Guideline levels for sustainable management of food production

Beata VARGA
Central Agricultural Office
Food and Feed Safety Directorate
HUNGARY

Goal: secure and acceptable level of protection of human health and the environment

consistent with relevant international guidance and practices **- long term management**

Requirements:

clear, definite regulation,

measure or action taken quick and efficient,

action should be defensible before the court

assessment from the regulatory side: action taken based on the monitoring results,

eg. imission (starting point not the emission, not the source term)

isotopes: possible releases from nuclear installations (EC RadProt 129 and 143, EUR 19841),

long-lived nuclides (^{241}Am, ^{237}Np, ^{135}Cs, ^{129}I, ^{99}Tc, ^{94}Nb, ^{79}Se, ^{14}C)

natural radionuclides (terrestrial),

violence – not only $T_{1/2}$>> in case of food and feed

(do not group the isotopes – ^{131}I)

system should ensure the possibility of active land-management

Tool – a regulation containing:

isotope-specific guideline level-system, derived from dose limits for inhabitants:

radionuclide concentration in **FOOD**

radionuclide concentration in **FEED**

radionuclide concentration in **SOIL** (for different land-use)

EXPECTATION

MONITORING

DECISION

REGULATION

Need of the society,
economical possibilities

Radionuclide concentration in soil

Regulation for soil concentration for different land-use

Decision about land-use

Suggestion for the subsequent land-use

Plan for subsequent land-use (iterative steps)

Monitoring of soil and product from the field

Suggestion of the use of the crop

Decision about the use of the products (iterative steps)

Monitoring of food-chain and
different stages of food production

Regulation for radionuclide content of food and feed

Decision about the consumption of food or feed
or consumption form of them

Classification based on land-use:

Forest
Energy plants
Crops for fodder
Pasture
Fruit
Cereals
Green vegetables

Determination of subsequent land-use:

time frame of the specific use
order of use
purpose of the use of specific crop – processing factors (possibility of postponed decision about changing)
soil „self-cleaning” - flux coming out by production, decay
food processing factors for different use

Primary decision on land-use might based on doserate (?)
– in case of emergency, as a screening, when quick decision needed
(aerial survey or route monitoring at 1m height)

DERIVATION OF GUIDELINE LEVELS

Starting with „end-user” or top of the food-chain – limits for foodstuffs – risk assessment

Limits for feedstuffs

Transfer factors
and other information,
like consumption rates

Goals

-Restricted use: forest

-Controlled use: energy plants, agricultural production (crops for fodder, pasture, fruit, cereals)

-Free use: green vegetables - small parcels

Limit for soil for different use
first(?): isotope-specific
concentration range
for 3 classified goal
or(?): for at least 7 possible use
at least for 4 main soil types

Lots of site-specific info -
or wide ranges with
high degree of conservatism

FOOD

Limits in force for radioactive isotopes in food

(after emergency for a given period, import rate)

Follow-up (Chernobyl)	For future event	Codex Alimentarius
737/90/EEC now: 733/2008/EC	3954/87/Euratom	CAC/GL 5-2006
616/2000/EC	2218/89/Euratom	
1609/2000/EC	2219/89/Euratom	
1635/2006/EC	944/89/Euratom	
2003/274/EC	770/90/Euratom	

Values in force: ^{137}Cs and ^{134}Cs together:
370Bq/kg – food for children younger than 6 months
370Bq/kg – milk, milk-products
600Bq/kg – other foodstuffs
10 times – minor foodstuff (spices)

2001/928/Euratom:
Limit: ^{222}Rn - 100Bq/l
^{210}Po – 0,1Bq/l
^{210}Pb – 0,2Bq/l

WHO Guidelines for drinking water quality (3rd edition) 2006:
Screening levels gross-α, gross-β, ^{222}Rn 100Bq/l

Guidelines foe food:

Background level (important to know for not to be too strict, but regulation should not based on the multiplication of background level)

Tolerance level (risk $5x10^{-6}$) :

- derivation of radionuclide concentration from 0.1mSv/year dose
- minimum(children below 1 year, adults)
- decision rule taking into account measurement uncertainty (Eurachem-CITAC guide)

Acceptable level for children below 1 year – from 1mSv dose (protection factor 5)

Acceptable level for adults – from 1mSv dose (protection factor 3)

Rounding rule – always down

In case of more isotope simultaneous presence:

sum of measured activity-concentration normalised by acceptable level < 1

Some values for the comparison -^{137}Cs

Regulation	***Food*** *Bq/kg*	***Effective dose***	
		Children < 1 year mSv/year	***Adults, mSv/year***
CAC/GL 5-2006	1000	0.42-4.2	0.72 -7.2
EU – follow up: children < 6 months	370	1.6	
EU – follow up: adult	600		4.3
EU –future: children < 6 months	400	0.4-1.7	
EU – future: adult	1250		2.2-8.9
Suggested for adult	30		0.3
Suggested for children below 1 year	30	0.2	
Suggested tolerance	9	0.06	0.09
Background (milkpowder included!)	0.15	0.0006	0.001

Feed – base of the derivation is the acceptable level for foodstuffs

Animal	*Method of the derivation*
Ruminants	Transfer to meat: minimum(concentration in feed of cow, sheep, goat) Transfer to milk: minimum(concentration in feed of cow, sheep, goat) Acceptable level: minimum concentration in feed (transfer to meat, transfer to milk) Decision limit = acceptable level – 2 x uncertainty of measured value (2.5% bad decision)
Pig	Acceptable level: Transfer to meat Decision limit = acceptable level – 2 x uncertainty of measured value (2.5% bad decision)
Poultry	Transfer to meat Transfer to egg Acceptable level: minimum concentration in feed (transfer to meat, transfer to egg) Decision limit = acceptable level – 2 x uncertainty of measured value (2.5% bad decision)

