

# **Incorporating sustainability into assessment and remediation of contaminated sites in Finland**

The 11<sup>th</sup> ICCL meeting, 9.10.2013, Durban

Jussi Reinikainen, SYKE

# Contents of presentation

- Overview of practices in Finland
- Updated Finnish guidelines on risk assessment and management
  - Revisions on risk assessment guidelines
  - Sustainable risk management and remediation
  - Generic recommendations for promoting sustainability
- Conclusions

# Finland

- Nordic country with 5 million people
- What are we known for?







aamulehdenblogit.ning.com



yle.fi



kimiraikkonenspace.com

www.kimiraikkonenspace.com  
by evenstarsaima



nokiamobilephonedetail.blogspot.com

# Development of regulations and practices in Finland

- 1989-1994 -> First national inventory of potentially contaminated sites
- 1993 -> Waste Act
  - Soil contamination and liabilities defined
  - Promotion of sustainable development already generic objective...
- 1994 -> Generic/land-use related (unofficial) guideline values
  - Risk basis not reported -> unclear conception of risks; over-conservative decisions
  - Remediation to guideline values by excavation a “rule”
- 2000 -> Environmental Protection Act
  - Regulation of contamination/pollution integrated under one law
  - Specific section and articles on soil and groundwater contamination
  - Sustainability still key objective
- 2007 -> Decree on Assessment of Soil Contamination and Remediation Need
  - Legal basis and general requirements for risk assessment (RA)
  - Risk-based guidelines values and separate risk assessment guidelines
- Today: remediation still mainly based on GVs and excavation
  - Risk-based remediation goals and *in situ* / on site remediation < 10%
- 2014 -> Updated guidelines on RA and sustainable risk management
- 2015? -> Decree on reuse of excavated soil

# Risk assessment and management in Finland – updated ministry guidelines

- Objectives: to increase 1) quality and appropriate use of risk assessment and 2) sustainability in risk management/remediation
  - 1) Consistent and justified site-specific risk assessments (RA)
    - Legal framework exists (e.g. Decree 214/2007) and RA is compulsory
    - Improvements needed in the appropriate use of RA
    - Recognition of the limitations of RA
  - 2) Maximizing the net-benefits of remediation
    - Generic legal objectives for sustainability exist (not targeted at site remediation)
    - Avoiding unnecessary remediation
    - Selection of the most appropriate methods, when remediation is necessary
- **Providing necessary risk reduction while minimizing the negative impacts of the selected actions**



# Revisions on risk assessment guidelines – the ones affecting also sustainability

- Common interpretation of important articles in the law
  - Including key definitions and terms not clearly defined in legislation
  - RA always needed when contamination or potential contamination is evaluated
- Detailed description of RA methodology and harmonization of certain elements
  - More emphasis on proper site investigations and conceptual model
  - Quantitative measurements/estimates of effects/risks always required
  - Assessment of risks to the quality of the environment always required
  - Common reference values for the protection of human health and the quality of groundwater, surface water and indoor air
  - National default values for certain exposure parameters
  - More detailed instructions for using guideline values
  - Recommendations and checklists for documentation

→ **From biased to representative sampling**

→ **From (over) conservative and somewhat unclear RA to realistic, transparent and consistent RA**

→ **From unfounded to justified and defensible decisions**

→ **From impractical to sustainable remediation**

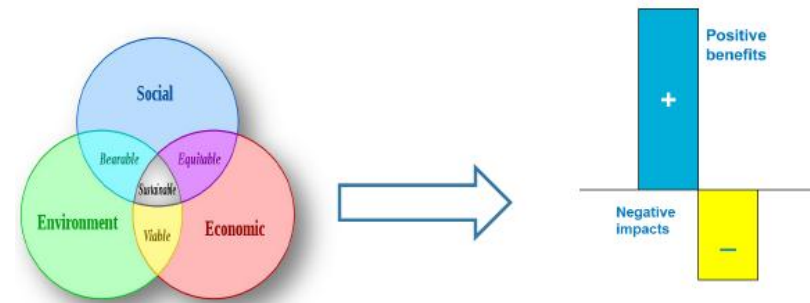
# Representative sampling – commonly neglected basics

- Basis for reliable RA and justified risk management decisions
  - Setting clear objectives
    - What are the exact questions to which you want answers from sampling?
    - Representative for one question is often not representative for another
    - Different sampling plan for different questions/purposes
  - Defining proper "decision units" (= sampling units)
    - What is the population of interest defined by your questions?
    - Smallest unit of importance to decision-making (e.g. exposure area)
    - In RA sampling targeted at exposure and transport routes or receptors
    - Exact delineation of area/mass/volume of soil, water, air, biota etc.
  - Ensuring sufficient quality assurance
    - How reliable do your results have to be (acceptable sampling error)?
    - Tackling the matrix heterogeneity in space (and in time)
    - Using statistics doesn't help if sampling isn't representative...
    - Selection of appropriate sampling design (e.g. discrete vs. composite or multi-increment samples; QA samples, proper pretreatment and analysis etc.)
- **When sampling can be considered as representative, average concentration of a DU can be used for RA**
- **Chasing "hot spots" is often not practical or even necessary**

