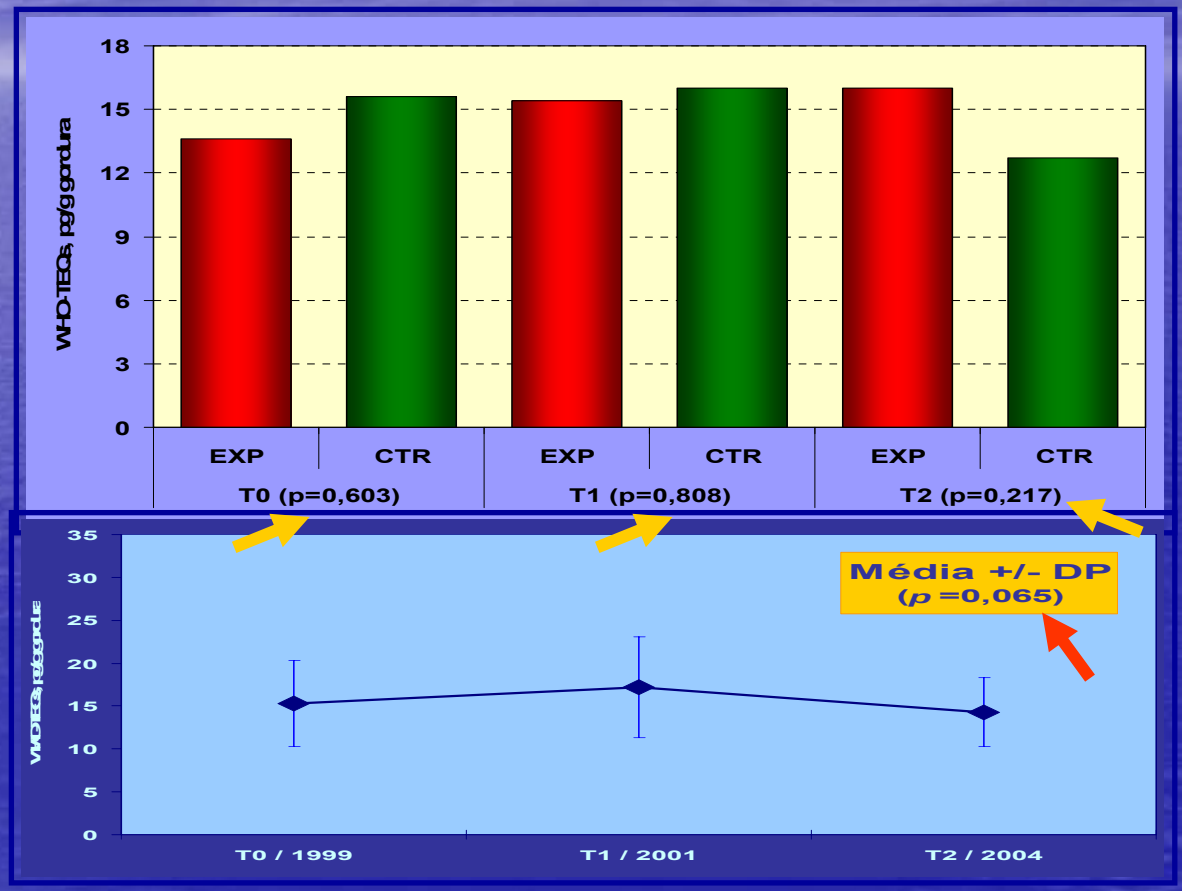
Human exposure to dioxins

(*measurements in **blood** of the General Population*)

