tds exposure

TOTAL DIET STUDIES: BETTER DATA – BETTER DECISIONS

Substances of interest and populations

Wednesday 5nd February 2014

Karine Vin (Anses)

SEVENTH FRAMEWORK PROGRAMME

WP2: populations and substances

- 7 Partners: ANSES (WP leader), U-Gent, ISS and TUBITAK-MAM (sub-task leaders), CRA NUT, HAH, and MSPSI/AESAN.
- General schedule and total PM of the WP: 13 months (M1-M13), 29.85 PM
- 3 sections:
  - Identification of the populations of interest
  - Relevance of the TDS approach
  - Hierarchization of the substances

tds exposure

Populations of interest and related specific foods

SEVENTH FRAMEWORK PROGRAMME

Populations of interest

- Objective: identify populations more sensitive / more exposed
- Dependant of the substance
- Identification of different population groups:
  - Age – gender groups : sensitive populations
  - Diet type groups: ethical, religious or geographical reasons
  - Geographical, professional or socio economic status: different diet or polluted environment
  - Disease or health related group: different diet for medical reasons

- Age – gender groups
  - Infants and children
  - Pregnant and lactating women
  - Childbearing age women
  - Postmenopausal women and elderly
  - Other age / gender groups

- Diet types groups
  - Vegetarians
  - People having specific diet habits
  - Athletes

- Geographical, professional or socio economic status
  - Coastal areas populations and fishermen
  - People living in a polluted or contaminated environment
  - Specific sub groups of populations, with different eating habits (low economical status, students…)

- Disease related groups
  - Diabetics / people on a diet
  - People suffering from hypercholesterolemia, hypertension and cardiovascular diseases
  - People suffering from osteoporosis
  - Celiac and gluten allergic sufferers
  - Cow's milk allergic sufferers…

Specific foods

- The objective is to identify:
  - Specific foods related to the targeted populations
- But not to identify:
  - Preparation and cooking practices
  - Type of storage, type of store and geographical origin of products
  - Self consumption and catering
  - Organic products

SEVENTH FRAMEWORK PROGRAMME

AGE-GENDER GROUPS

Population groups	Specific foods to be included in the food baskets
Infants (0-3y)	Baby foods Growing-up milk Honey Supplements
Children (4-18y)	Food specially designed for children
Pregnant women / lactating women	Supplements Herbal tea
Post menopausal women	Fortified foods
Elderly (institutional or free living)	Functional foods Supplements Salt free diet

SEVENTH FRAMEWORK PROGRAMME

DIET TYPE GROUPS

Population groups	Specific foods to be included in the food baskets
Vegetarians	Soy products, vegetable beverages (soy “milk”…), grains, nuts, legumes, pulses Supplements
People having specific dietary habits (ethnical origin)	Rice, hot pepper, spices, condiments, soya sauce and other sauces, tropical fruits and vegetables, roots
Athletes	Supplements (proteins...) Sport beverages

SEVENTH FRAMEWORK PROGRAMME

GEOGRAPHICAL, PROFESSIONAL OR S.E. STATUS

Population groups	Specific foods to be included in the food baskets
Coastal areas population Fishermen	Higher consumption of fish and seafood
People living in a polluted or contaminated environment (residents around polluting industry / farmers / population in disaster area...)	No specific foods
Specific sub-groups of populations, with different eating habits (single males, people with low economic status, students…)	No specific foods but higher consumption of some type of foods

SEVENTH FRAMEWORK PROGRAMME

DISEASE RELATED GROUPS

Population groups	Specific foods to be included in the food baskets
Diabetics People who are on a diet	Light and without sugar products Supplements Table top sweeteners
People suffering from hypercholesterolemia, hypertension and cardio vascular diseases	Products with phytosterols Light and low fat products Low salt products
People suffering from osteoporosis	Fortified dairy products
Celiac sufferers and gluten allergy sufferers	Gluten-free products Corn, rice
Cow's milk allergy sufferers	Ewe's or goat's milk, vegetable "milks"
Other allergy sufferers	No specific foods most of the time

