

tds ► exposure



European
Commission

**Stakeholder conference
Total Diet Studies
Exposure Assessment
Jacob van Klaveren RIVM**

GENERAL PRESENTATION OF THE WP

- ▶ List of partners: RIVM, URV, BfR, Fera, IFR, ANSES, Ugent, NIPH
- ▶ General schedule:
 - food grouping
 - Link to sources of uncertainty
 - harmonised perspective
 - tests, risk prioritisation
 - validation or biomarkers
- ▶ Links with other WPs:
 - WP6 database structure – exposure
 - WP7 uncertainties (inclusion of uncertainties in MCRA)
 - WP9 new TDS data

Health risk assessment

Exposure assessment

- Exposure sources: **food**
- Exposure route: **diet**
- Exposure level
- Highly exposed groups

Effect assessment

Hazard identification

Identification of negative health effects
– target organ and critical effect

Hazard characterization

- Selection of critical data
- Mechanism of toxicity
- Dose-response for critical effect
- "Point of departure"
- Kinetic and dynamic variability
- Sensitive groups

Risk characterization

Compare estimated exposure and "safe exposure level"

EFSA guidance



Essential principles

- representative of the whole diet
- pooling of foods
- food analysed as consumed

Overall objectives exposure assessment

- create a risk management tool based on TDS exposure assessment and risk mitigation measures
- to improve exposure assessment methodology regarding TDS
- to harmonise exposure assessment approach regarding TDS over Europe

WORK IN PROGRESS AND ACHIEVEMENTS

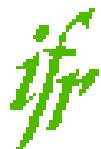
- ▶ Overview of TDS performed in the past
- ▶ Training to harmonise the methodology using MCRA
- ▶ Level of detail in food grouping
 - Variation and homogeneous within food group
 - Small and broad food category
- ▶ Link between foodex1 and national code

Composite food groups

119 categories of foods were combined into 20 groups for analysis

Bread	Other cereals	Carcase meats	Offals	Meat products
Poultry	Fish	Oils and fats	Eggs	Sugars and preserves
Green vegetables	Potatoes	Other vegetables	Canned vegetables	Fresh fruit
Fruit products	Beverages	Milk	Dairy products	Nuts

Separated into groups likely to contain substances,
and those consumed in large quantities



Example : milk samples

Food item grouping

2 criteria

Code	Food item
18041	coconut milk
19021	full cream dry milk
19023	full cream UHT milk
19024	full cream pasteurized milk
19026	condensed full cream milk
19027	sweeten condensed full cream milk
19041	semi skim UHT milk
19042	semi skim pasteurized milk
19045	semi skim UHT milk restored with vitamins
19046	semi skim UHT milk restored with proteins, vitamins, and minerals
19044	semi skim dry milk
19054	skim dry milk
19050	skim milk
19055	skim UHT milk restored with vitamins
19110	flavoured semi skim milk
19122	chocolate milk
19127	strawberry flavoured semi skim milk
19200	goat milk

1242 food items
(INCA2 classification,
INCA2 coding)



TDS Code	TDS Food item
18041	coconut milk
100028	full cream milk
19026	condensed full cream milk
19027	sweeten condensed full cream milk
100026	semi skim milk
19044	semi skim dry milk
19054	skim dry milk
100027	skim milk
19110	flavoured semi skim milk
19122	chocolate milk
19127	strawberry flavoured semi skim milk
19200	goat milk