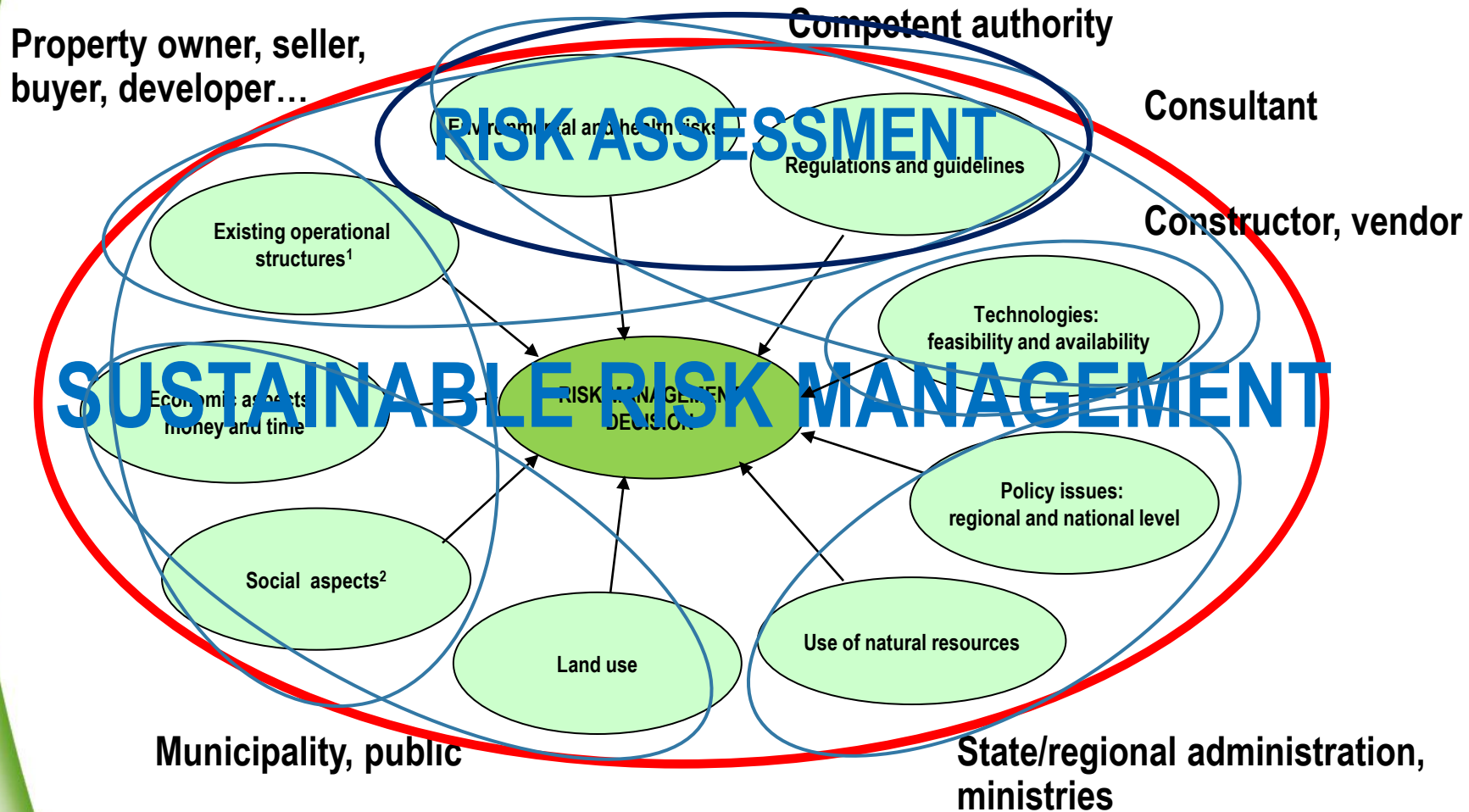


# Sustainable risk management and remediation – definitions in the Finnish context

- Sustainability
  - Generic objective in environmental legislation
  - Balancing between environmental, economic and social considerations
  - Evaluated on local, regional, national or global level
- Sustainable remediation
  - Maximizing net-benefits of remediation
  - Evaluated on local/site level, when remediation need has been confirmed
  - Selection of the most appropriate, technically feasible, methods
  - Optimization of the remedial design
- Sustainable risk management
  - Sustainable remediation + other actions for managing risks (e.g. relating to land use)
  - Should also be evaluated on regional level



# Framework for decision-making – combining multiple factors and stakeholder views



1) e.g. administrative practices and responsibilities, ownerships

2) e.g. employment, image and valuation aspects, cultural values, attractiveness of the area

