

Monitoring programs and development of environmental and industrial standard guideline values of dioxins in Vietnam: Progress and perspectives

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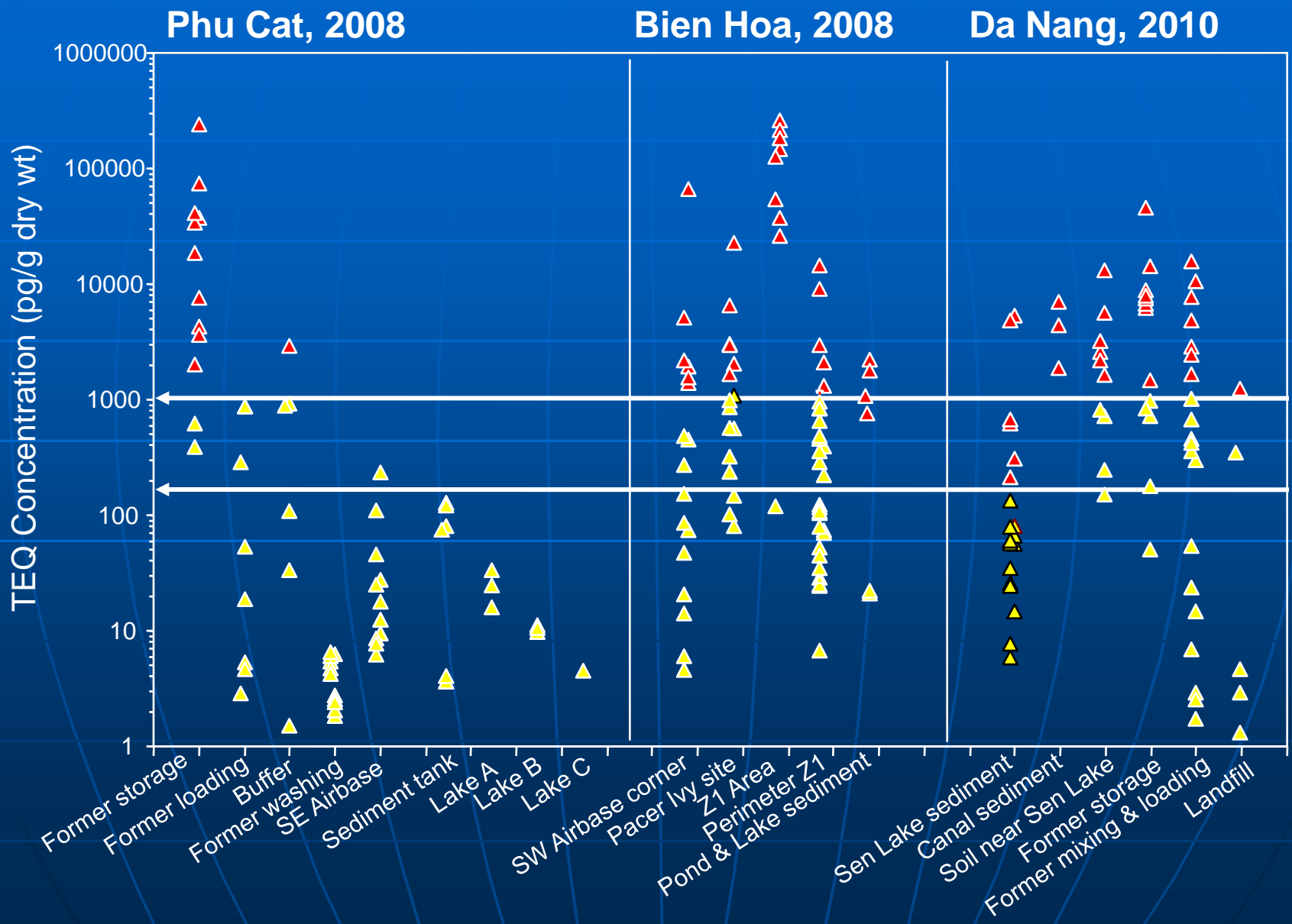
Outline

- AO/Dioxin issues in Vietnam: update
- Dioxin from other sources:
 - Open landfill dumping sites
 - Industrial activities
- Technology options to reduce dioxin from industry
- Current status and development of emission standard guideline values

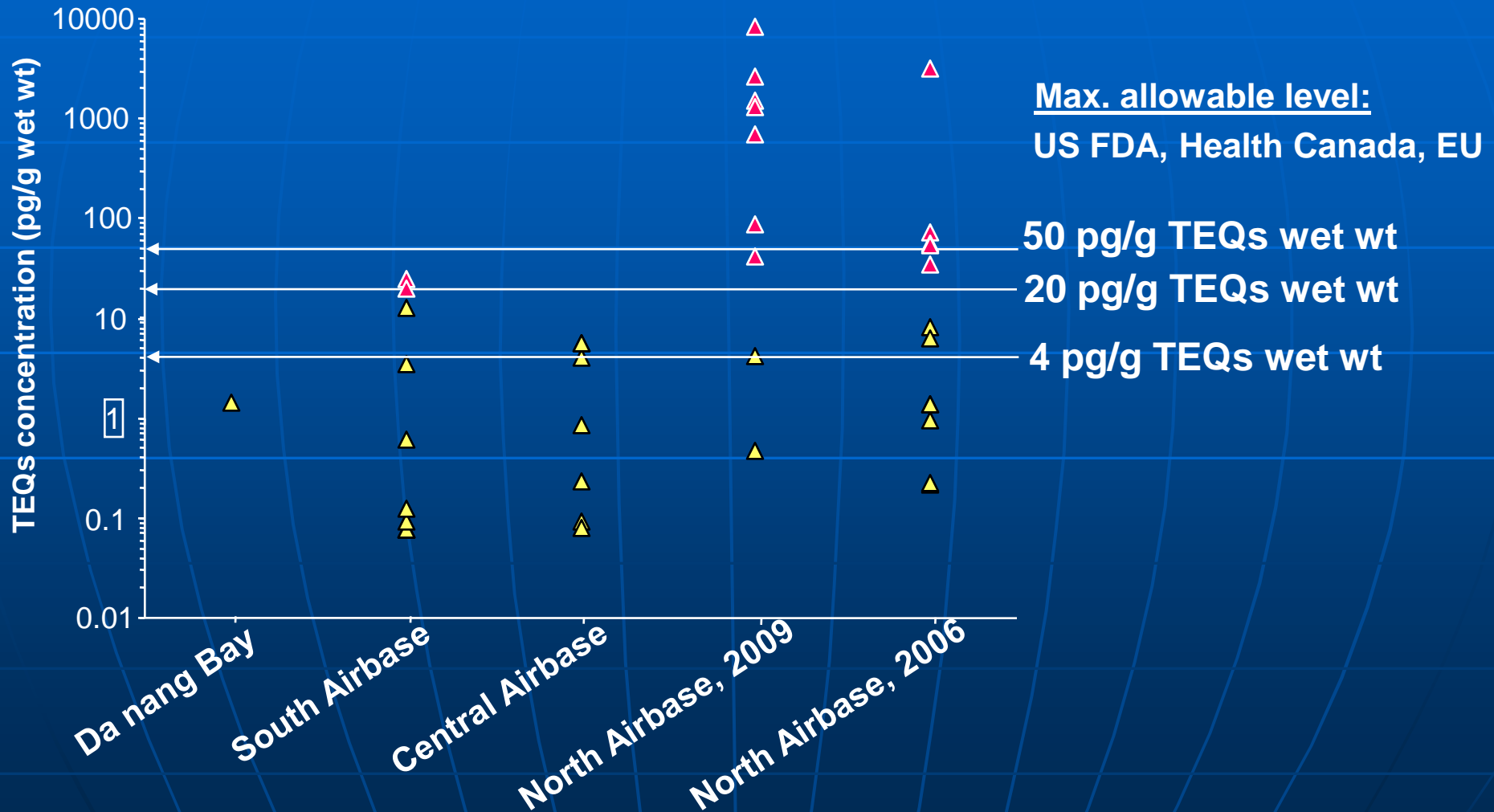
Dioxin issues in Vietnam

- Agent Orange issues: Extraordinary high degree of contamination at former US Army Airbase – AO/Dioxin contaminated hotspots
- Open dumping landfill for municipal wastes in Asian developing countries including Vietnam: potential sources of PCDD/Fs
- PCDD/Fs releases from industry: very limited information based on actual measurements of industrial samples