754 item groups



88% adult consumption
89% child consumption

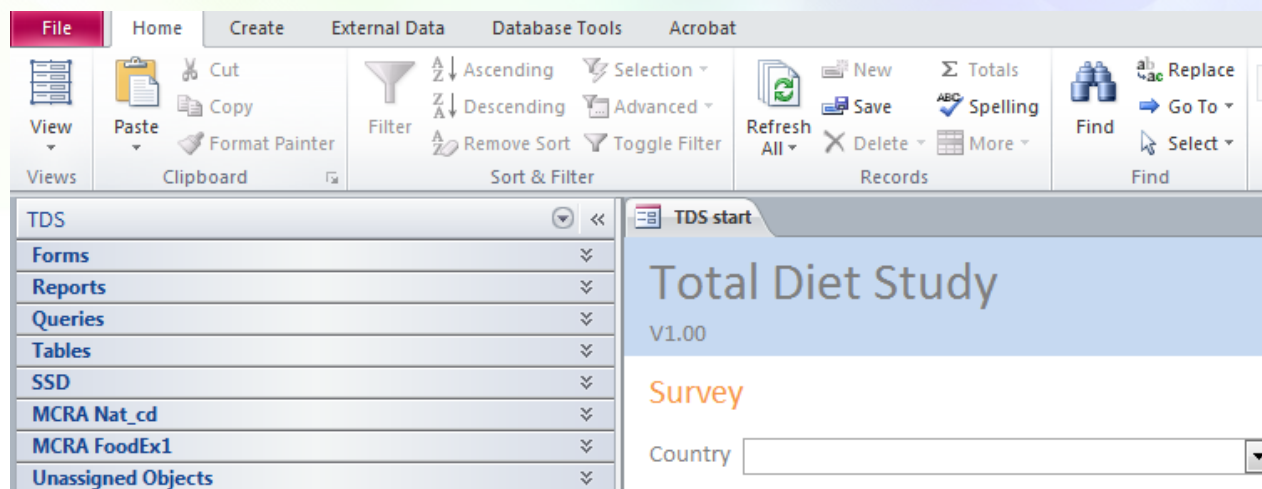
TDS Code	TDS Food item
100028	full cream milk
100026	semi skim milk
100027	skim milk
19122	chocolate milk

8 regional lists
+ 1 national list

= 212 food items
(1319 samples)

HISTORICAL DATA AND HARMONISED APPROACH

- ▶ MS Access database for:
 - Transferring historical data into FoodEx1
 - Decision tree when think were national codes and FoodEx1 did not match
 - More national codes link to one FoodEx1 code
 - Pooled samples



NATIONAL CODING NOT ALWAYS SAME DETAIL AS FOODEX1

- Decision tree University of Ghent for:

Mapped National code - FoodEx1

National product		FoodEx1	
1	ARROWROOT POWDER	A.01.000319	Arrowroot (<i>Maranta arundinacea</i>)
1000	LAMB LEG; HALF LEG ROAST LEAN ONLY	A.01.000732	Mutton / lamb meat (<i>Ovis aries</i>)
1001	LAMB LEG RAW LEAN AND FAT	A.01.000732	Mutton / lamb meat (<i>Ovis aries</i>)
1002	LAMB SCRAG AND NECK STEWED LEAN AND FAT	A.01.000732	Mutton / lamb meat (<i>Ovis aries</i>)
1003	LAMB SCRAG AND NECK STEWED LEAN ONLY	A.01.000732	Mutton / lamb meat (<i>Ovis aries</i>)
1004	LAMB SCRAG AND NECK STEWED LEAN ONLY WEIGHED WITH FAT AND BO	A.01.000732	Mutton / lamb meat (<i>Ovis aries</i>)




Source Deliverable 8.1

COMPARING NATIONAL CODES AND FOODEx1

Table 4: Percentiles of long-term exposure to dioxin-like compounds in adults living in Belgium, Netherlands, France, UK and Spain obtained via two classification systems

	Total dioxin-like compounds							
	Exposure (pg TEQ/kg bw/day)							
	Using national codes				Using FoodEx1 codes			
	P50	P90	P95	P99	P50	P90	P95	P99
Belgium	0.69	1.46	1.82	2.60	0.65	1.40	1.75	2.61
France	0.39	0.78	0.95	1.38	0.40	0.76	0.91	1.21
The Netherlands	0.78	1.65	2.53	4.87	0.77	1.64	2.48	4.86
Spain	0.48	1.17	1.53	2.40	0.49	1.19	1.53	2.42
UK	0.99	1.55	1.76	2.23	0.99	1.55	1.75	2.16

MCRA 8 release (mcra8.rivm.nl)