# Assessment of sustainability in remediation

- Integrated part of remediation planning
  - Liable party for remediation evaluates sustainability before final selection of methods
  - Acceptance by authority in administrative decision regarding remediation
- Optimization of environmental, economic and social components
  - Many factors reflect sustainability to opposite directions or on different levels: e.g. future liabilities on site vs. overall environmental impacts with excavation
  - Transparent and justified value judgement and stakeholder involvement required
  - Decision always a compromise between different views
  - Effects during the whole life cycle of a project should be considered
- Qualitative or quantitative assessment based on defined indicators
  - Process itself more important than the tools used
  - Qualitative comparisons often sufficient enough
  - Thorough quantitative assessment mainly on larger sites with big impacts

# Generic recommendations on sustainable risk management and remediation

- Objectives
  - To promote sustainable practice (even on sites where site-specific sustainability assessments are not being done)
  - To increase consistency in decisions
- Sustainability pre-evaluated for certain situations in decision-making
  - 9 identified situations or factors with associated recommendations
  - Based on what was considered to lead to more sustainable practice
  - Value judgement integrated in recommendations
  - Existing national practices and conditions taken into account
  - Prepared in co-operation with many stakeholders
  - Recommendations consider both risk assessment and risk management
- Planning state of site important starting point
  - Land use change and redevelopment/construction plans main drivers for remediation in Finland
  - Recommendations given for already built sites and sites under redevelopment
- Recommendations shall be considered, but applied case-by-case
  - Not legally binding, but broadly agreed
  - Some recommendations partly overlapping



## Generic recommendations concern...

1. Possibilities in regional land use planning
2. Suitability of risk assessment regarding land use
3. Timing of remediation with respect to site redevelopment
4. Clean enough top soil on redevelopment sites
5. Contaminants of concern
6. Applicability of *in situ* ja on site techniques
7. Reuse potential of excavated soils
8. Treatment methods for excavated soils
9. Stakeholder participation

# Recommendations 1/3

- Sustainability in land use planning
  - Risk management on site or regional level, before remedial decisions
  - Contamination taken into account early enough; siting activities, avoiding unnecessary remediation, reuse of excavated soils etc.
    - Sustainability assessment should always be part of regional planning and selection of risk management options
- Applicability of risk assessment; built vs. redevelopment site
  - Suitability of RA (risk-based remediation goals) on site, where planning is unfinished or realization of redevelopment/construction works is uncertain
    - Requires an accepted town/city plan or draft plan
    - Assessing different scenarios (worst-case) also possible
  - RA is always fit for already built/existing sites
    - Targeted and validated assessment possible (e.g. targeted measurements)
- Timing of remediation
  - Remediation need ≠ urgency of remediation
    - If possible, remediate within construction works or redevelopment activities

# Recommendations 2/3

- Clean-enough surface soil
  - Surface soil has a special role: risk potential / soil use / perceptions etc.
  - Includes rather strong value judgement
    - Redevelopment sites: remediation based on threshold and guideline values (0,5 -1 m). Recommendation does not include unsensitive land use, paved areas and "low-risk metals"
    - Built sites: site-specific RA
- Contaminants of concern
  - Elimination of PBT-substances = "phase-out"
  - Includes rather strong value judgement
    - Redevelopment sites: removal and destruction (when C > upper GV)
    - Built sites: site-specific RA with special terms (removal, when soil is excavated e.g. due to construction)
  - Volatile compounds
    - Redevelopment sites : removal under buildings + management of vapors
    - Built sites : site-specific RA; soil air/indoor air measurements, modeling
  - NAPL
    - Removal of free phase NAPL (when feasible)

## Recommendations 3/3

- Selection of remediation methods
  - Evaluation of the potential to use *in situ* and on site techniques
- Reuse of excavated soils
  - Basic principles for soil reuse presented
  - Specific regulation on soil reuse under preparation
    - Evaluation of reuse potential on site or outside the site
- Requirements for excavated soils
  - Changes in the environmental permits of the treatment facilities needed
    - Elimination for organic compounds (when feasible)
    - Evaluation of the overall environmental effects of treatment
- Participation and communication
  - Regarding both the selection of methods and the communication afterwards
    - Involvement of important stakeholders to decision-making process



# Conclusions

- Reliable risk assessment prerequisite to successful risk management
    - Clear objectives
    - Appropriate assessment process (incl. representative sampling)
    - Transparent documentation
    - Revised guidelines will increase reliability in risk assessments
  - Sustainable risk management and remediation a common goal
    - Justified use of risk assessment
    - Selection of remediation methods by multiobjective sustainability assessment
    - Optimization of the selected methods to further increase sustainability
    - Revised guidelines with generic recommendations will promote sustainability in risk management and remediation
- Overall effects on practices remain to be seen...

# Thank you!

[jussi.reinikainen@ymparisto.fi](mailto:jussi.reinikainen@ymparisto.fi)