SEVENTH FRAMEWORK PROGRAMME

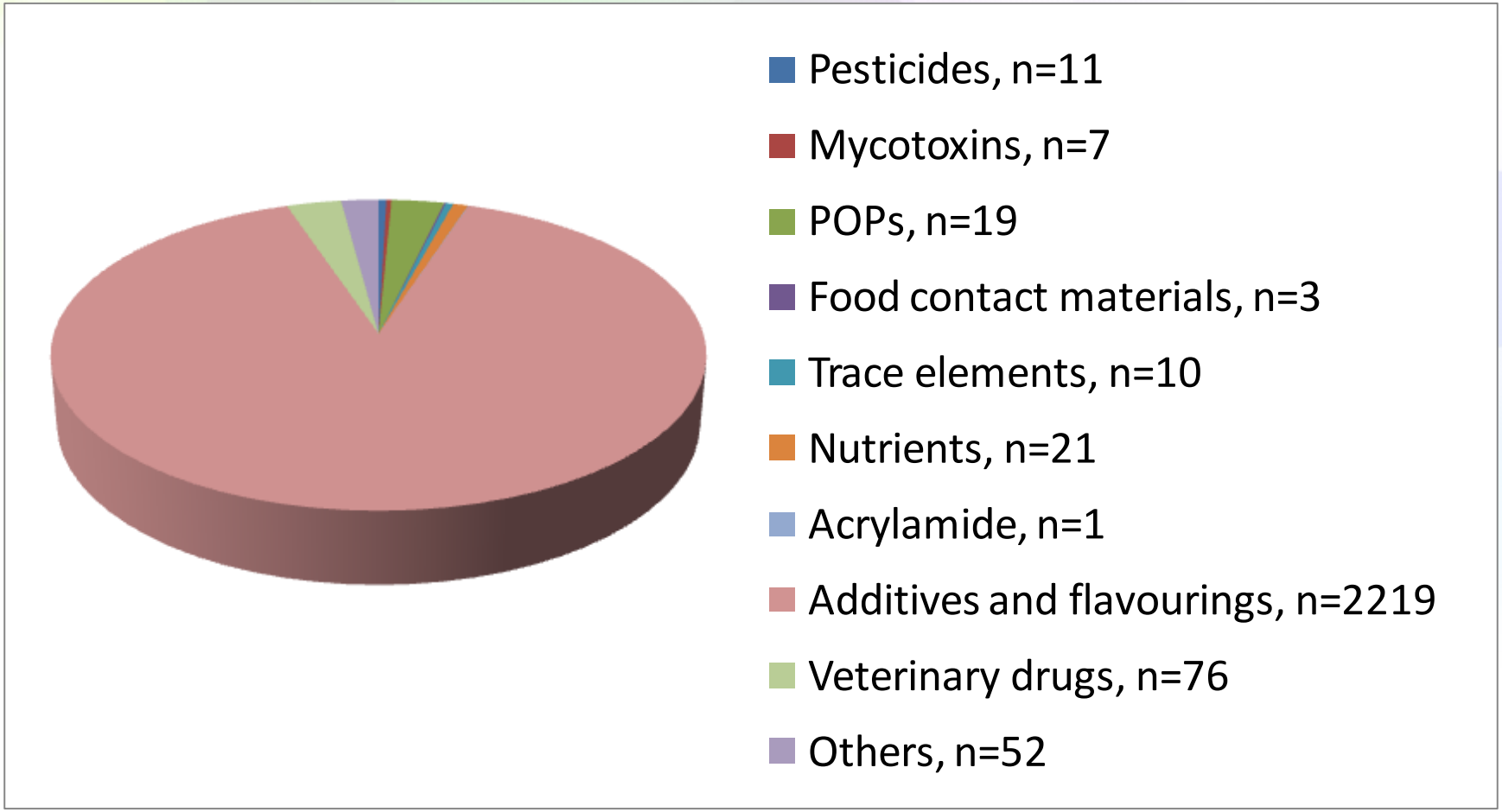
tds exposure

Substances of interest:

Relevance of the TDS approach

SEVENTH FRAMEWORK PROGRAMME

2412 substances evaluated



Principles of a TDS

- Representative of the whole diet
- Pooled samples
- Food analyzed as consumed

SEVENTH FRAMEWORK PROGRAMME

Relevance criteria proposed

Significant part of the diet	• Is the substance likely to be present in a significant part of the diet?
Analytical method existing to analyze the substance in all potential food contributors	• Do we have any analytical method to analyze the chemical in potential food contributors?
Impact of pooling (dilution effect, or occurrence criterion)	• Is the presence of the substance likely to occur often in one or different food groups? And is the concentration likely to increase or decrease with pooling (volatile substances for instance)?
Preparation impact	• Is the concentration not too highly impacted by the home preparation?