MCRA 8

MCRA stands for **Monte Carlo Risk Assessment**.
MCRA is a web-based system for probabilistic exposure and risk assessment of chemicals in the diet.
The MCRA system brings together statistical models, shared data and data uploaded by the user.
MCRA 8 also provides **Cumulative Exposure Assessment** for chemicals grouped in a Cumulative Assessment Group for which a single health effect is considered relevant.
Optionally exposure from other routes can be added in an **Aggregate Exposure Assessment**.
MCRA 8.0 was developed in [EU project ACROPOLIS](#)

Login

Username

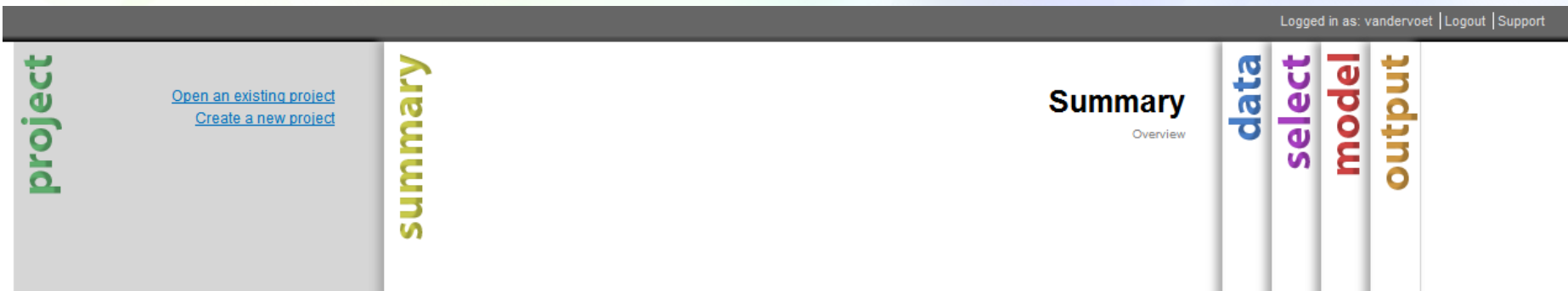
Password

[Go to registration](#)