Comparison of dioxin contamination in 3 hotspots – Survey in 2008 & 2010

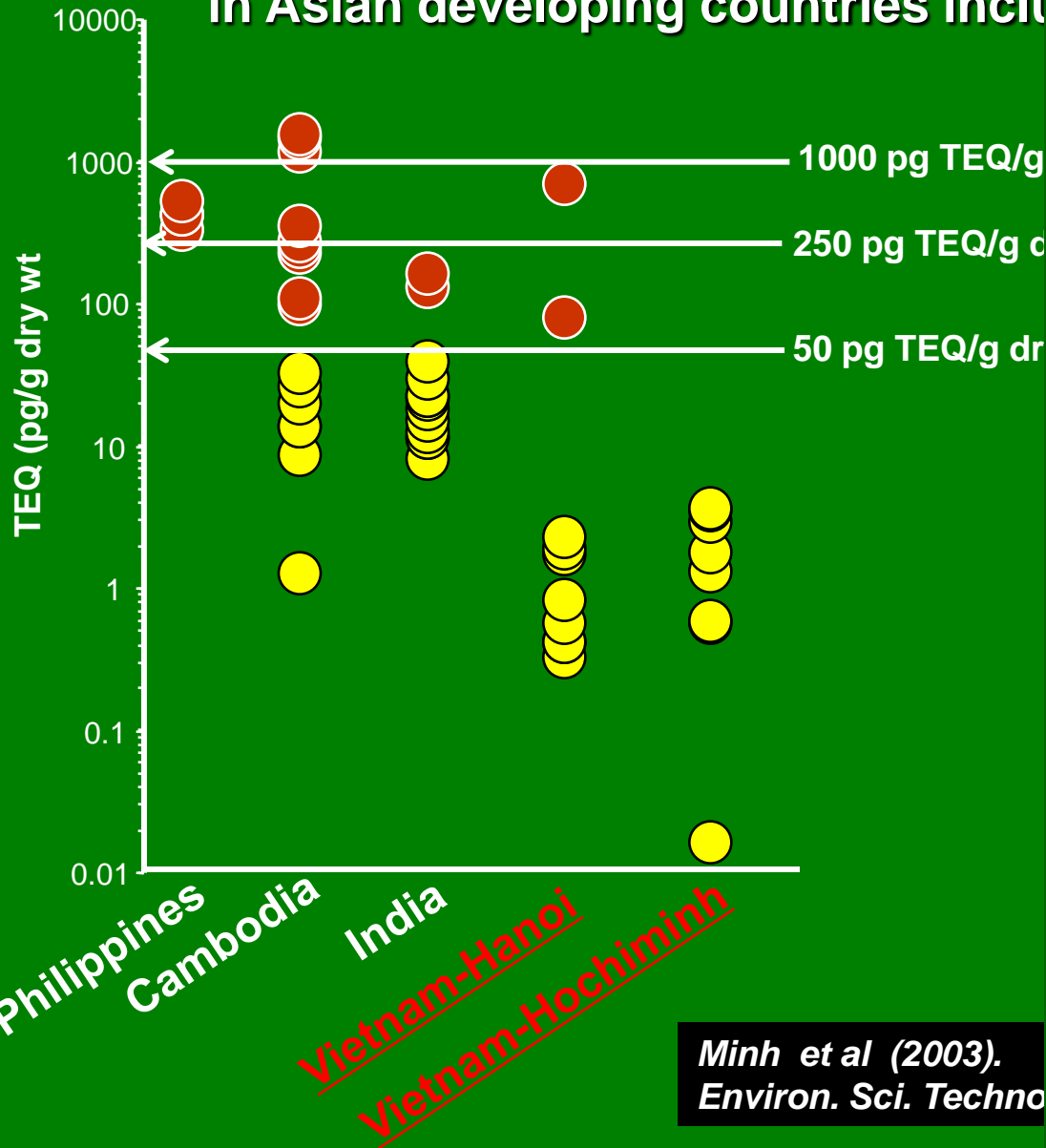


Da Nang airbase – dioxin concentrations in fish Survey in 2006 & 2009

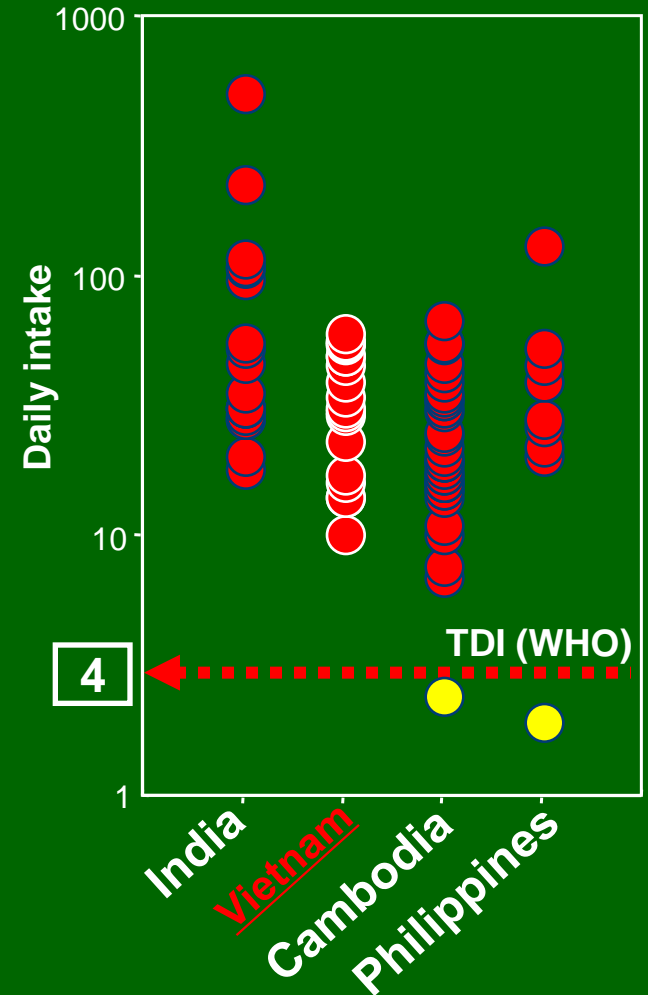


Open dumping sites for municipal wastes in major cities from Asian developing countries

Dioxin in soils from open dumping sites in Asian developing countries including Vietnam



Daily intake for breast fed children TEQs (pg kg⁻¹ day⁻¹)



Minh et al (2003).
Environ. Sci. Technol.

USAGE OF AGENT ORANGE BIEN HOA AIRBASE, SOUTH VIETNAM

RANCH HAND (Dec. 1966 – Feb. 1970)

Total transport and handling amount:

- Agent Orange: 98,000 barrels (20,384,000 L)
- Agent White: 45,000 barrels (9,360,000 L)
- Agent Blue: 16,300 barrels (3,390,000 L)

- December 1969 – March 1970: four large spills from 28,000-liter tanks of AO occurred in the airbase.



Implementation efforts on issues related to soil contamination monitoring & remediation in Vietnam

Contaminated soil/sediment in Agent Orange/Dioxin at hotspots:

POPs pesticides stockpiles

Efforts to tackle issues

Legal documents:

- 02 Decisions from Prime Minister
- National action plan for environmental remediation drafted

Actions:

- Monitoring programs (Ministry of Defense, Office 33 & Inter. Agencies, companies)
- Isolation, containment programs of dioxin contaminated soils
- GEF-UNDP Project: environ. Remediation of AO/dioxin contaminated hotspots

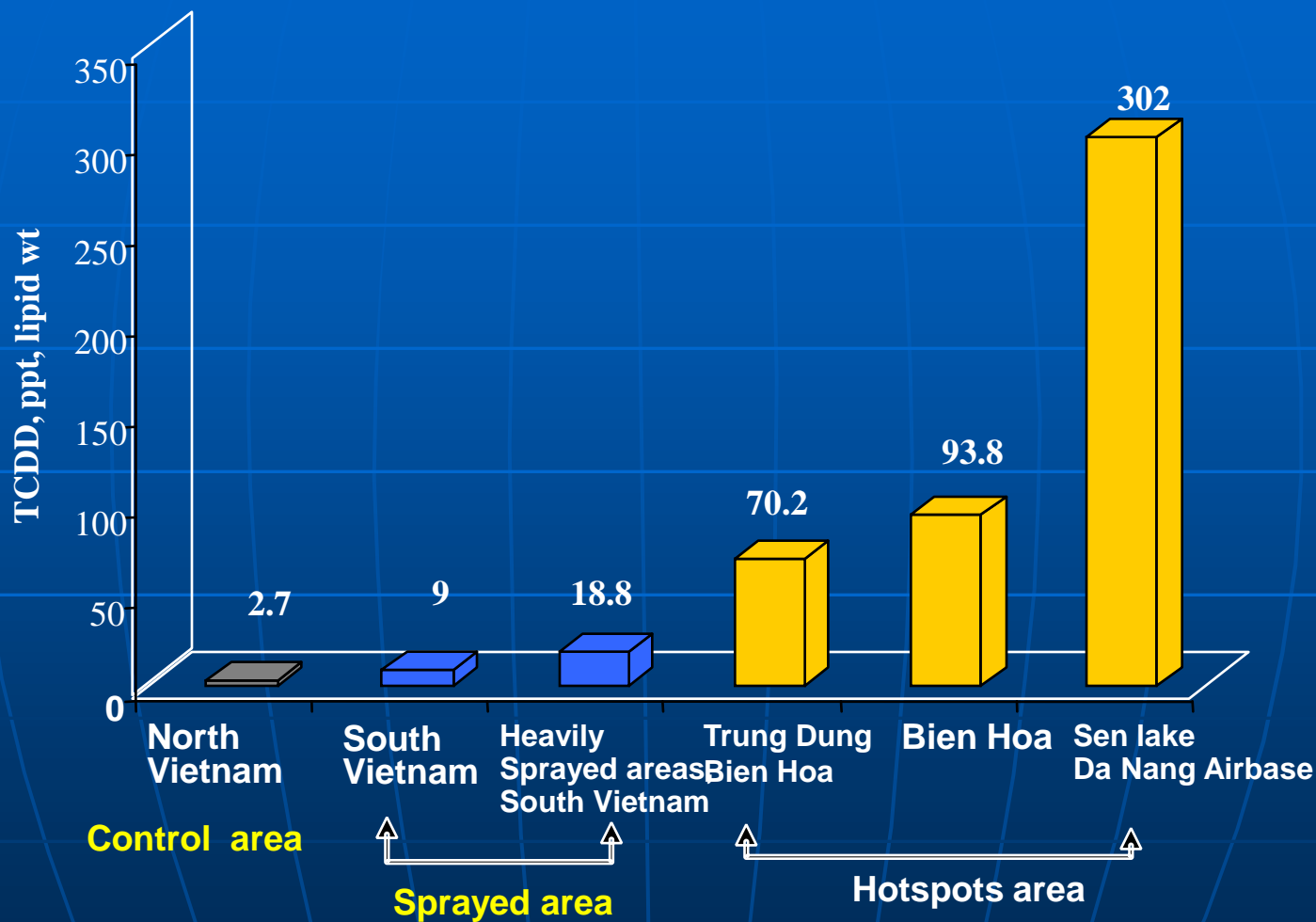
Legal documents:

- 01 Decisions from Prime Minister & 01 decision from MONRE

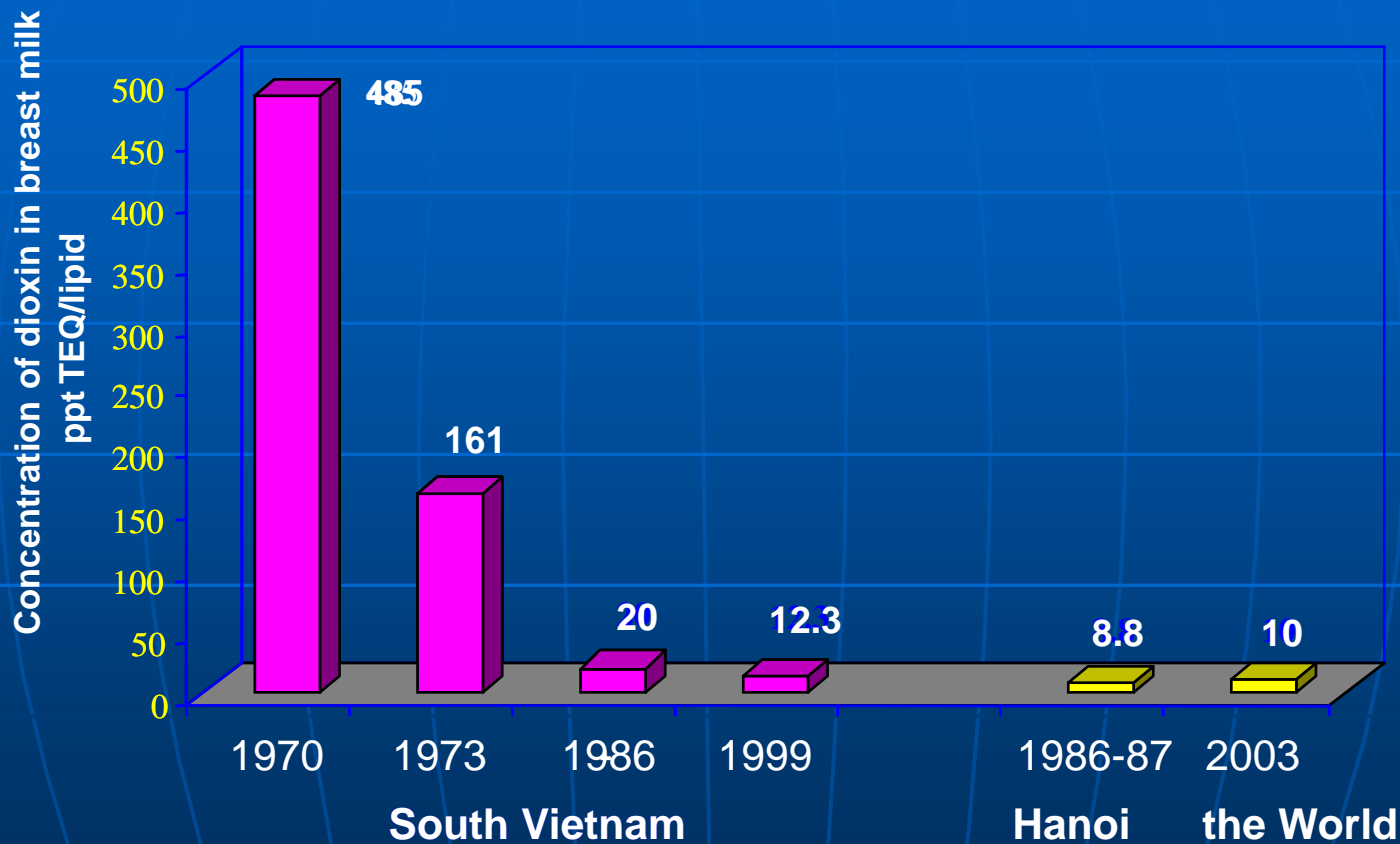
Actions:

- Monitoring programs to identify stockpiles (VEA, MONRE & research institutes)
- Isolation, containment programs of pesticides contaminated soils
- GEF-UNDP Project: Sound management and disposal of POPs pesticides stockpiles

