Updating of Norwegian soil quality guidelines and inclusion of new substances

**1st Joint Nordic Meeting on Remediation of Contaminated Sites.
NORDROCS, Malmö, September 20-21, 2006**

Mona Weideborg

Eilen Arctander Vik

aquateam

Previous work – short summary

SFT (99:01): *Guidelines on risk assessment of contaminated sites*, included soil quality guidelines for most sensitive land use for selected environmental hazards (substances of concern and with sufficient data for deriving Soil quality guideline (SQC):

➢ **Metals (As, Pb, Cd, Hg, Cu, Zn, Cr (III), Cr (VI), Ni)**
➢ **PAH (Napthalene, Fluorene, Fluoranthene, Pyrene, Benzo(a)pyrene)**
➢ **PCB7**
➢ **Pentachlorophenol**
➢ **Chlorinated pesticides (Lindane, DDT)**
➢ **Chlorinated benzenes (mono, di, tri, tetra, penta, hexa)**
➢ **Volatile chlorinated hydrocarbons (DCM, TCM, TRI, TETRA, 1,1,1-TCE)**
➢ **BTEX (Benzene, Toluene, Ethylbenzene and Xylene)**
➢ **Aliphatic hydrocarbons (different fractions)**
➢ **Additives to gasoline and oil products (MTBE, 1,2-dichloroethane, 1,2-dibromoethane, tetraethyl-Pb)**

aquateam

Procedure for deriving Guidelines :

1. **Health based SQC (total all exposure from ingestion, dermal contact, inhalation of dust, inhalation of vapour, consumption of drinking water, consumption of vegetables and consumption of fish)**
2. **Ecotoxicological SQC (PNEC-soil from terrestric organisms, or derived from PNEC-water)**
3. **Ideal SQC: the lowest of 1 and 2**
4. **Adjustment of ideal SQC for detection limit (LOD) for the most probable analytical method**
5. **Adjustment for the reported background values (metals, bioavailability in soil**
6. **Proposed new soil quality guidelines**

The proposed new SQC are not yet confirmed by SFT, but should be a basis for discussion

aquateam

Why updating guidelines from 1999?

➢ More human and ecotoxicological data are now available, as well as migration and transport data. EU has performed new risk assessments for several substances after 1999.
➢ New information of environmental hazards are coming up: (e.g. BFR, PFOS, Alkyl phenols, phthalates).
➢ Lower detection limits (LOD) for chemical analysis
➢ Aquatic data should be included in the guidelines, since leaching from contaminated sites to nearby water recipients happens

aquateam

Focus

- Requirement and evaluation of data quality
- Handling of substances with insufficient or missing data
- Difficult substances, e.g. surfactants

aquateam

Changes in SQC (mg/kg)

Parameter	SQC SFT 99:01	Proposed new SQC	Background for changes
Lead (Pb)	63	100	New human health data
Cadmium (Cd)	3	4	New human health data
Chromium (Cr)	25	32	New ecotox data
Nickel (Ni)	50	63	New ecotox data
Benzo(a)pyrene	0.1	0.01	New ecotox data
Fluorene	0.6	0.8	New ecotox data
Fluoranthene	0.1	1	New ecotox data
Pyrene	0.1	1	New ecotox data
Pentachloro-phenol	0.005	0.007	New transport data (Kd and H)

aquateam

Changes in SQC (mg/kg)cont.

Parameter	SQC SFT 99:01	Proposed new SQC	Background for changes
MCB	0.5	0.03	New ecotox data
1,2-DCB	0.5	0.1	New LOD
1,4-DCB	0.5	0.02	New LOD
1,2,4-TCB	0.2	0.05	New LOD
1,2,4,5-TetraCB	0.3	0.05	New human health and Kd and H data
Hexachloro-benzene	0.03	0.01	New human health and Kd and H data
TCM	0.01	0.02	New human health data
TRI	0.01	0.2	New Kd and H data
TETRA	0.03	0.01	New ecotox data

aquateam

Changes in SQC (mg/kg)cont.

Parameter	SQC SFT 99:01	Proposed new SQC	Background for changes
Benzene	0.005	0.006	New human health data
Toluene	0.5	0.3	New ecotox data
Ethylbenzene	0.5	0.01	New ecotox data
Xylene	0.5	0.03	New ecotox data
MTBE	2	0.7	New ecotox data
1,2-dichloroethane	0.003	0.1	New human health and Kd and H data

aquateam

Conclusions "old" parameters

- Relatively small changes in ideal SQC, but the values are more reliable, since more data have been available since 1999.
- Ecotox and health data often give the same SQC.
- Some SQCs are lowered, due to better chemical analyses and lower LOD

aquateam

Proposed SQC (mg/kg) for selected new substances

Parameter	Proposed SQC	Background
Brominated flame retardents:		
PentaBDE	0.08	Health data (consumption of vegetables) for PBDE-99
DecaBDE	0.002	Health data (consumption of vegetables) for PBDE-209
HBCDD	-	Not sufficient data available
TBBA	0.001	Ecotox data (EU, 2003)
BBA	0.001	Ecotox data (EU, 2003)

aquateam

Proposed SQC (mg/kg) for selected new substances, cont.

Parameter	Proposed SQC	Background
Alkyl phenols and ethoxylates:		
Nonyl phenol	0.005	Ecotox data (endocrine effects), adjusted for LOD
Nonyl phenol ethoxylate	0.1	2.5% degrades to nonyl phenol
Octyl phenol	0.005	Ecotox data (endocrine effects), adjusted for LOD
Octyl phenol ethoxylate	0.04	Ecotox data

aquateam

Proposed SQC (mg/kg) for selected new substances, cont.