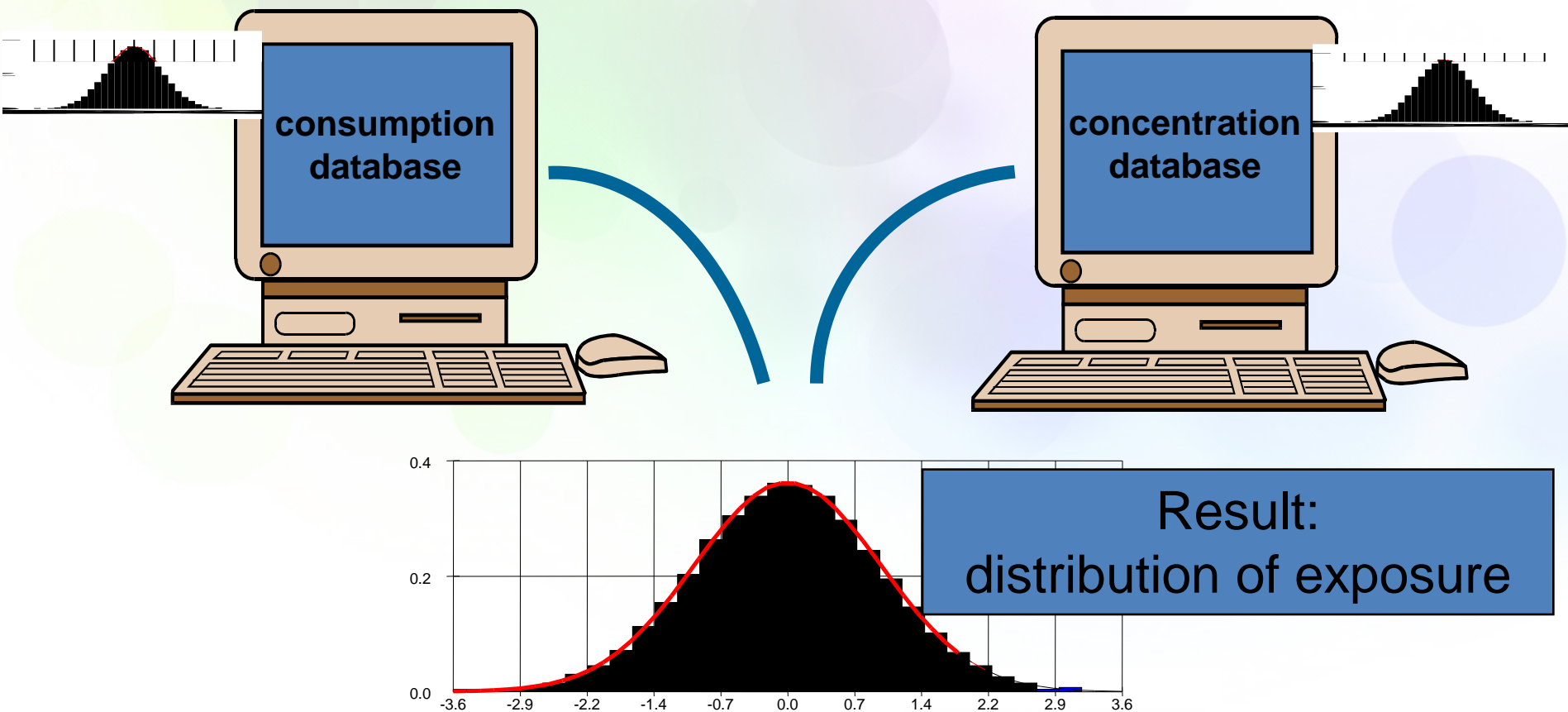
LOGIN

MCRA 8 overview

- ▶ Organise TDS data in MCRA8
- ▶ integration TDS issues e.g. uncertainties and TDS database (Food Case Risk) (MCRA9)



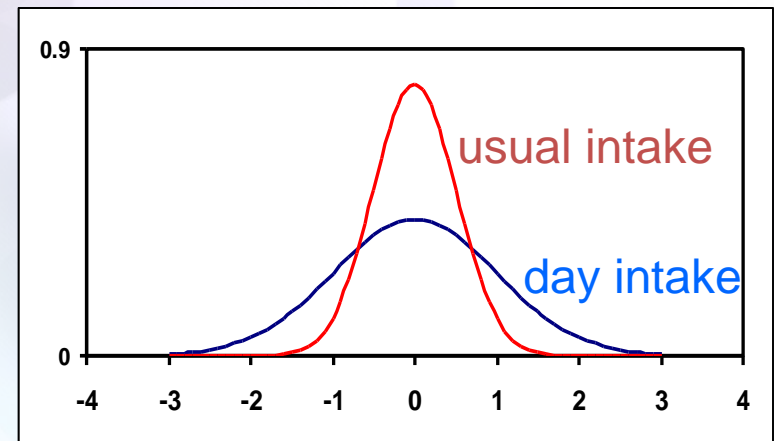
MCRA: How it works acute



Random sampling from a concentration and a consumption database

How it works chronic (ETUI project)

- Observed individual Mean
EFSA Guidance
- variance components model
 - between individuals
 - days within individuals
 - transformation to a log or power (Box-Cox) scale
 - remove within persons variation



MCRA: Data

summary
data

Data [?]

select
model
output

✓ **Foods*** [clear](#)

Selected file: TDS v2.00 - Netherlands MCRA FoodEx1.mdb [change](#)

✓ **Consumptions*** [clear](#)

Selected file: TDS v2.00 - Netherlands MCRA FoodEx1.mdb [change](#)

✓ **Compounds*** [clear](#)

Selected file: TDS v2.00 - Netherlands MCRA FoodEx1.mdb [change](#)

✓ **Concentrations*** [clear](#)

Selected file: TDS v2.00 - Netherlands MCRA FoodEx1.mdb [change](#)