Review of dioxin human blood data

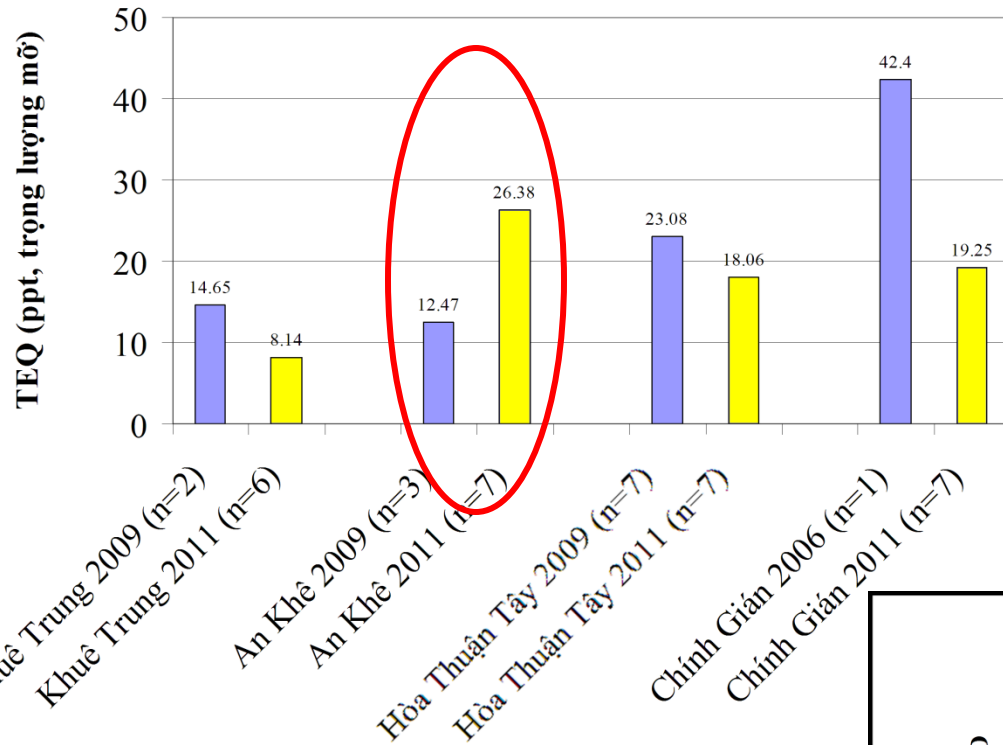


Trend of the concentrations of dioxin in breast milk in South Vietnam

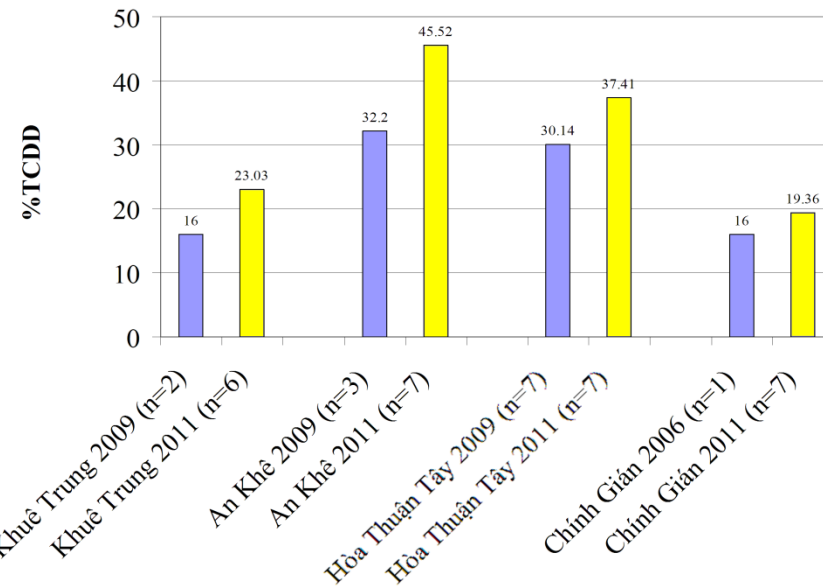


Trends of dioxin in breast milk samples in Da Nang

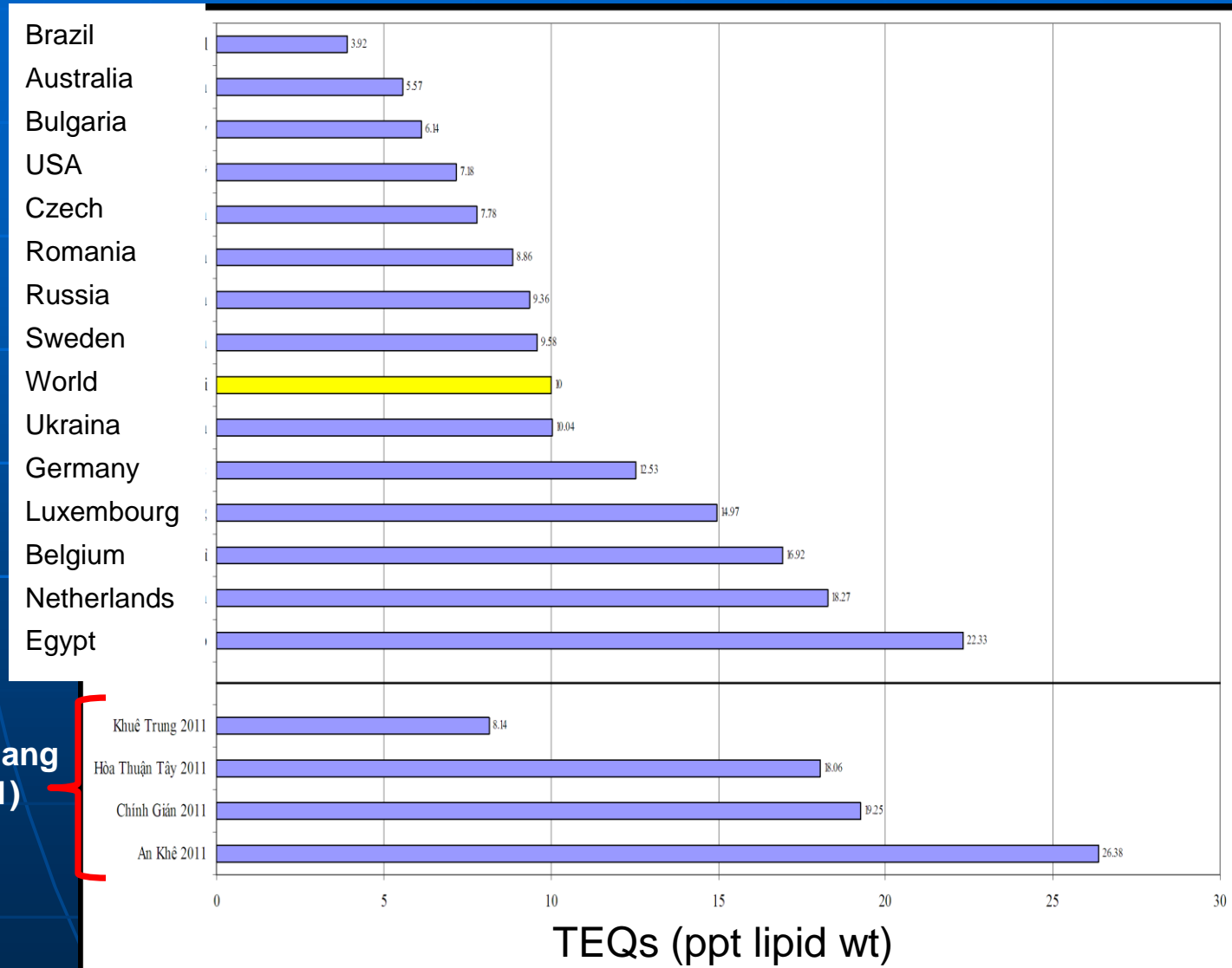
TEQ (pg/g lipid wt)



% TCDD/TEQ

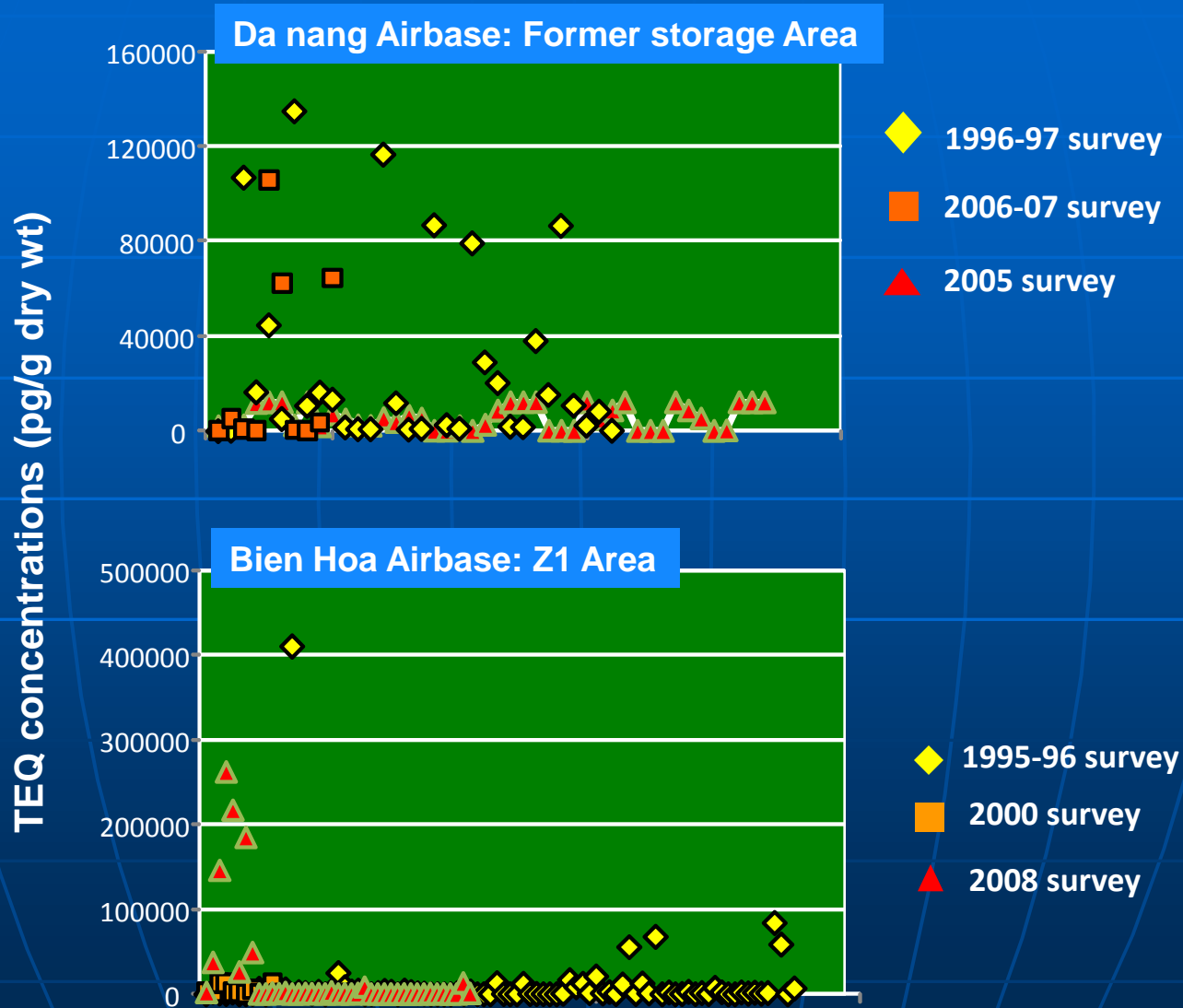


Dioxin in breast milk from Da Nang & other countries



Da Nang
(2011)

Trend of dioxin levels in soils and sediment from 02 Agent Organe/Dioxin contaminated hotspots



SAMPLES USED FOR THIS STUDY

Samples within Bien Hoa airbase (the hotspots)

- 114 soil samples
- 11 sediment samples

Samples from pond/lakes near Bien Hoa airbase

- 12 sediment samples

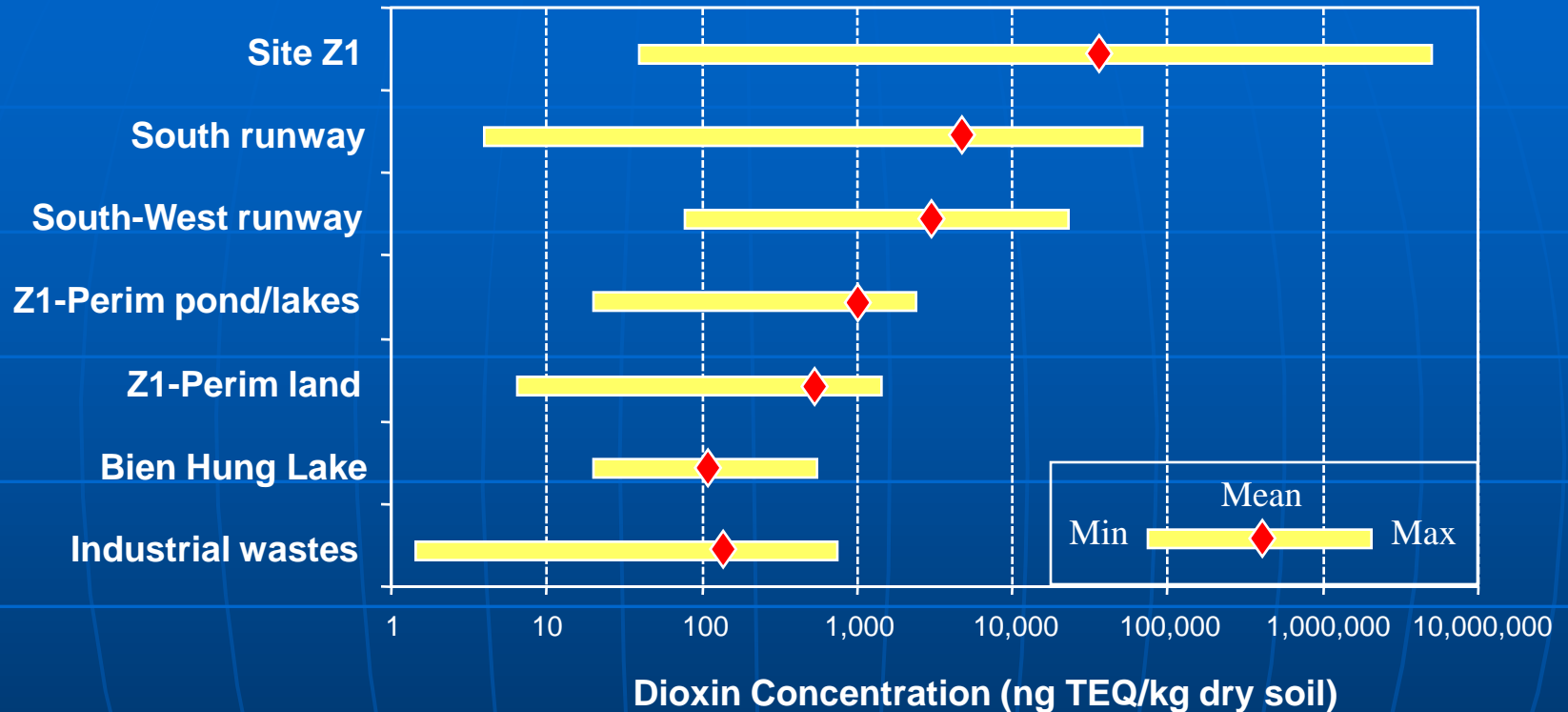
Samples from other industrial areas

- 3 sewage samples
- 3 samples from a hazardous waste incinerator
- 1 samples from wood processing factory