Differences

EXP vs CTR

not significant



Relatively stable

***background* exposure**

Suggesting **<u>effective control</u>** in relation to dioxin emissions

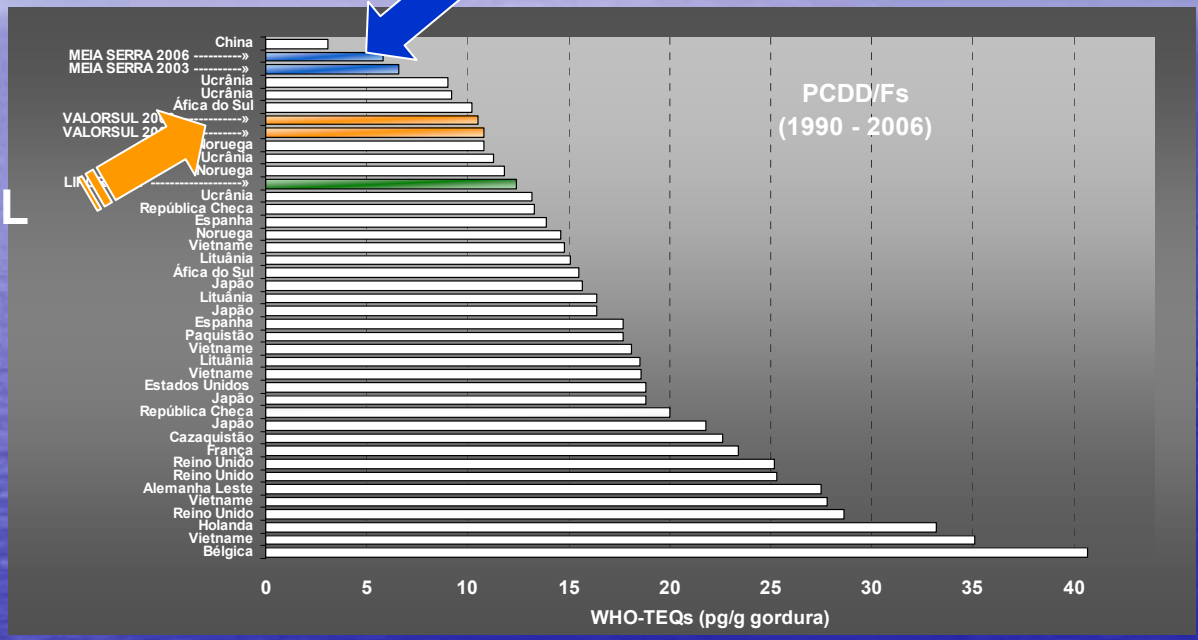
Results from VALORSUL Surveillance Program

Human exposure to dioxins

(*measurements in **blood** of the General Population*)

MEIA SERRA

VALORSUL



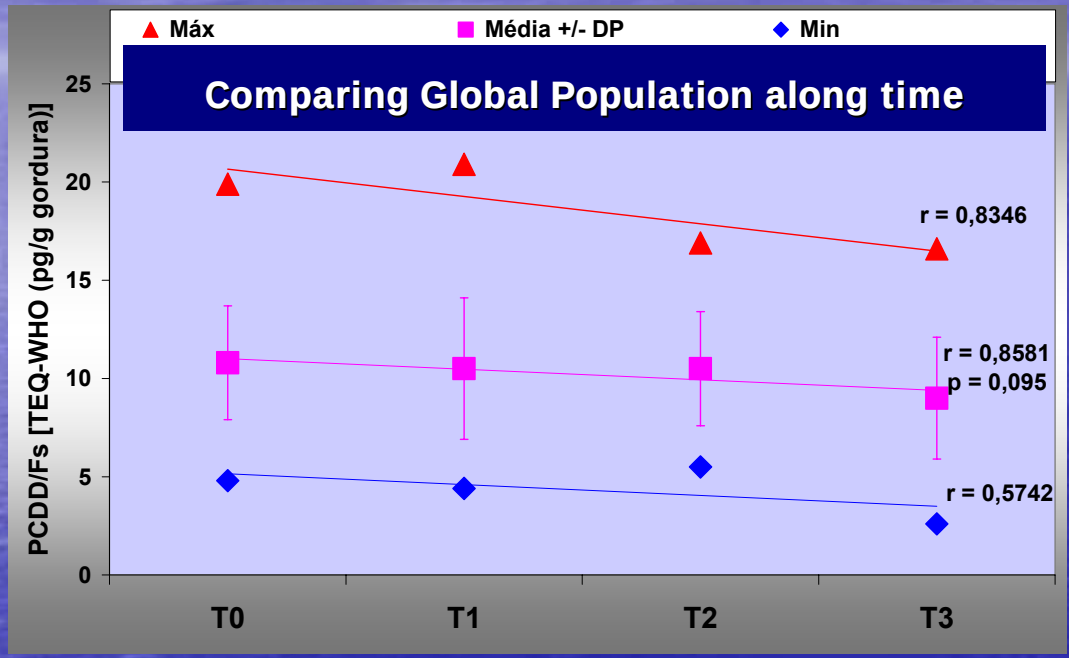
Suggesting:

background exposure **lower** than published levels in comparable populations

Results from VALORSUL and MEIA SERRA Surveillance Programs

Human exposure to dioxins

(*measurements in* ***breast milk***)