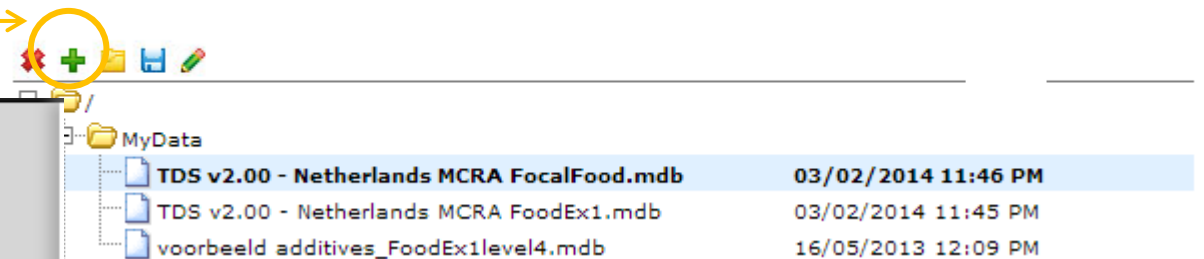
[Show advanced settings](#)

Clear All

Compile & Continue

MCRA: upload data

File manager



MyData		
TDS v2.00 - Netherlands MCRA FocalFood.mdb	03/02/2014 11:46 PM	
TDS v2.00 - Netherlands MCRA FoodEx1.mdb	03/02/2014 11:45 PM	
voorbeeld additives_FoodEx1level4.mdb	16/05/2013 12:09 PM	

project

MCRA

Monte Carlo Risk Assessment

General options

[Open an existing project](#)

[Create a new project](#)

[Open file manager](#)

Selection of compounds

summary
data
select

Select [?]

Compounds Conversion Population Subsets Food Subsets

Select a compound from the list.

Compound

- Dioxins LB
- Mono-ortho substituted PCBs
- Non-ortho substituted PCBs
- TEQ dioxins and dioxin-like PCBs

Next step >>

model
output

MCRA: Model

summary

data

select

model

Model [?]

Concentrations Exposures Monte-Carlo Uncertainty Output

Concentration data can be sampled directly from the data (empirical model) or from parametric models. Concentrations < LOR (Limit Of Reporting) (non-detects) can be co-modelled (censored models) or one can specify a non-detects handling method for imputation. Agricultural use data can be used to impose true zeroes for all or part of the non-detects. Effects of processing on concentrations can be specified using processing factors

Concentration model

Custom

Default concentration model

Empirical

Non-detects replacement

By zero

• Factor f (f x LOR)

0.5

Show advanced settings

Show concentration models

Next step >>

MCRA: Model (2)

model

Model [?]

Concentrations Unit-variability Intakes Monte-Carlo **Uncertainty** Output

Repeated analyses are made using resampled data. Results are displayed in the form of approximate confidence intervals. Warning: computation times may be substantially longer.

Perform uncertainty analysis



Number of iterations per resampled set

Number of resample cycles

Resample concentrations



• Parametric uncertainty



Resample individuals



[Show advanced settings](#)

Next step >>

MCRA: output requirements

model

Model ?

Concentrations Unit-variability Intakes Monte-Carlo Uncertainty **Output**

Specify details of output that will be generated

Show percentiles for

Percentage for drilldown

Percentage for upper tail

Show % of population below level(s)

- Exposure levels ← % of TDI
- Exposure levels are

[Show advanced settings](#)

Next step >>

Run the model

summary

Summary ?

Data

Single data-source: TDS v2.00 - Netherlands MCRA FoodEx1.mdb

Select

Food consumption survey: DNFCs-3

Compound: TEQ dioxins and dioxin-like PCBs LB

Model

Concentration model: empirical, nondetects set to zero.

Number of Monte Carlo simulations: 100000

Uncertainty analysis: No

Run

17% (cancel)

Input data loading complete

Output

Outputs: No output available

data

select

model

MCRA: Output (1)

summary
data
select
model
output

Output ?