SEVENTH FRAMEWORK PROGRAMME

Summary of the relevance of the TDS approach by substance

Substance group	Substances	Relevance?	Key element
Nutrients	Nutrients	Yes	-
Environmental contaminants	Trace elements	Yes	Impact of preparation
	Dioxins, furans, PCBs, brominated and perfluorinated compounds	Yes	Impact of preparation (brominated compounds)
Chemical substances intentionally added to foods	Foods additives	Yes	Some additives only
	Flavourings	**No**	Volatility
Chemical residues of substances being deliberately applied at other points in the food production chain	Pesticide residues	Yes	Impact of pooling
	Veterinary drug residues	Yes	Impact of preparation

SEVENTH FRAMEWORK PROGRAMME

Substance group	Substances	Relevance?	Key element
Contaminants formed during food processing	PAHs	Yes	Impact of preparation
	Furan	**No**	Volatility + Food preparation “as consumed”
	Acrylamide	Yes	Impact of preparation / pooling
	3-MCPD and related compounds	Yes	Impact of pooling
Naturally occurring contaminants	Mycotoxins	Yes	Impact of pooling
	Phytoestrogens	Yes	Avoid pooling of soy-based products with other products
	Alkaloids	**No**	Pooling effect

SEVENTH FRAMEWORK PROGRAMME

Substance group	Substances	Relevance?	Key element
Contaminants transferred from food packaging or food contact materials	Melamine, MOSH, bisphenol A, phtalates	Yes	Effect of packaging (BPA) Impact of preparation (phthalates)
Others	Radionuclides	Yes	Radioactive decay (for short-lived radionuclides)
	Nanoparticles	**No**	No validated analytical method
	Nitrosamines	Yes	Impact of cooking

SEVENTH FRAMEWORK PROGRAMME

tds exposure

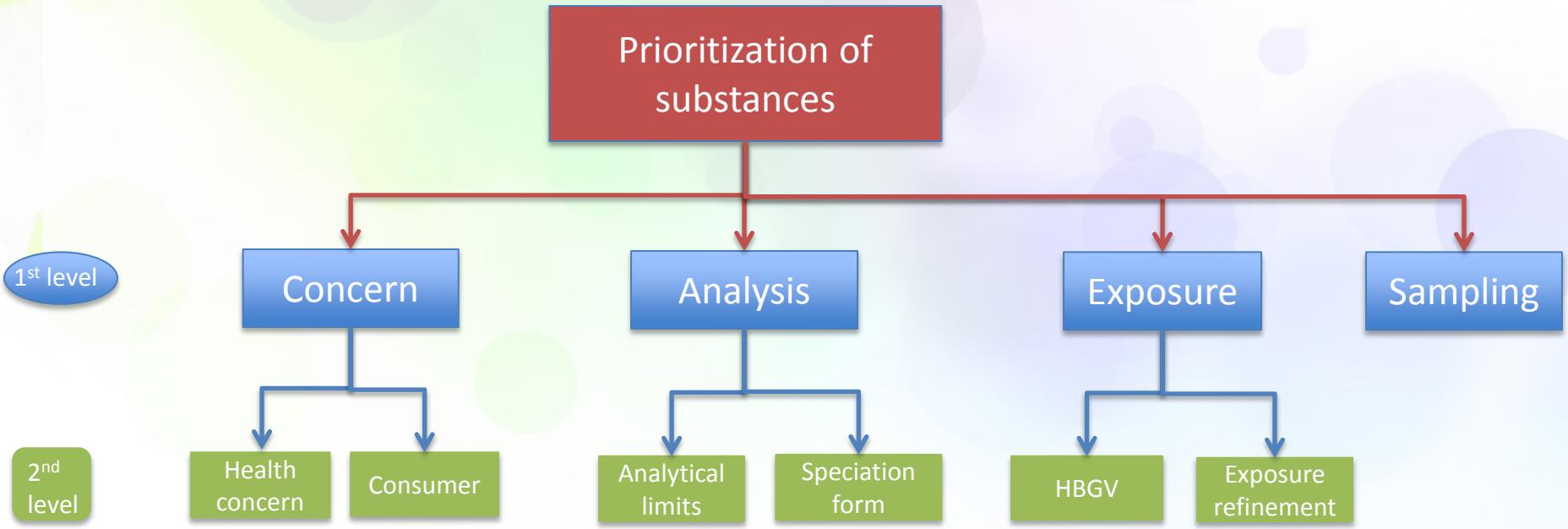
Substances of interest:

hierachization of the substances

SEVENTH FRAMEWORK PROGRAMME

The decision process in AHP (Analytic Hierarchy Process)

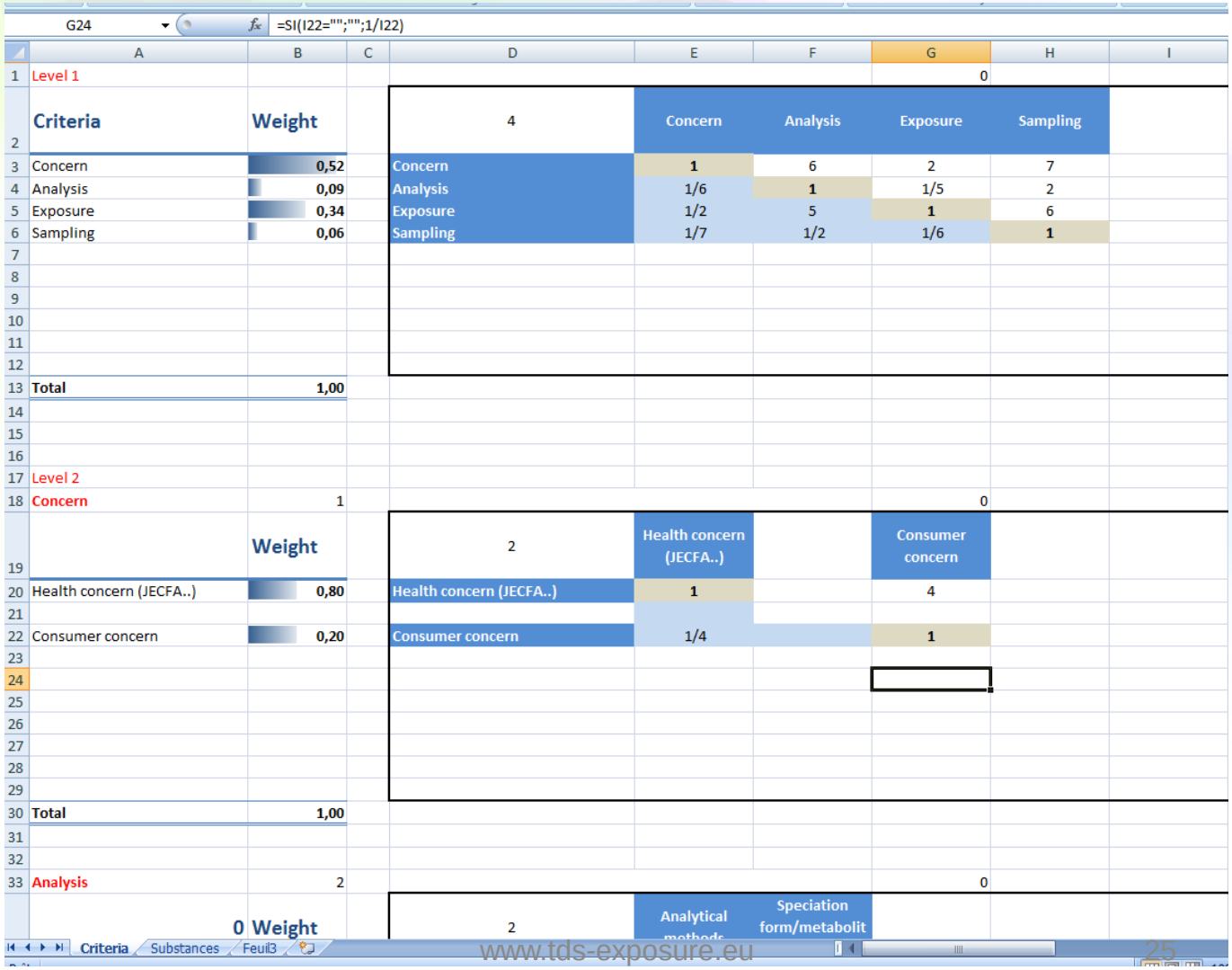
1. Identifying the criteria to be used to compare the substances
2. Defining the relative weights for criteria
3. Evaluating the importance of each alternative for each criteria
4. Aggregation of all judgments