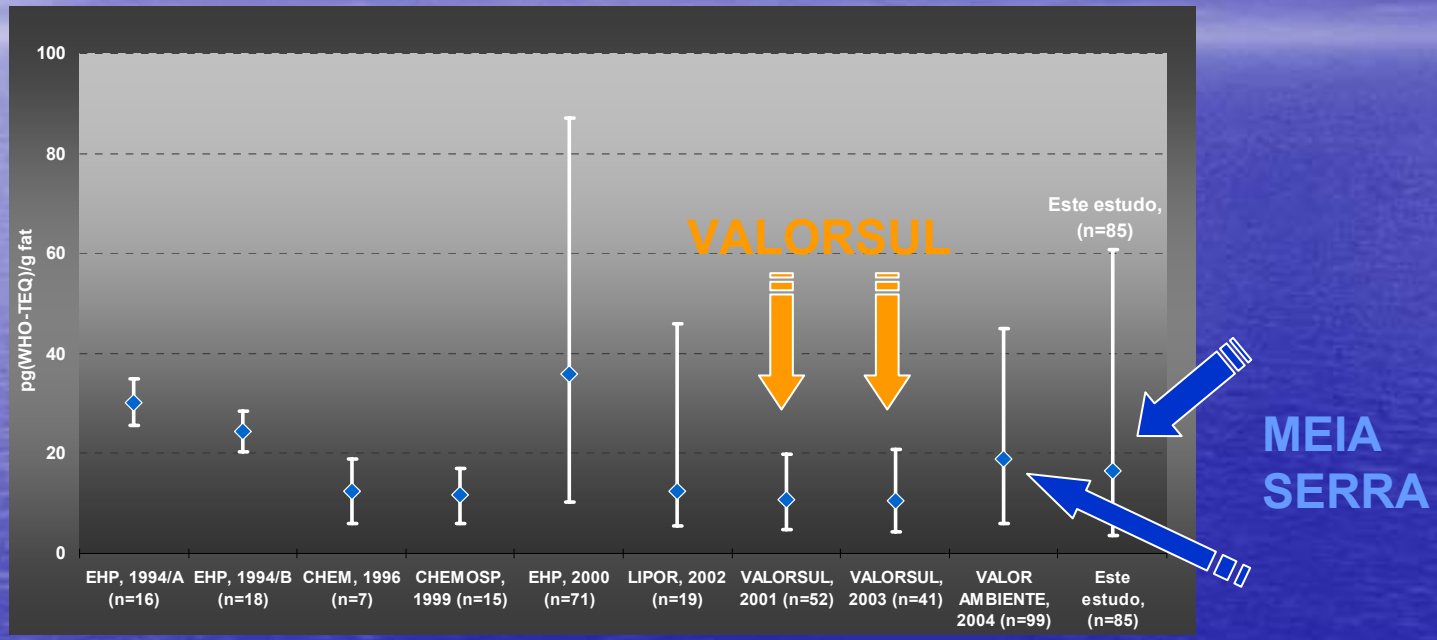


Suggesting **<u>trend for reduction</u>** in relation to baseline

Results from VALORSUL Surveillance Program

Human exposure to dioxins

(*measurements in* ***breast milk***)



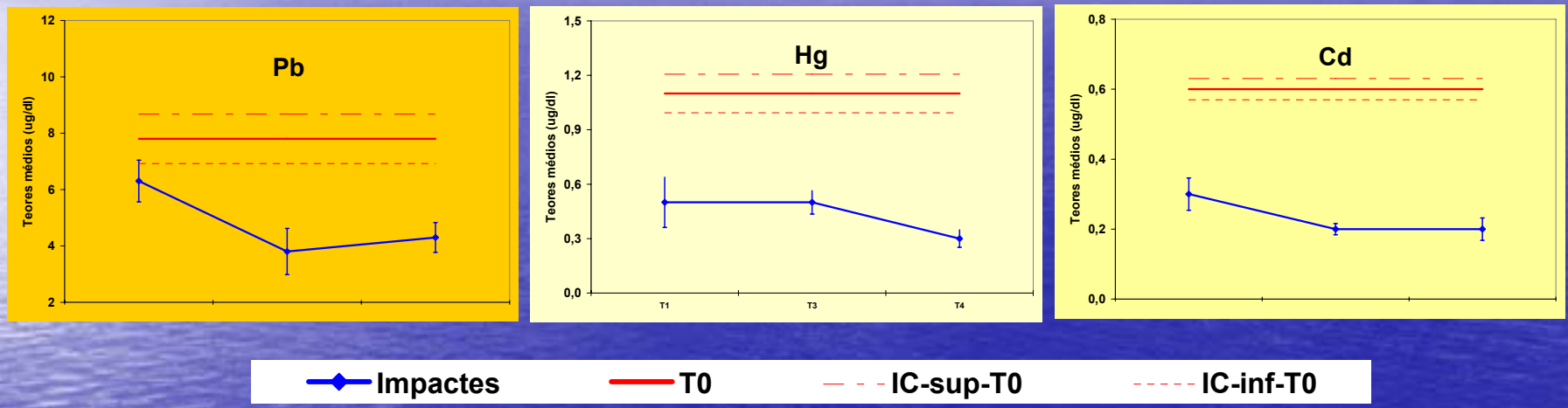
Suggesting:

background exposure **lower** than published levels in <u>comparable populations</u>

Results from VALORSUL and MEIA SERRA Surveillance Programs

Human exposure to Pb, Hg, Cd

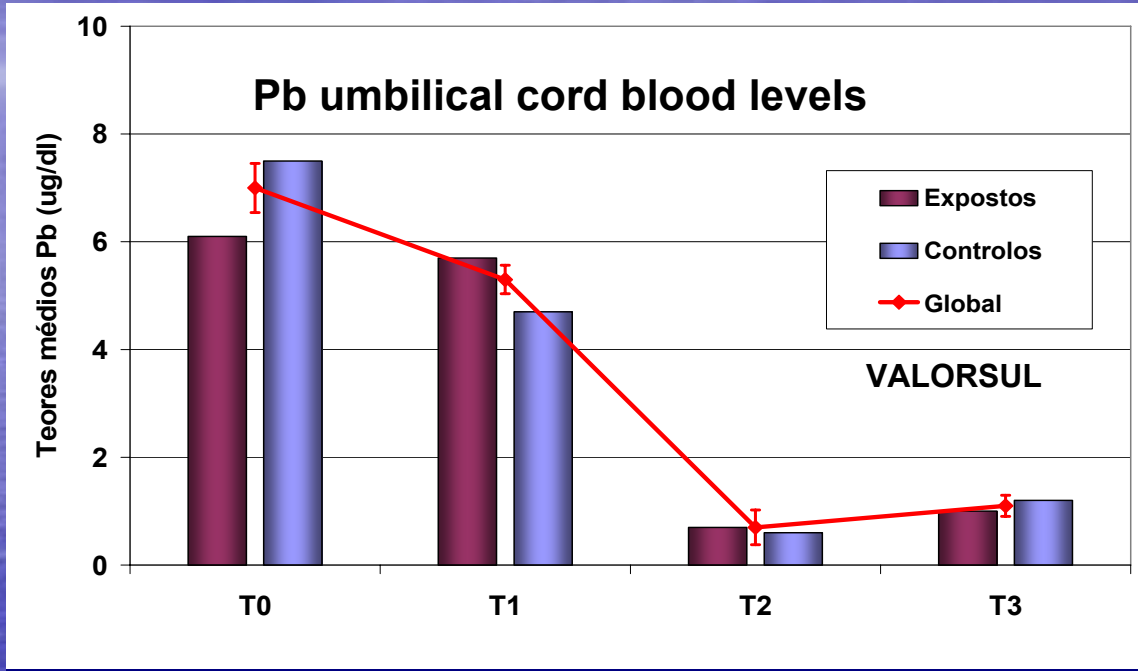
(*measurements in **blood** of the General Population*)



- **Systematic and statistically significant reduction ($p < 0.001$) in relation to baseline levels for the most relevant heavy metals**
- **In global terms, blood levels of Pb, Hg and Cd lower than lower limits of reference values or maximum admissible values** (when established)

Results from VALORSUL Surveillance Program

Foetal exposure to Lead



Comparison between EXP and CTR along time

Suggesting:

- Incinerator **<u>effective control</u>** in relation to Pb emissions
- Improvement of environmental quality concerning Pb foetal exposure