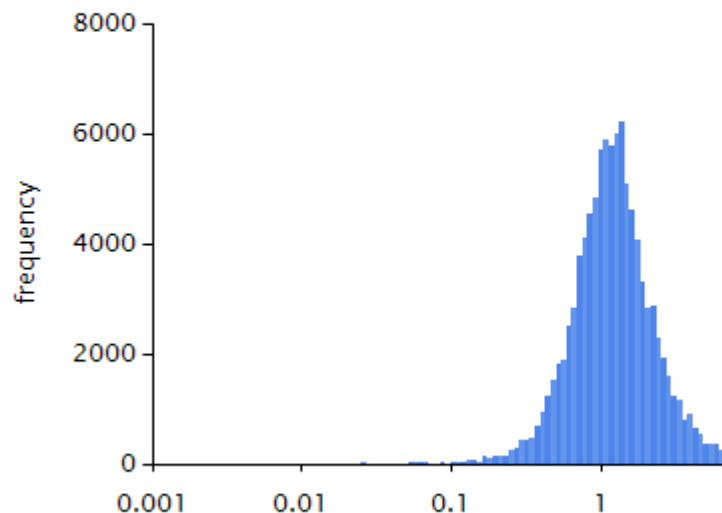
Selection (0): Select an action...

Output	Completed	Description	Select
short detailed conversion	3-10-2013 10:43:9		

MCRA: Output (2)

Transformed dietary exposure distribution

Transformed dietary exposure distribution (99.9% positives)



Example, no real data

Exposure percentiles

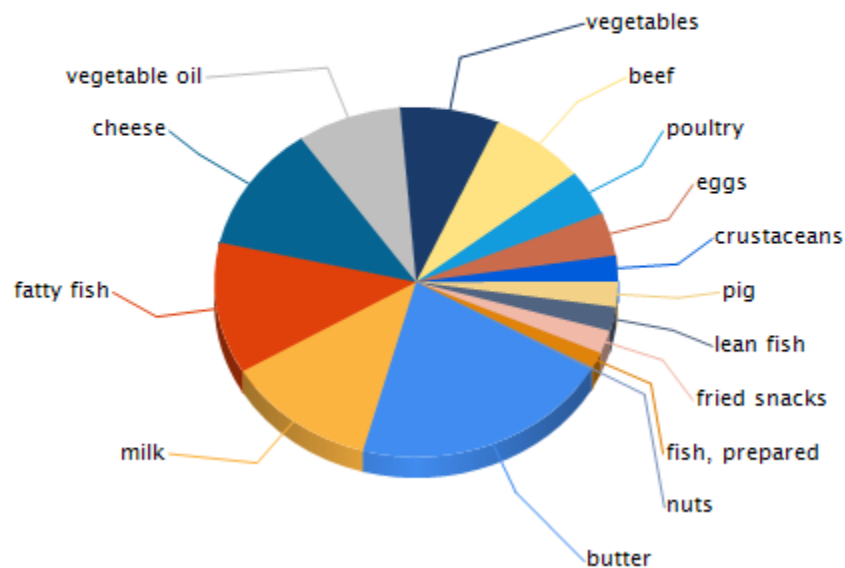
Reference: TEQ dioxins and dioxin-like PCBs LB, ARfD = NaN ($\mu\text{g}/\text{kg bw}/\text{day}$),

Percentage	
50.00 %	1.227
90.00 %	2.784
95.00 %	3.898
99.00 %	8.508
99.90 %	17.66
99.99 %	31.96

MCRA: Output (3): Contribution foods

Contribution to total exposure distribution for food as measured

Contribution to total exposure distribution for foods as measured



Add own residue finding

New Project

Enter Name, Tag(s) and Description for your new project. Choose a scenario (default is exposure type of exposure (Acute or Chronic). A single compound analysis is default or check the for other options.

Name

TDS polluted egg

Tags

Description

Click to edit..

Exposure type

Acute

Cumulative exposure

☐

Hide advanced settings

Aggregate exposure

☐

Use focal commodity

☒

Submit

summary

data

Data ?

✓ Foods* [clear](#)

Selected file: TDS v2.00 - Netherlands MCRA FoodEx1.mdb [change](#)

✓ Consumptions* [clear](#)

Selected file: TDS v2.00 - Netherlands MCRA FoodEx1.mdb [change](#)

✓ Compounds* [clear](#)

Selected file: TDS v2.00 - Netherlands MCRA FoodEx1.mdb [change](#)

✓ Concentrations* [clear](#)

Selected file: TDS v2.00 - Netherlands MCRA FoodEx1.mdb [change](#)

✓ Focal food samples* [clear](#)

Selected file: TDS v2.00 - Netherlands MCRA FocalFood.mdb [change](#)

Define food item that has to be replaced

summary

data

select

Select ?