Summary of the prioritization criteria

Criterion groups	Criteria	Conclusion
Concern	Health concern	↗Evidence of harmful effect, ↗Priority
	Consumer concern	↗Concern, ↗Priority
Analysis	Analytical limits	↘Left-censorship, ↗Priority
	Speciation forms/metabolites	↗Specificity of the method, ↗Priority ↗Ability to approximate, ↗Priority
Exposure	HBGV	↗Robustness of HBGV, ↗Priority
	Exposure refinement	↗Risk, ↗Priority
Sampling	Contamination origin	↘Geographical and/or temporal variations, ↗ Priority

Defining the relative weights for the criteria

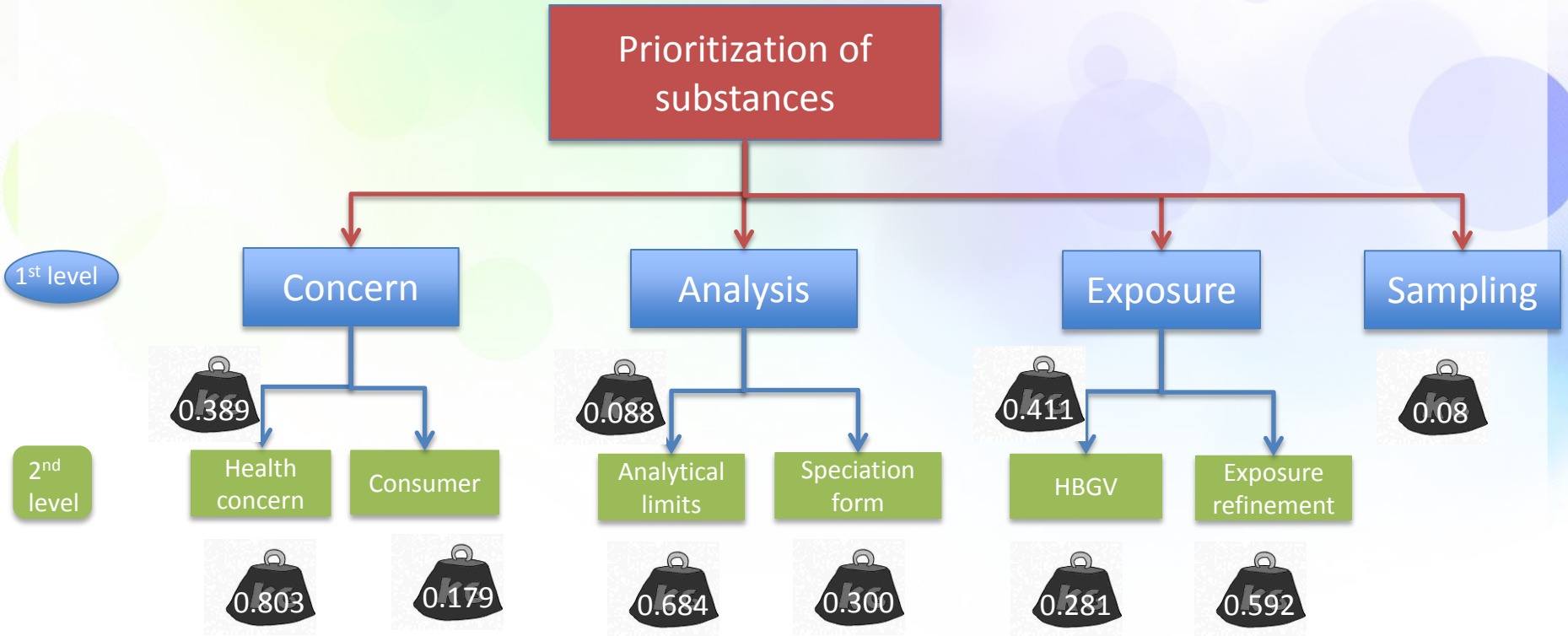


G24 =SI(I22="";"";1/I22)