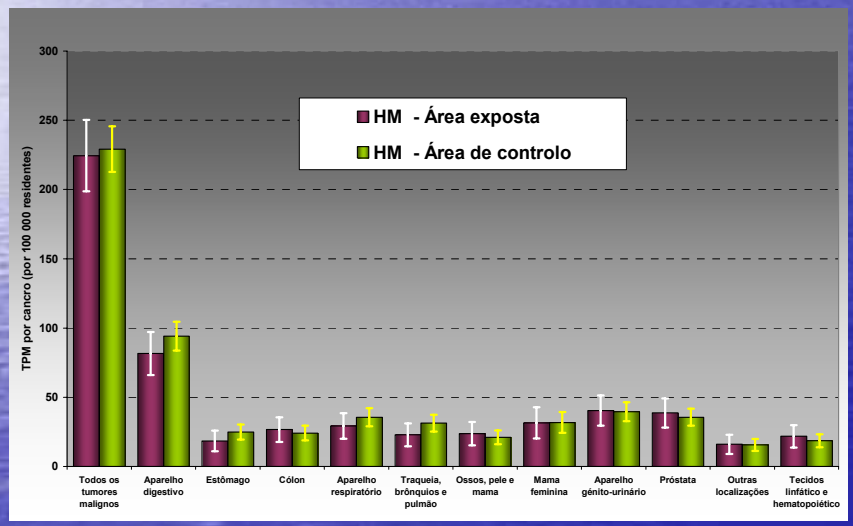
Results from VALORSUL Surveillance Program

Cancer mortality rates (by cancer type)

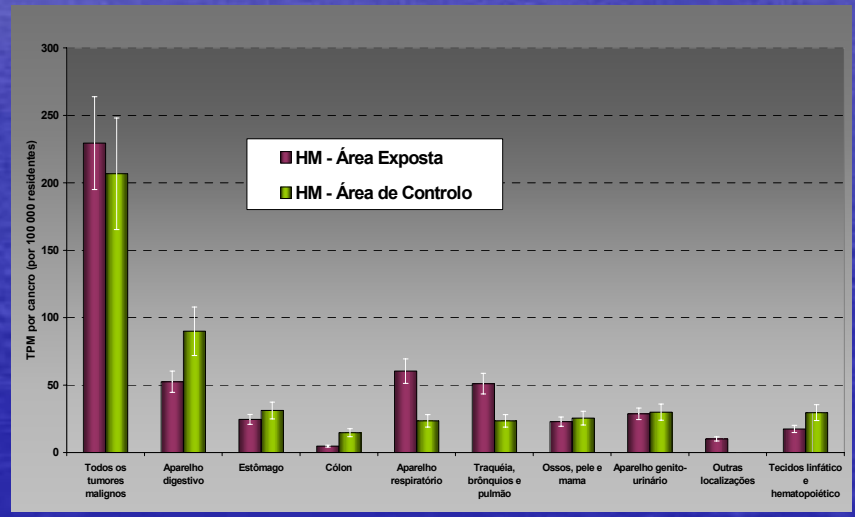
(using health and demographic registries)

Comparison between EXPOSED and CONTROLS

VALORSUL



MEIA SERRA



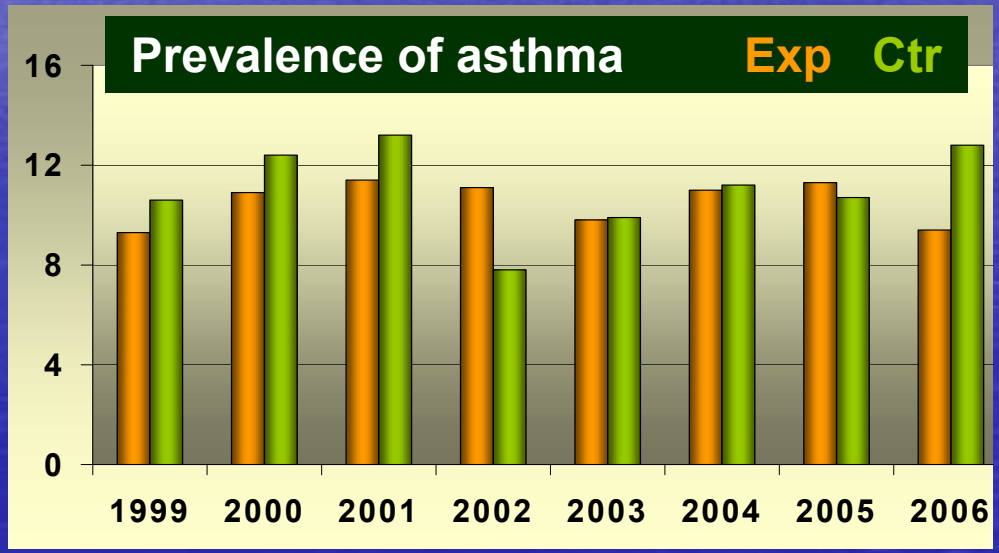
- Baseline characterization
- Does not allow taking conclusions on Facilities' control (long latency)