Compounds Focal Foods Conversion Population Subsets Food Subsets

Sample Subsets

Select the focal food(s). For these foods, the samples of the focal food datasource replace the samples of the food of the base commodity datasource.

Focal Foods

Whole egg, chicken

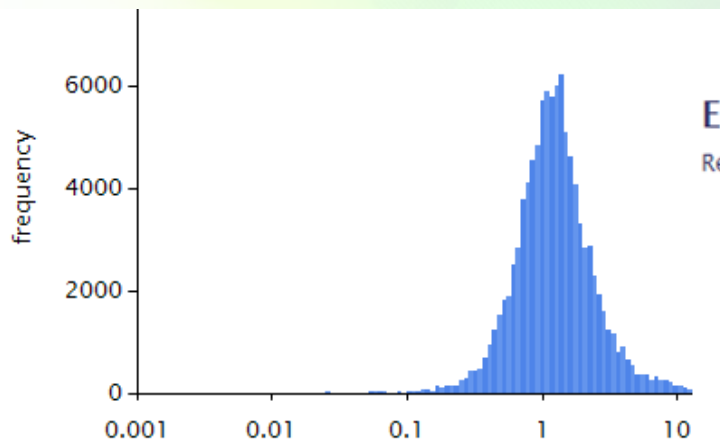
clear

Next step >>

model

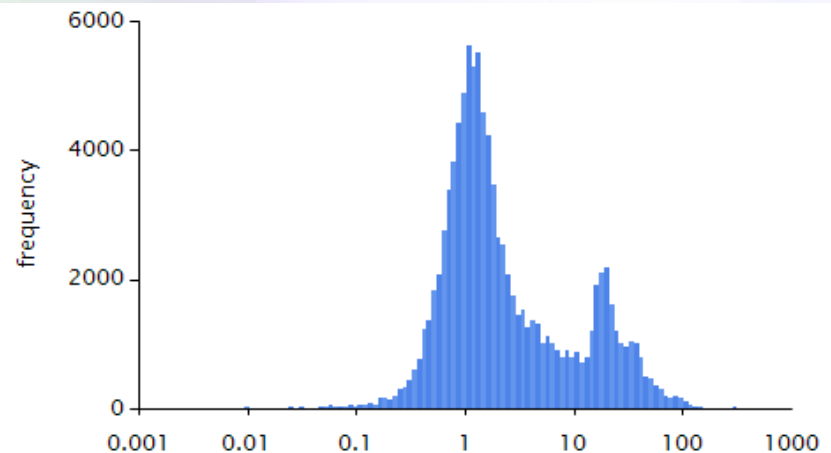
With and without contaminated egg

Without contamination



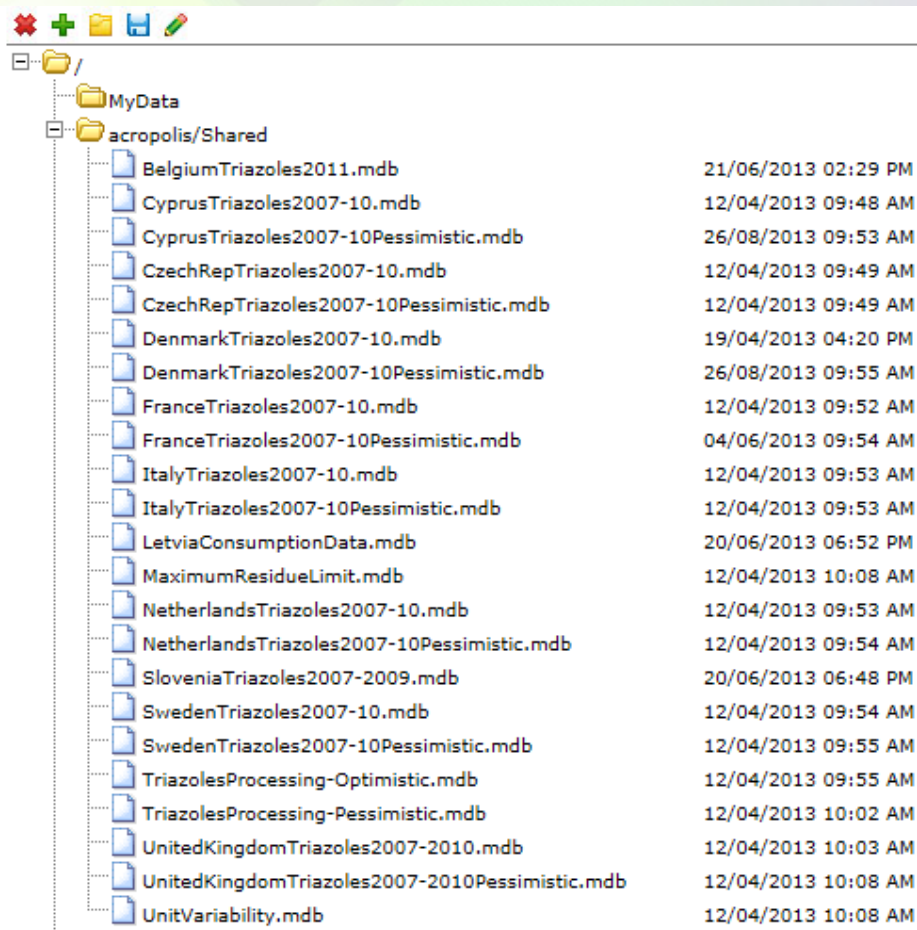
Example, no real data

With contaminated egg



Example, no real data

Future harmonised perspective



MyData	
acropolis/Shared	
BelgiumTriazoles2011.mdb	21/06/2013 02:29 PM
CyprusTriazoles2007-10.mdb	12/04/2013 09:48 AM
CyprusTriazoles2007-10Pessimistic.mdb	26/08/2013 09:53 AM
CzechRepTriazoles2007-10.mdb	12/04/2013 09:49 AM
CzechRepTriazoles2007-10Pessimistic.mdb	12/04/2013 09:49 AM
DenmarkTriazoles2007-10.mdb	19/04/2013 04:20 PM
DenmarkTriazoles2007-10Pessimistic.mdb	26/08/2013 09:55 AM
FranceTriazoles2007-10.mdb	12/04/2013 09:52 AM
FranceTriazoles2007-10Pessimistic.mdb	04/06/2013 09:54 AM
ItalyTriazoles2007-10.mdb	12/04/2013 09:53 AM