Feed

Commission Regulation (Euratom) No 770/90

Maximum permitted levels of radioactive contamination (caesium-134 and caesium-137) of feedingstuffs (as it is):

animal	Bq/kg
Pigs	1250
poultry, lambs, calves	2500
other	5000

Example: ^{137}Cs

FOOD - 30Bq/kg in meat

FEED – acceptable level ^{137}Cs: 70Bq/kg – 3.3mGy/year

in force: 5000Bq/kg – 249mGy/year

(1mGy/day: small probability of any effect for biota)

Protection of human being = protection of biota?!

CHARACTERISATION:

Scale of contaminated area - survey
Likely radionuclides present, concentrations, distributions
Other contaminative processes and industries
Local background
Geology and hydrogeology
Soil types
Vegetation
Land-use
Population density
Living habits

Decision makers have to decide, from when and where sustainable management system is applied; deliberation of need, benefits and costs

NEED OF SOCIETY

RISK ASSESSMENT:

Source analysis
Environmental transport analysis
Dose and exposure analysis
Scenario analysis (likely)

SELECTION OF POSSIBLE MANAGEMENT OPTIONS
AGRICULTURE – LONG-TERM

Some important documents:

IAEA-TECDOC-1616: *Quantification of Radionuclide Transfer in Terrestrial and Freshwater Environments for Radiological Assessments, 2009*

ICRP publications : among them

Supporting guidance 5, 2007

Publication 103, 2007

Remediation of contaminated environment – edited by G. Voigt and S. Fesenko
Serie: Radioactivity in the environment, Volume 14, 2009

EC Radiation protection 122: Practical use of the concepts of clearance and exemption, Part I, 2000; Part II, 2001


If you have any idea or comment please let me know!
What is the probability of any prediction?
Many thanks for your attention!

Isotope	CAC/GL 5-2006		2218/89/EURATOM		Suggested acceptance level		Suggested acceptance level for feedstuffs		
	child < 6 months	adult	child < 6 months	adult	child < 1 year	adult	ruminants	pork	poultry
^{3}H	1000	10000	400	1250	5000	10000	-	-	-
^{14}C	1000	10000	400	1250	400	700	-	-	-
^{32}P	-	-	400	1250	20	100	200	900	2000
^{35}S	-	-	400	1250	500	3000	1000	-	-
^{36}Cl	-	-	400	1250	60	400	3000	-	-
^{51}Cr	-	-	400	1250	1000	10000	30000	-	-
^{54}Mn	-	-	400	1250	100	600	40000	40000	100000
^{55}Fe	-	-	400	1250	80	1000	8000	-	10000
^{59}Fe	-	-	400	1250	10	200	1000	-	2000
^{60}Co	1000	1000	400	1250	10	100	6000	-	6000
^{65}Zn	-	-	400	1250	10	100	70	200	800
^{75}Se	-	-	400	1250	30	100	900	100	100
^{76}As	-	-	400	1250	60	200	-	-	-
^{89}Sr	1000	1000	400	1250	10	100	2000	10000	3000
^{90}Sr	100	100	75	750	2	10	200	1000	300
^{95}Nb	-	-	400	1250	100	700	8000000	-	10000000
^{95}Zr	-	-	400	1250	70	400	6000000	-	20000000
^{99}Mo	-	-	400	1250	100	700	30000	-	10000
^{99}Tc	1000	10000	400	1250	60	600	10000	-	1000
^{103}Ru	100	100	400	1250	90	500	20000	90000	-
^{106}Ru	100	100	400	1250	8	60	2000	-	-

Isotope	CAC/GL 5-2006		2218/89/EURATOM		Suggested acceptance level		Suggested acceptance level for feedstuffs		
	child < 6 months	adult	child < 6 months	adult	child < 1 year	adult	ruminants	pork	poultry
^{110m}Ag	-	-	400	1250	20	100	100000	-	-
^{124}Sb	-	-	400	1250	20	100	10000	-	-
^{125}Sb	-	-	400	1250	60	300	30000	-	-
^{129}I	100	100	400	1250	3	3	8	200	10
^{131}I	100	100	150	2000	3	10	20	700	50
^{134}Cs	1000	1000	400	1250	20	20	40	40	100
^{137}Cs	1000	1000	400	1250	30	30	70	60	100
^{140}Ba	-	-	400	1250	20	100	1000	-	1000
^{141}Ce	-	-	400	1250	80	600	100000	-	-
^{144}Ce	1000	1000	400	1250	10	80	20000	-	-
^{154}Eu	-	-	400	1250	20	200	-	-	-
^{192}Ir	1000	1000	400	1250	50	300	-	-	-
^{210}Pb	-	-	400	1250	0.08	0.6	10	-	-
^{210}Po	-	-	400	1250	0.02	0.3	90	-	1
^{226}Ra	-	-	400	1250	0.1	1	80	-	-
^{235}U	100	100	400	1250	1	9	300	-	100
^{238}U	-	-	400	1250	1	9	300	-	100
^{239}Pu	1	10	1	80	0.1	1	6000	-	-
^{241}Am	1	10	1	80	0.1	2	500	-	2000
^{244}Cm	-	-	1	80	0.2	3	-	-	-