Samples from industrial areas in North Vietnam

- Wastewater from an industrial waste incinerator, paper factory
- Fly ash samples from steel making and paper factory
- Stack gas samples from industrial wastes incinerators, steel making, paper factory, and cement kilns

COMPARISON OF DIOXIN IN BHA & OTHER SOURCES IN INDUSTRY



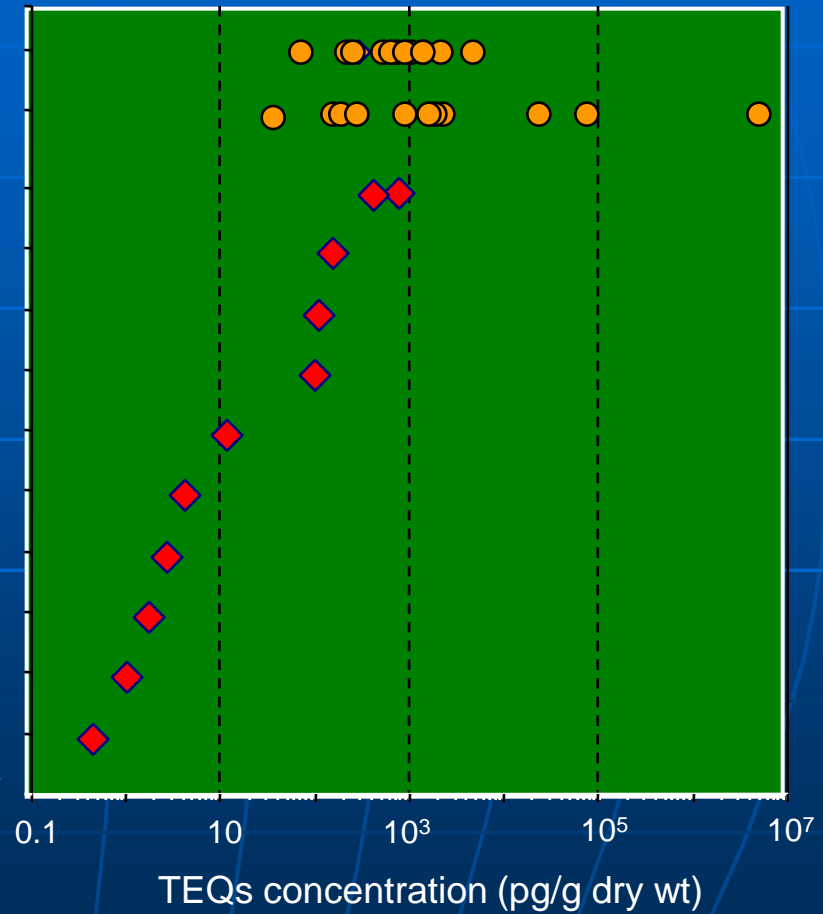
- The most contaminated site (Z1) is being contained by active landfill method
- Evaluation for remediation of other sites is being done under the project sponsored by UNDP-VN

Dioxin levels in AO/Dioxin hotspot and industrial samples in Bien Hoa, southern Vietnam

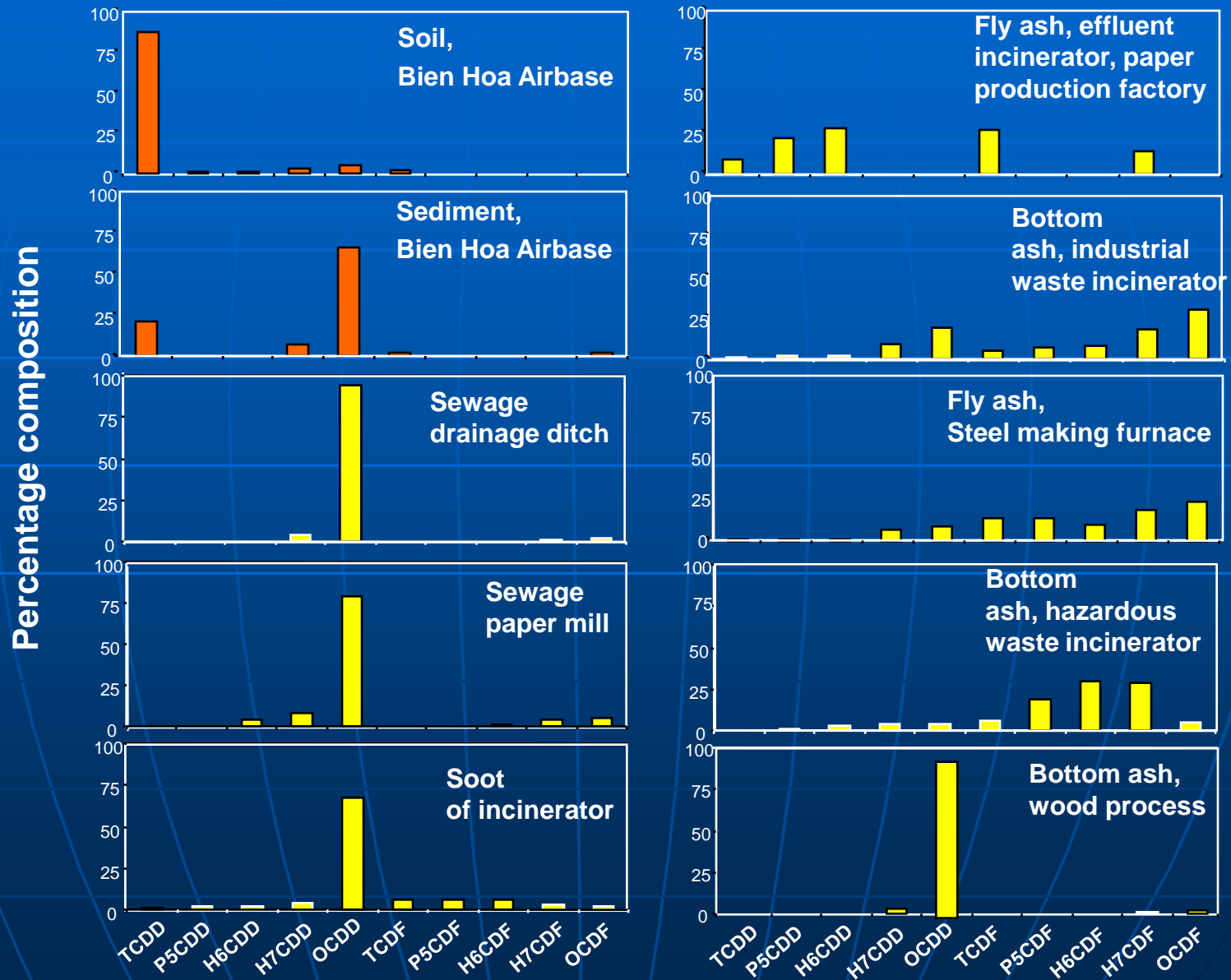
AO/Dioxin hotspot { Sediment, Bien Hoa Airbase
Soil, Bien Hoa Airbase

Industrial samples {

- Soot incinerator (inside scrubber)
- Bottom ash, hazardous waste incinerator
- Bottom ash, industrial waste incinerator
- Fly ash, steel making furnace
- Sewage in drainage ditch
- Bottom ash, wood process
- Sewage, chemical factory
- Sewage, paper mill
- Ash, effluent incinerator
- paper production factory
- Ash, carbon incinerator, paper production factory