ItalyTriazoles2007-10Pessimistic.mdb	12/04/2013 09:53 AM
LetviaConsumptionData.mdb	20/06/2013 06:52 PM
MaximumResidueLimit.mdb	12/04/2013 10:08 AM
NetherlandsTriazoles2007-10.mdb	12/04/2013 09:53 AM
NetherlandsTriazoles2007-10Pessimistic.mdb	12/04/2013 09:54 AM
SloveniaTriazoles2007-2009.mdb	20/06/2013 06:48 PM
SwedenTriazoles2007-10.mdb	12/04/2013 09:54 AM
SwedenTriazoles2007-10Pessimistic.mdb	12/04/2013 09:55 AM
TriazolesProcessing-Optimistic.mdb	12/04/2013 09:55 AM
TriazolesProcessing-Pessimistic.mdb	12/04/2013 10:02 AM
UnitedKingdomTriazoles2007-2010.mdb	12/04/2013 10:03 AM
UnitedKingdomTriazoles2007-2010Pessimistic.mdb	12/04/2013 10:08 AM
UnitVariability.mdb	12/04/2013 10:08 AM

CONCLUSIONS

- ▶ We were able to convert the results using national codes toward a harmonised EU platform
- ▶ Next step is to look at methodological aspects
 - Overestimating or underestimating
 - Completeness e.g. 10 % of food items is not sampled, how does it affect the TDS exposure
 - Effect of variation and uncertainty
- ▶ First ideas about integration FoodCaseRisk and MCRA
- ▶ Possible to connect stakeholder's own residue finding to TDS data