	A	B	C	D	E	F	G	H	I
1	Level 1						0		
2	**Criteria**	**Weight**		4	Concern	Analysis	Exposure	Sampling	
3	Concern	0,52		Concern	1	6	2	7	
4	Analysis	0,09		Analysis	1/6	1	1/5	2	
5	Exposure	0,34		Exposure	1/2	5	1	6	
6	Sampling	0,06		Sampling	1/7	1/2	1/6	1	
7									
8									
9									
10									
11									
12									
13	**Total**	1,00							
14									
15									
16									
17	Level 2								
18	Concern	1					0		
19		**Weight**		2	Health concern (JECFA..)		Consumer concern		
20	Health concern (JECFA..)	0,80		Health concern (JECFA..)	1		4		
21									
22	Consumer concern	0,20		Consumer concern	1/4		1		
23									
24									
25									
26									
27									
28									
29									
30	**Total**	1,00							
31									
32									
33	Analysis	2					0		
		0 **Weight**		2	Analytical methods	Speciation form/metabolit			

Criteria | Substances | Feuil3

Weights of the criteria



6-level scales for each criterion and sub-criterion

Criteria/sub-criteria	Scale
Health concern	Health concern according to bibliographic data (literature) and/or previous evaluations (JECFA, EFSA, etc.)
	6 Sufficient evidence of harmful effects on humans: CMR activity, neurotoxic effects, hepatotoxicity, etc. (e.g. IARC class 1 for carcinogenicity)
	5 Sufficient evidence of harmful effects on animals but limited evidence of effects on humans (e.g. IARC class 2A for carcinogenicity)
	4 Sufficient evidence of harmful effects on animals but inadequate evidence of effects on humans (e.g. IARC class 2B)
	3 Limited evidence of harmful effects on animals but inadequate evidence/evidence suggesting lack of effects on humans (e.g. IARC class 3 for carcinogenicity)
	2 Inadequate evidence of harmful effects on animals and inadequate evidence of effects on humans
	1 Evidence suggesting lack of harmful effects on humans and inadequate evidence/evidence suggesting lack of effects on animals (e.g. IARC class 4 for carcinogenicity)
Consumer concern	Consumer/population/media concern, whatever the source of information
	6 Very afraid of the substance/does not want to be exposed under any circumstances
	5 Afraid of the substance/prefers to limit its exposure
	4 Has heard about the substance (occurrence, effects, etc.) but is not yet afraid
	3 Has heard about the substance (occurrence, effects, etc.) but is completely indifferent
	2 Knows the substance (name) but does not know anything on the potential effects
	1 Does not know the substance

SEVENTH FRAMEWORK PROGRAMME

Criteria/sub-criteria	Scale
Analytical limits	Percentage of left-censored data expected
	6 <30 %
	5 [30-60[%
	4 [60-80[%
	3 [80-90[%
	2 [90-95[%
	1 [95-100] %
Speciation forms/metabolites	Ability of the method to analyze the speciation forms/metabolites, if any
	6 There is no speciation form/metabolite
	5 The method is specific for all the speciation forms/metabolites
	4 The method is specific of the speciation forms/metabolites in some foods, but not in all foods. But we can approximate the concentrations by *ad hoc* factors for the foods for which the method is not specific
	3 The method is not specific of the speciation forms/metabolites but we can approximate the concentrations by *ad hoc* factors for all foods or the majority of foods
	2 The method is not specific of the speciation forms/metabolites but we can approximate the concentrations by *ad hoc* factors for some foods
	1 The method is not specific of the speciation forms/metabolites and the concentrations cannot be approximated by *ad hoc* factors
Exposure refinement	Results of previous studies on exposure (TDS or other)
	6 Exposure already assessed and risk identified (>HBGV or low margin of exposure (MOE))
	5 Exposure already assessed in another country and risk identified (>HBGV or low MOE)
	4 Exposure already assessed but no HBGV (possible to assess trends) or discordant conclusions
	3 Exposure already assessed in another country but no HBGV, or discordant conclusions
	2 Exposure already assessed in another country and no risk identified (<HBGV or high MOE)
	1 Exposure already assessed and no risk identified (<HBGV or high MOE)