Homolog pattern of PCDD/Fs in AO/Dioxin In hotspot and industrial samples

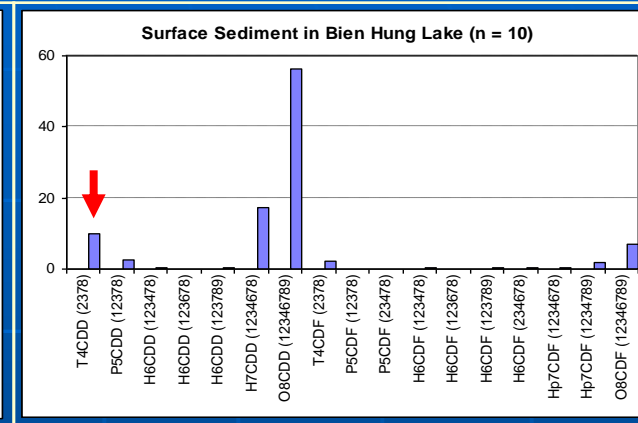
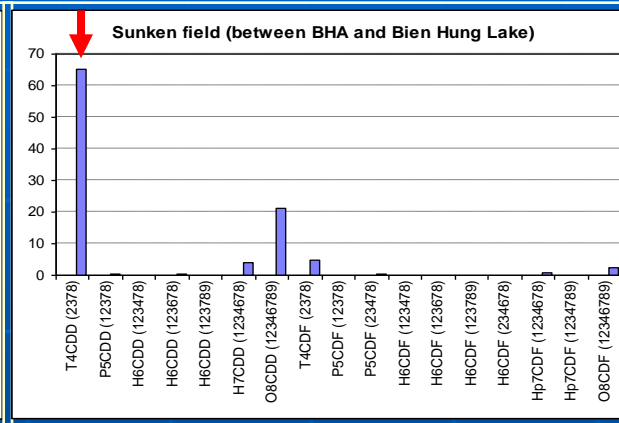
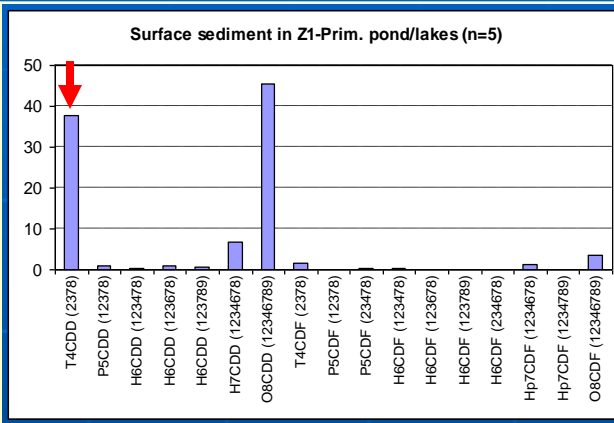


Comparison of PCDD/Fs patterns of soils & sediments from hotspots and other locations

Sediment in lakes within BHA

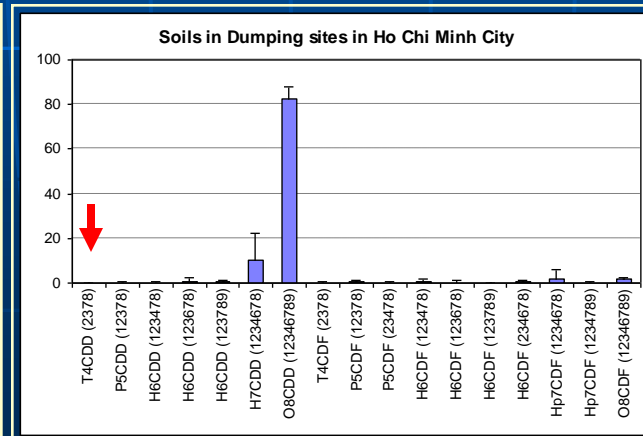
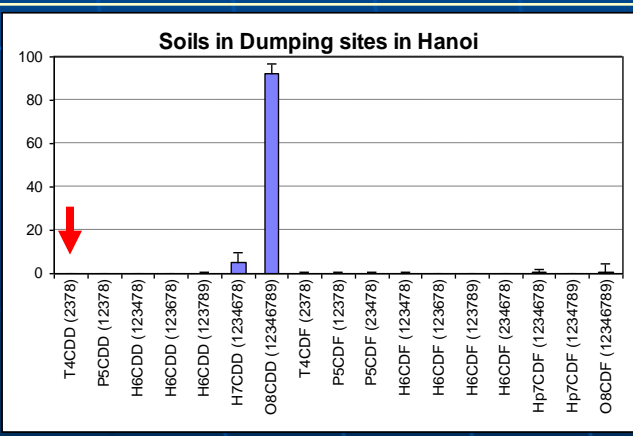
Sediment in a pond outside BHA

Sediment in Bien Hung Lake



Soil in Dumping site, Hanoi

Soil in Dumping site, HCMC



(Data of dumping soil cited from: Minh et al., 2003, Environmental Science & Technology)

Dioxin from industry: present regulations in Vietnam

Regulations/Standards levels of Dioxins:

- **QCVN 02:2008/BTNMT** về khí thải lò đốt chất thải y tế quy định nồng độ cho phép của tổng dioxin và furan trong khí thải là **2,3 ng-TEQ/Nm³** **Threshold level for emission gas of medical waste incinerators**
- **QCVN 41: 2011/BTNMT** về đồng xử lý chất thải nguy hại trong lò xi măng với nồng độ tối đa cho phép của TCDD/Fs là **0,6 ng TEQ/Nm³**. **Threshold level for emission gas of cement kiln co-firing hazardous wastes**
- **TCVN 8183:2009** qui định ngưỡng TCDD/Fs trong đất và trầm tích tại các điểm bị ô nhiễm nặng là **1000 và 150 ng TEQ/kg**. **Threshold level for soil and sediment at contaminated hotspots:**
- Dự thảo **QCVN** trong đất công nghiệp tối đa là **1200 ng TEQ/kg**. **Draft regulation of threshold for industrial soil**

Challenges/issues

- Information on dioxin emission is lacking
- Technical difficulty in sampling & analysis in emission and ambient gas
- Lack of standardized guidelines for sampling & analysis
- Lack of effective regulations/standards for dioxins in industries: no road map, no classification for different industrial sources categories

Research Programs on dioxins from industries

- GEF funded project executed through UNIDO and VEA: 2010 – 2011. Budget: USD 700,000. Demonstration of BAT/BEP to reduce dioxins in 04 industrial sectors
- Vietnamese Government: through Ministry of Science and Technology: Assessment of dioxin emission from potential industrial sources in Vietnam. 2012-2016. Budget: USD 500,000
- GEF funded project implemented through UNDP and Office 33: Environmental Remediation of the Dioxin contaminated hotspots.