Prevalence of Asthma

Comparing EXPOSED vs CONTROLS - VALORSUL

Prevalence of asthma

	Expostos	Controlos	p	Global	p
1999	9,3	10,6	0,41	10,1	
2000	10,9	12,4	0,41	11,9	
2001	11,4	13,2	0,44	12,5	
2002	11,1	7,8	0,14	9,3	0,37
2003	9,8	9,9	0,96	9,9	
2004	11	11,2	0,51	11,2	
2005	11,3	10,7	0,71	10,9	
2006	9,4	12,8	0,05	11,3	



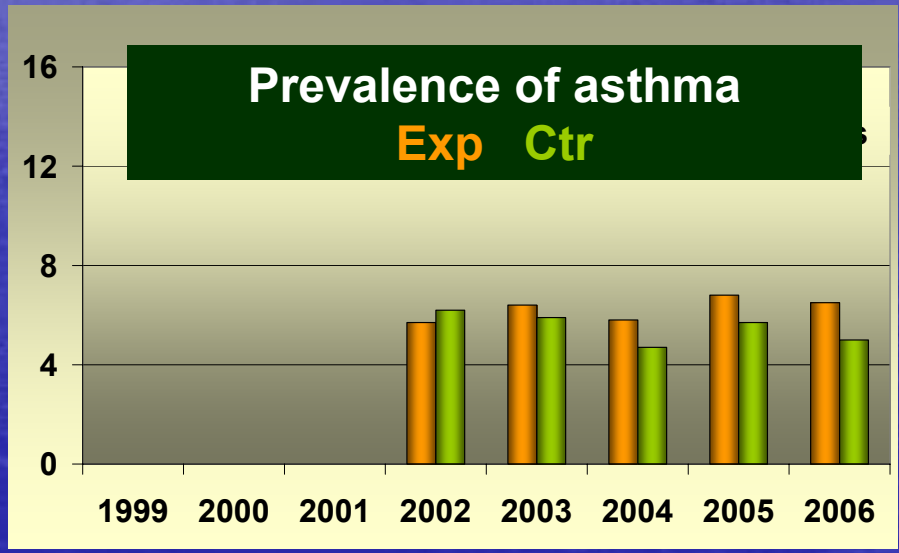
- Differences EXP vs CTR statistically not significant ► Incinerator is controlled
- Temporal trend for relative stability

Prevalence of Asthma

Comparing EXPOSED vs CONTROLS – MADEIRA ISLAND

Prevalence of asthma

	Expostos	Controlos	p	Global	p
2002	5,7	6,2	0,71	6,0	
2003	6,4	5,9	0,67	6,1	
2004	5,8	4,7	0,36	5,1	0,79
2005	6,8	5,7	0,44	6,1	
2006	6,5	5,0	0,38	5,6	



- Differences EXP vs CTR <u>statistically not significant</u> ► Incinerator is controlled
- Temporal trend for relative stability
- Prevalence of asthma in VALORSUL Area ≅ 2x that in MADEIRA

Conclusions

1. Results from Surveillance Programs show:
   - Generally differences between EXPOSED and CONTROL not statistically significant for exposures nor for pathologies and health conditions

- Results suggest the effectiveness of source control measures in relation to both Incinerators under study

Conclusions

2. Results from Exposure determinations show:

- Generally lower levels in relation to those for baseline or reference situation

- Meaning: evidence of a general significant trend for reduction of exposure to almost all studied relevant pollutants

Conclusions

3. Comparing results from VALORSUL and MEIA SERRA, levels are, in general, higher for VALORSUL

Meaning: living in Madeira may result in lower exposure to critical pollutants and then in lower related health risks

Conclusions

4. Advantages of developing ProVEpAs
(Besides main goal of demonstrating efficacy of implemented mitigation)

- To fulfil important gaps of relevant information even only at local level
- To identify relevant aspects susceptible of PREVENTION
- To contribute to base decisions e. g. for waste management strategies and at least maintenance/non deterioration of present situation
- To create needed national capacity and experience, to be able to participate in current or future Environmental Health Strategies at national and/or European level