Parameter	Proposed SQC	Background
Organo-tin:		
Tributyltin-oxide (TBTO)	0.001	Ecotox data (based on PNEC marine Imposex gastropoda 0.07 ng/l), adjusted for LOD
Triphenyltin chloride (TPHT-Cl)	0.001	Ecotox data (PNEC marine 0.6 µg/l), adjusted for LOD
Phthalates:		
Di (2-ethylhexyl) phthalate (DEHP)	-	No sufficient data. EU PNEC-soil 13 mg/kg (not based on endocrine effects)

aquateam

Slide 1

Proposed SQC (mg/kg) for selected new substances, cont.

Parameter	Proposed SQC	Background
Chlorinated paraffins:		
MCCP (Medium chain)	-	No sufficient data. PNEC-soil 1 mg/kg (EU draft 2003)
SCPP (Short chain)	-	No sufficient data. PNEC-soil 0.8 mg/kg (EU, 2000)
Dioxine	0.00025	Naturvårdsverket's ecotox-value
Polychlorinated naphthalenes (PCN)	0.00025	The same as for dioxine, since the substances have similar characteristics

aquateam

Slide 2

Proposed SQC (mg/kg) for selected new substances, cont.

Parameter	Proposed SQC	Background
Volatile chlorinated hydrocarbons:		
Tetrachloromethane	0.02	Health data (inh. of vapour)
1,1,2-trichloroethane	0.01	Ecotox data (0.001 mg/kg), adjusted for LOD
Phenols and chlorophenols:		
Σ mono,di,tri,tetra-chlorophenols	0.06	Health data trichlorophenol (inh. of vapour)
Phenol	0.1	Ecotox data

aquateam

Slide 3

Proposed SQC (mg/kg) for selected new substances, cont.

Parameter	Proposed SQC	Background
Chlorinated benzenes:		
1,2,3-trichlorobenzene	0.01	Ecotox data
1,3,5-trichlorobenzene	0.01	Ecotox data
Tricresyl phosphate	-	PNEC-soil 0.009. LOD too high to be used as SQC
PFOS/PFOA	-	Not sufficient data for SQC

aquateam

Slide 4

Evaluation of data quality for SQC

➢ Ideally:
- Ecotox and health data basis for SQC
- All important effect data evaluated, also endocrine effects, aquatic toxicity, etc.
- Degradation products should be evaluated in the same way as parent compound
- The worst case should be taken into consideration
- LOD lower than ideal SQC

➢ Reality:
- Some data is insufficient or missing
- Degradation products not considered
- PNEC-soil values too high to protect aquatic organisms?
- LOD higher than ideal SQC

aquateam

Example: Different data for nonyl phenol

|	
PNEC –soil based on soil organisms (earthworm)	NOEC: 3.44 mg/kg
	AF: 10
	PNEC-soil: 0.3 mg/l
PNEC-soil based on aquatic organisms (PNEC-soil = PNEC-water● Kd)	NOEC: 0.4-190 µg/l
	Endocrine effect: 0.4 µg/l
	AF:10
	PNEC-water: 0.04 µg/l
	Kd: 66 l/kg
	PNECsoil: 0.0026 mg/kg
Other adjustments	LOD: 0.005 mg/kg
SQC	**0.005 mg/kg**

aquateam

PNEC-soil based on aquatic and terrestrial data
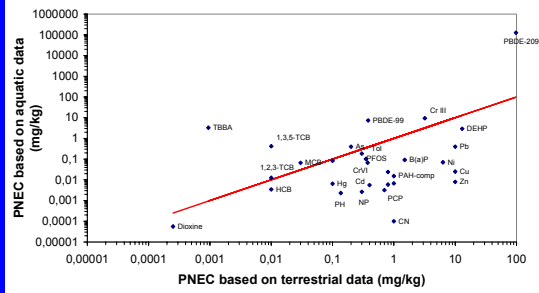
PNEC-soil = PNEC-water ● Kd
Kd: partition coefficient soil-water (l/kg)

aquateam

Assessment factors (AF) based on aquatic and terrestrial data
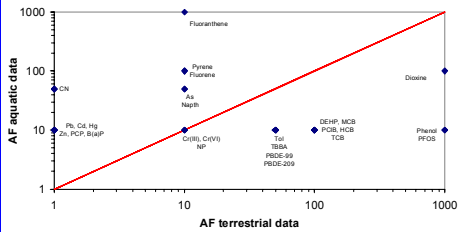
More reliable data above the red line
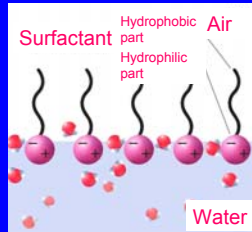
aquateam

Example: Use of data from degradation products Nonyl phenol ethoxylate (NPEO)

– Insufficient toxicity and transport data for NPEO

– 2.5% of NPEO biodegrades to Nonyl Phenol

– PNEC-soil for NP: 0.003 mg/kg

– PNEC-soil for NPEO: 0.003●100% /2.5% =0.12 mg/kg

– SQC for NPEO: 0.1 mg/kg

aquateam

Surfactants (e.g.tensides, corrosion inhibitors, alkyl phenols)

- Problems to decide transport and bioaccumulation data
- Surfactants have a tendency to accumulate at phase interfaces

aquateam

Surfactants – influence on substances in a mixture

- Release more of other substances from soil to water
  - Reduce the Kd value of other substances

- SQC will not always be sufficiant for protection of organisms in the nearby water recipient
- Evaluation of mixture of substances in contaminated sites is important!!

aquateam

Proposed further work

- Areal specific quality criteria should be generated
- More focus on leaching to nearby water recipients
- More focus on background values, diffuse pollution, etc
- An interactive web-based chemical database should be established (data frequentluy updated).

aquateam