Sampling of industrial samples: stack (emission) gas, fly ash

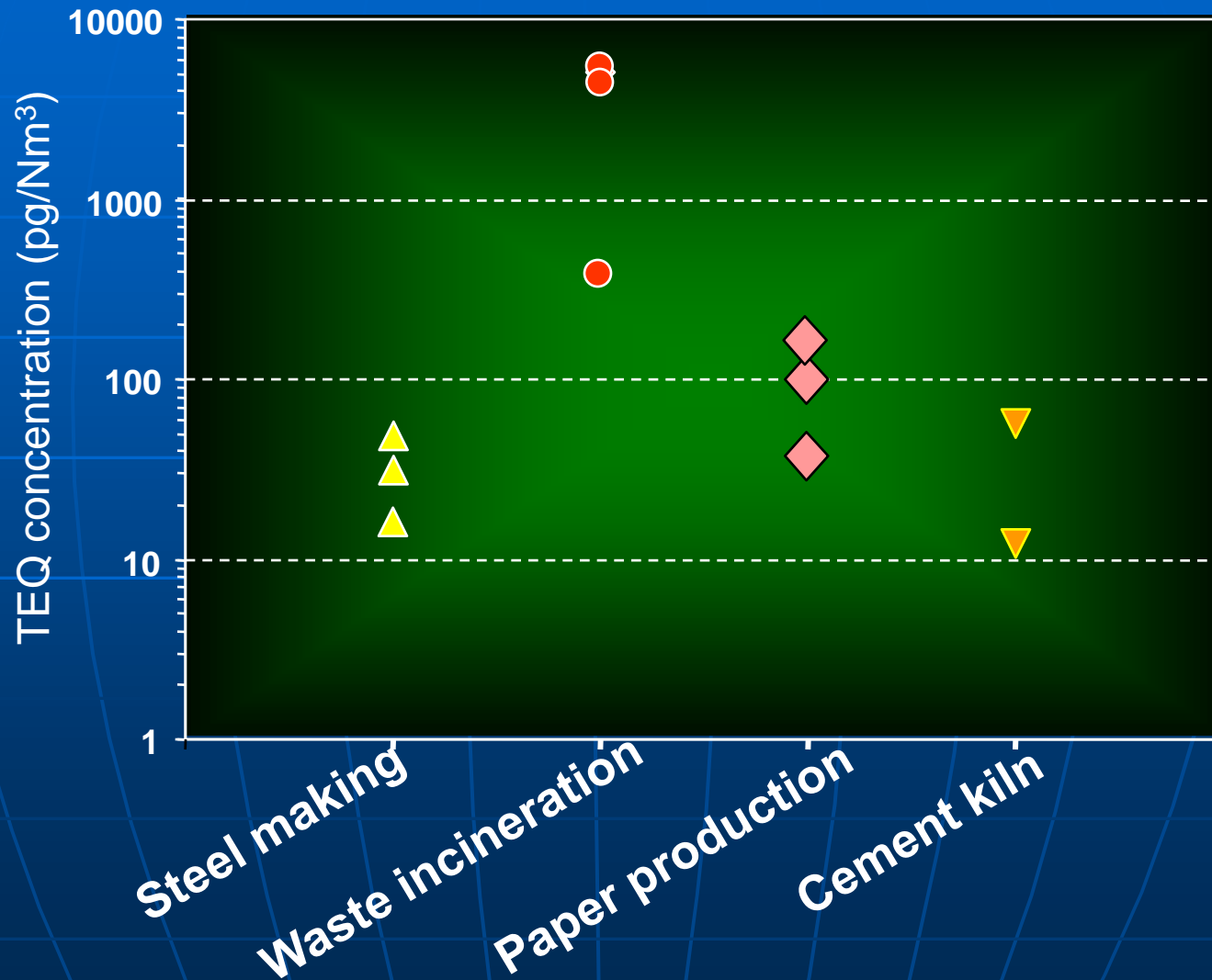


Waste incinerators

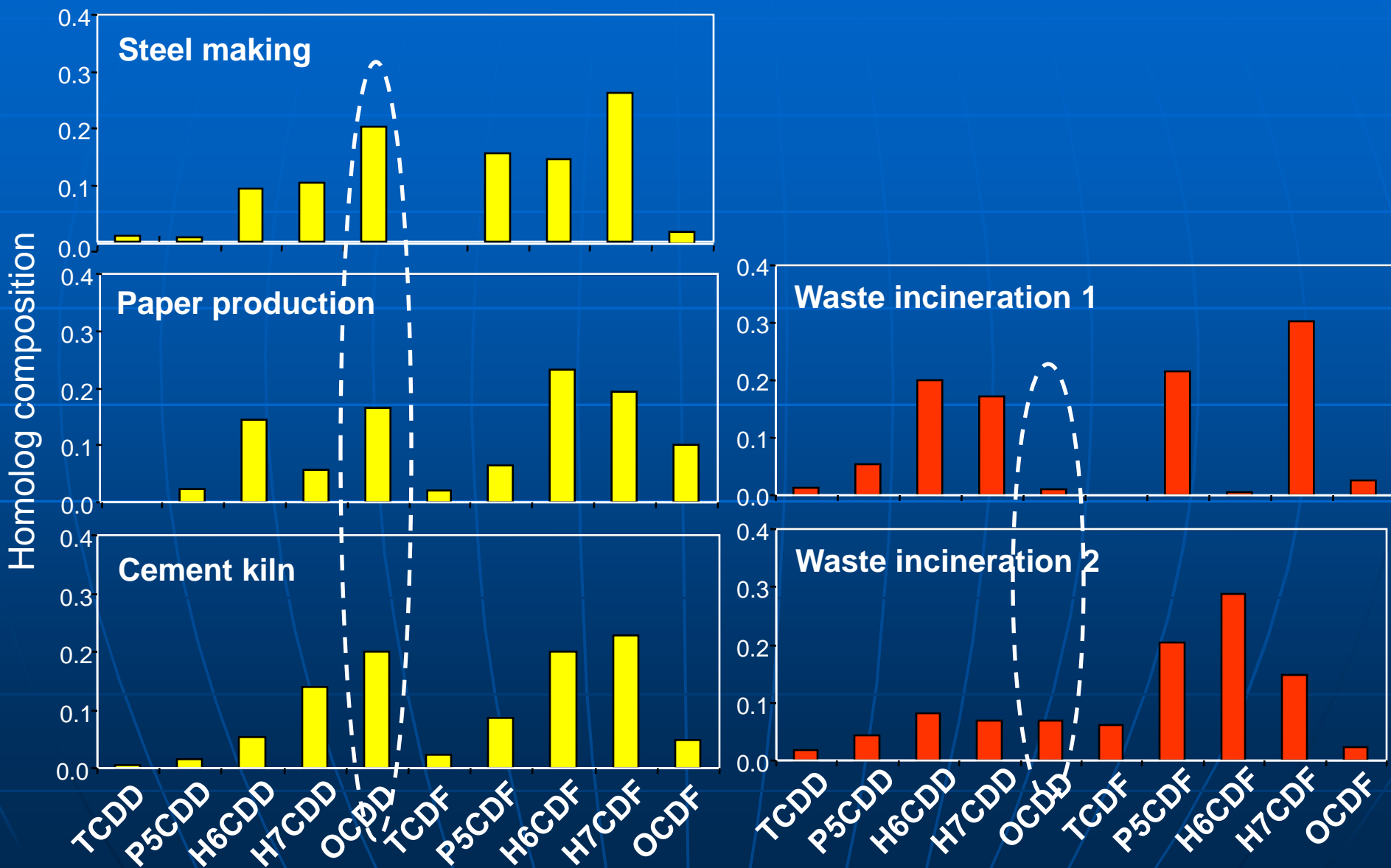
Steel making Plant



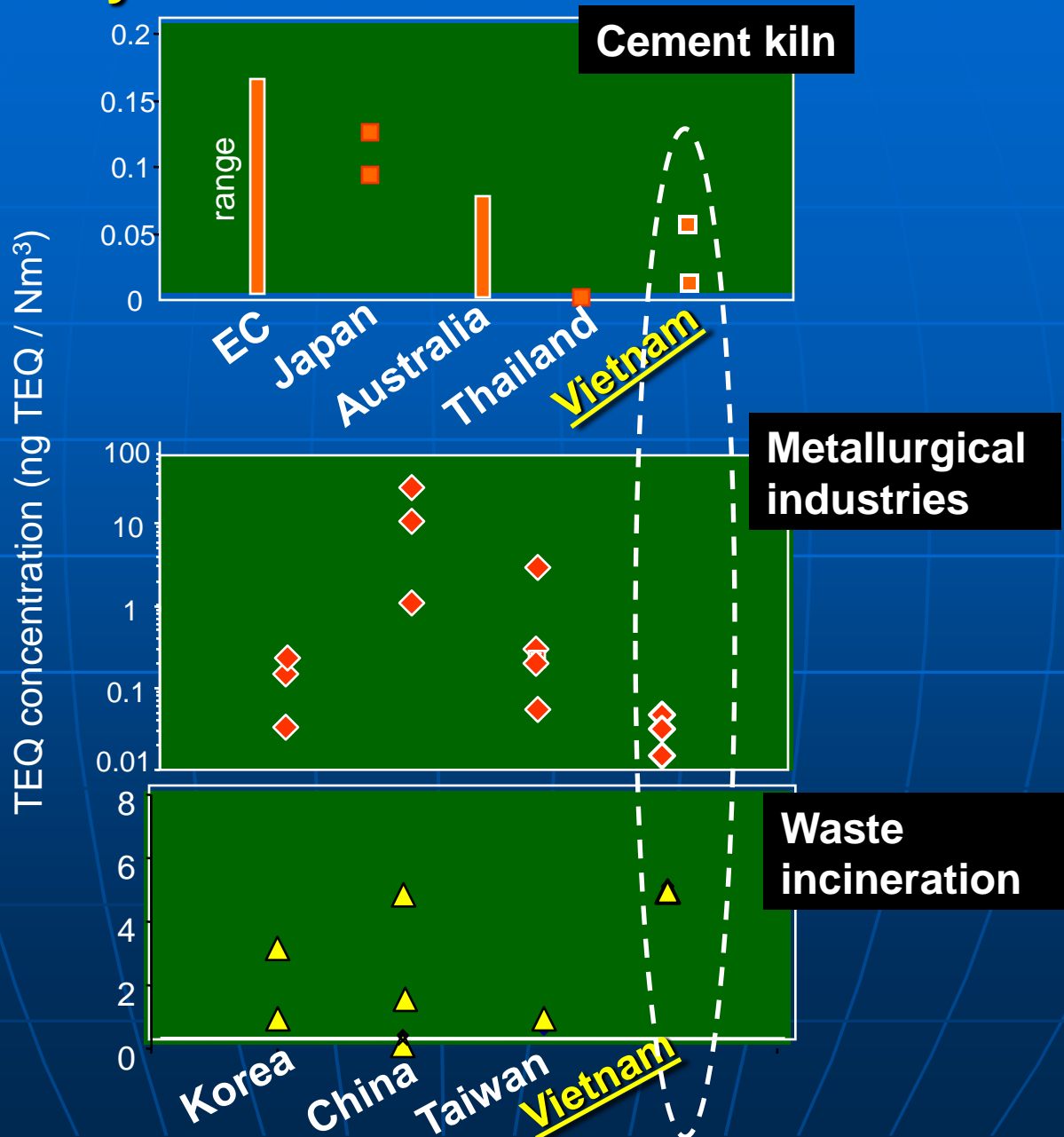
PCDD/Fs in stack gas from selected industrial sectors