Criteria/sub-criteria	Scale
Exposure refinement	Results of previous studies on exposure (TDS or other)
HBGV	Existence of a reference value
	6 HBGV defined with robust data and effects observed in humans (epidemiology)
	5 BMDL defined with data on humans
	4 HBGV defined with data on animals (uncertainty factors)
	3 BMDL defined with data on animals or not robust data (insufficient to established a HBGV)
	2 No HBGV (nor BMDL) but possibility to use other values (e.g. "reference point")
	1 No reference value/data at all
Sampling	Geographical and seasonal variation of the concentration
	6 The substance is uniformly distributed at the geographical scale of the TDS (whole territory, regions...) and at the seasonal scale
	5 The substance is uniformly distributed at the geographical scale of the TDS but not at the seasonal scale
	4 The concentration of the substance is moderately different from a geographical point to another and uniformly distributed or moderately uniformly distributed at the seasonal scale
	3 The concentration of the substance is moderately different from a geographical point to another and highly different at the seasonal scale
	2 The concentration of the substance is highly different from a geographical point to another (lots of hot spots for instance) but uniformly distributed or moderately uniformly distributed at the seasonal scale
	1 The concentration of the substance is highly different from a geographical point to another and from a sampling date to another

SEVENTH FRAMEWORK PROGRAMME

Implementation of the multi-criteria analysis for the substances for which the TDS approach is relevant

Consumer concern	Consumer/population/media concern, whatever the source of information
6	Very afraid of the substance/does not want to be exposed under any circumstances
5	Afraid of the substance/prefers to limit its exposure
4	Has heard about the substance (occurrence, effects, etc.) but is not yet afraid
3	Has heard about the substance (occurrence, effects, etc.) but is completely indifferent
2	Knows the substance (name) but does not know anything on the potential effects
1	Does not know the substance

Score for each substance/substance group

	Criteria							Intermediate calculations							Score	Ranking
Substance or family	Health concern	Consumer concern	Analytical limits	Speciation form/metabolites	HBGV	Exposure refinement	Sampling	Health concern	Consumer concern	Analytical limits	Speciation form/metabolites	HBGV	Exposure refinement	Sampling		
Nitrites (E249-250)	5	2	1	6	4	4	6	0,66917	0,05967	0,114	0,3	0,18733	0,39467	0,080	0,090	2
Sorbates (E200-203)	1	1	3	5	4	1	6	0,13383	0,02983	0,456	0,25	0,18733	0,09867	0,080	0,050	5
Benzoates (E210-213)	3	1	3	5	4	1	6	0,4015	0,02983	0,342	0,25	0,18733	0,09867	0,080	0,062	3
Sulfites (E220-228)	4	2	3	5	4	6	6	0,53533	0,05967	0,342	0,25	0,18733	0,592	0,080	0,095	1
Lecithin (E322)	1	2	3	6	1	3	6	0,13383	0,05967	0,342	0,3	0,04683	0,296	0,080	0,054	4

Illustration of the methods: list of substances

Ranking	Substances
1	Methylmercury
2	Cadmium
3	Inorganic arsenic
4	Lead
5	Dioxins, furans, dioxin-like PCBs
6	Sulfites (E220-228)
7	Aluminium
8	Acrylamide
9	Bisphenol A
10	Mineral oil saturated hydrocarbons (MOSHs)
11	Inorganic mercury
12	3-MCPD and related compounds
13	Non dioxin-like PCBs
14	Nitrites (E249-250)
15	Aflatoxins (B1, B2, G1, G2)

Conclusion

- The methodology rather than the list
- To be done before each TDS
- Population: context / available data
- Substances:
  - Identification of substances of interest
  - Relevance of a TDS (for new substances)
  - Identification and weighting of the criteria
  - Hierachization of the substances