Homolog pattern of PCDD/Fs in stack gases from selected industrial sectors

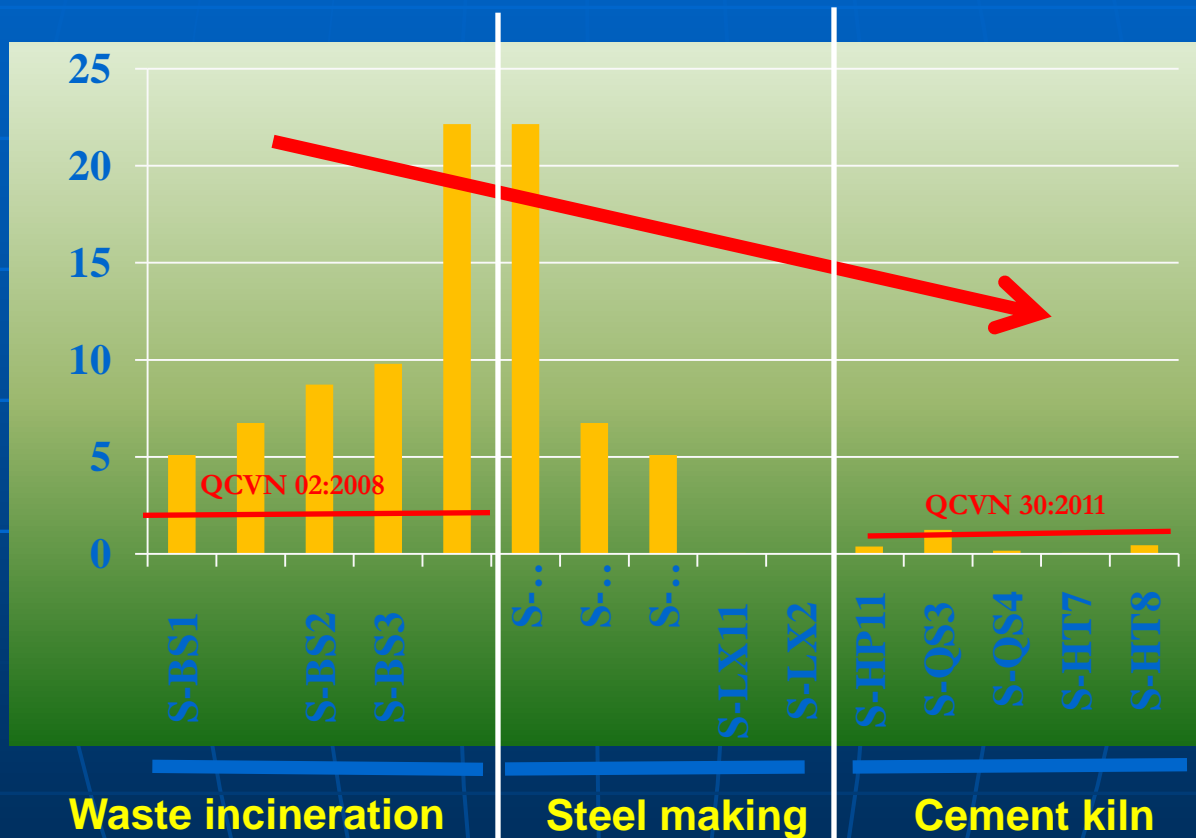


Comparison of PCDD/Fs emission (stack gas samples) from industry in different countries



Dioxin in stack gas from different industrial sources

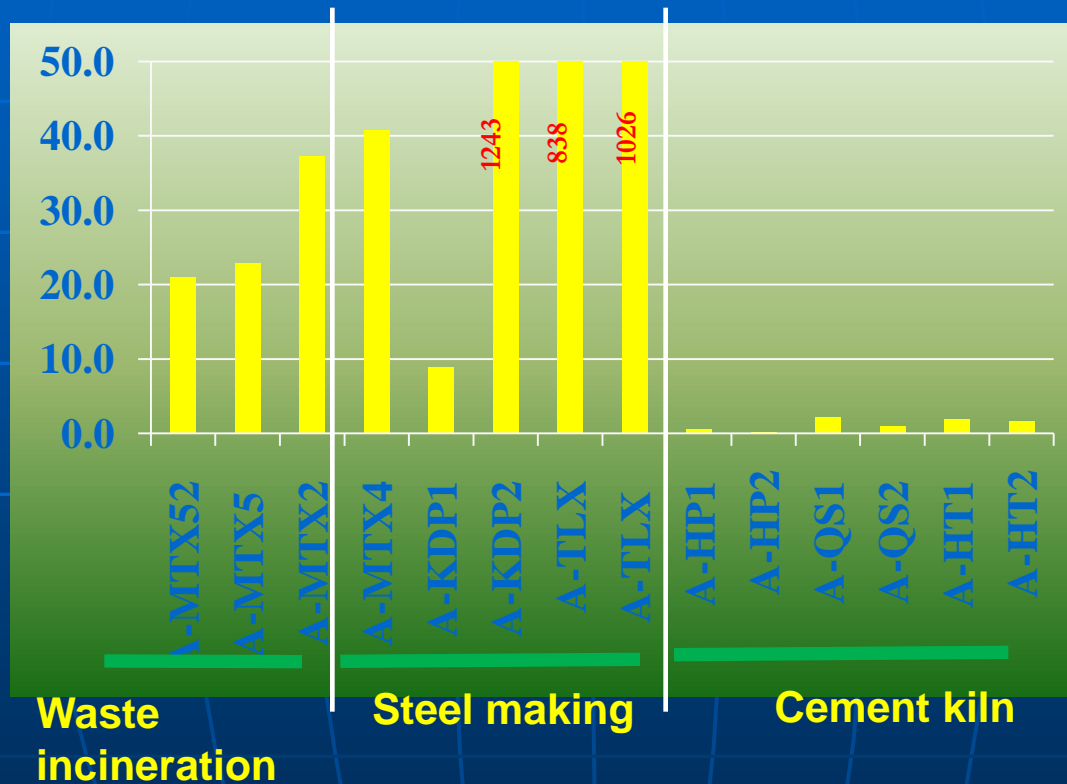
Total TEQ in stack gas samples (ng/Nm³)



Dioxin emission: waste incineration > steel making > cement kiln

Dioxin in fly ash samples

- Total TEQ in fly ash samples (pg TEQ/g)

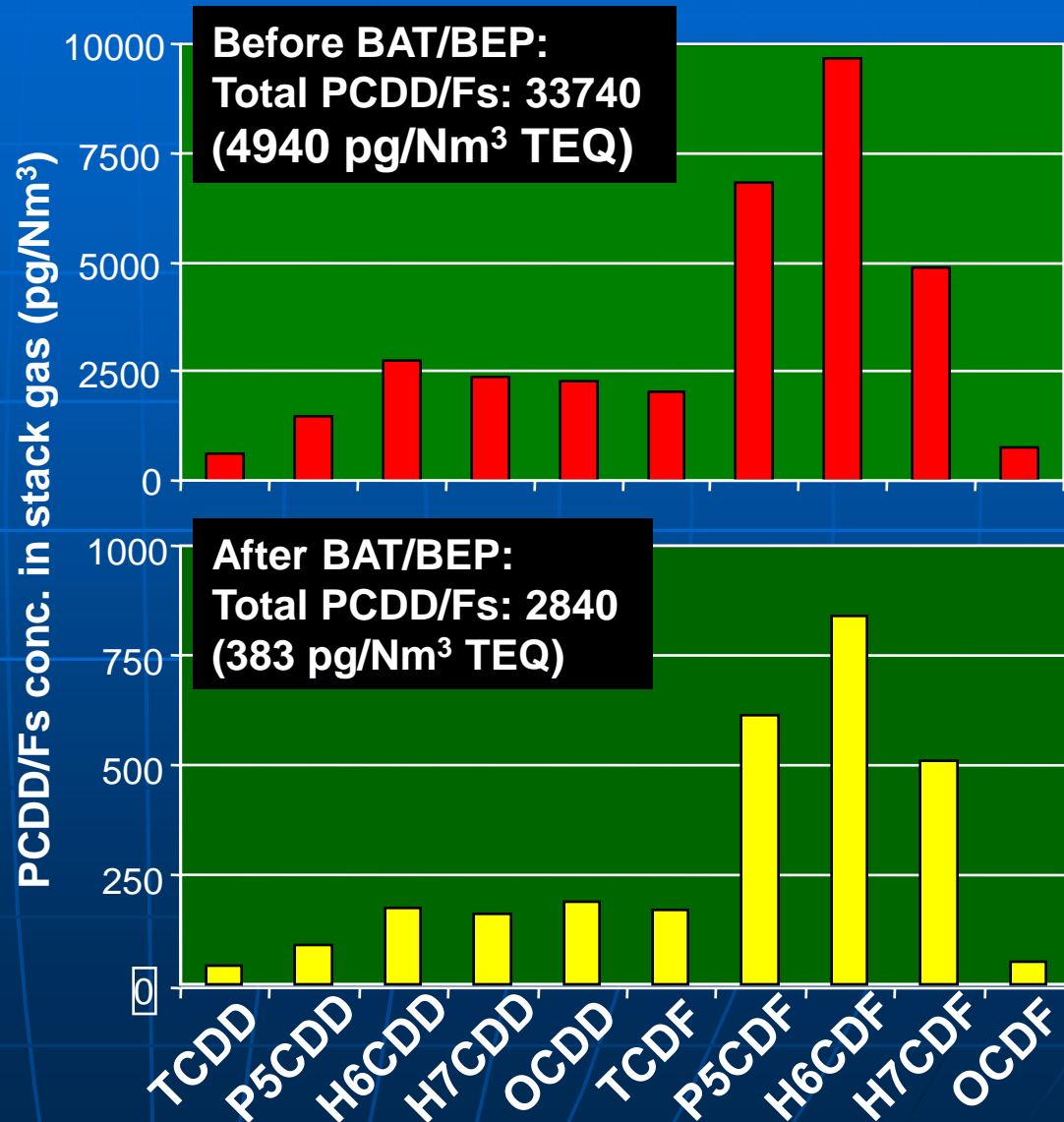


Dioxin emission: steel making > waste incineration > cement kiln

Demonstration of BAT/BEP for reduction of (dioxins) in waste incineration

Possible BAT/BEP measures:

- Appropriate sorting input materials
- Strict control of temperature in the secondary furnace
- Proper control of unused air when reduce the temperature
- Better control and improve the gas treatment system



Summary

- Dioxin contamination in AO/Dioxin hotspots is higher than those from industrial sources
- Congener/homolog pattern is useful tool to trace & characterize sources of PCDD/Fs
- Steel making and non-ferrous metallurgy industry & waste incineration are sectors that deserves further attention & investment due to comparatively high potential to PCDD/Fs formation and releases
- Despite declining trends, human exposure (through breast milk) in areas near Da Nang airbase (affected by former AO/Dioxin storage) still high and deserves continuous monitoring

ACKNOWLEDGEMENTS

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- GEF-UNDP Project “Environmental remediation of dioxin contaminated hotspots in Vietnam”
 - Dioxin Lab Project: Bill & Melinda Gates Foundation & the Atlantic Philanthropies
 - GEF-UNIDO BAT/BEP Project GF/VIE/08/005
- **Technical supports:**
 - Vietnam Russia Tropical Center (VRTC), Division 937, Ministry of Defense Vietnam
 - Officers of Bien Hoa DONRE and industry zones
 - Office 33, MONRE