

Calculation Guide NORM – Assessing the dose

Jörg Dilling, Michael Kümmel, Bernd Hoffmann
Federal Office for Radiation Protection, Germany

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Introduction

- Why do we need dose assessments?

Simply, because you cannot measure!

- Main questions: For what? and How?

**Advanced
Modelling**

**Clearance
values**

Generic

Licensing

Conservatism

Realism

**Simplified
calculations**

Site specific

Legal situation in Germany

current state

- RPO (2001), Annex XII, Part D („Principles for the determination of radiation exposure of residues“):
 - Application of realistic exposure paths and exposure assumptions
 - Include all exposures occurring on intended recycling or disposal option

additionally

- Directive 2013/59/Euratom
 - Article 66 („Estimation of doses to the members of the public“):
 - realistic assessment of doses
- Radiation Protection Law (2017)
 - Practices concerning NORM: Ordinances on
 - principles for the determination of radiation exposure

Existing calculation guides in Germany

AVV §47

- basis for authorisation procedure for facilities and installations according to atomic law
- focussing on artificial radionuclides
- identical places for the most unfavourable receiving point, independent of exposure pathway
- unlikely consumption rates

Calculation guide mining

- evaluation of releases from former mining legacies
- focussing on radionuclides of U-238 series
- realistic exposure times
- average consumption rates

Different goals and levels of conservatism

Concept of calculation guide mining (1999, revision in 2010)

- evaluation of numerous, but similar legacies from former uranium mining (Wismut)
- standardised calculation methods
- simplified but sufficient conservative procedure
- no advanced modelling, evaluation from the “office desk”
- description of the reference person with realistic parameters
- calculation of effect dose for workers and members of the public
- verification of given values for the effective dose (e.g. dose constraints)
- graded approach

Calculation guide mining - considered exposure situations

- exposure situations
 - indoors
 - underground workplaces
 - outdoors
 - food consumption
- exposure pathways
 - external exposure to gamma radiation
 - inhalation of radon and dust
 - ingestion of locally produced food (incl. breast milk)
 - unintended ingestion of contaminated material

→ have proven its worth in practice

Evolution towards a calculation guide NORM

Uranium Mining → one NORM-Industry

Calculation guide mining should serve as a basis for a calculation guide NORM

Transfer from intervention situations (remediation of Wismut legacies) to common working activities of industries

- favoured recycling pathways
- disposal

Adoption of existing procedures assessing the does

Calculation guide mining

- general structure
- equations and symbols
- staying with 6 age groups
- model for the release and transport of radon
- as far as possible, keeping the set of parameters for members of the public and workers

RP122

- groundwater model

Alterations in comparison with calculation guide mining

- short description of technologic processes forming NORM
- remarks to deviations from secular equilibrium
- considering radionuclides of Thorium series
- modelling the groundwater contamination (simplified and generic)
- different geometries for gamma exposure
- determination of the exposure resulting from inhalation of dust by using filters from breath protection masks

Structure of calculation guide NORM

- one volume per German`s relevant industries (see Radiation Protection law 2017)
- dose assessment for workers and members of the public

- general part
 - identical for all volumes

- specific part
 - characteristics of industry of concern
 - containing calculation procedure

General part

- scope and principles
- short introduction to different kind of NORM residues
- detailed description of reference person
- characterisation of receiving points
- description of exposure scenarios and exposure pathways
- graded approach

Specific part

- industry specific
 - short characterisation of relevant processes forming NORM
 - description of relevant exposure scenarios and pathways
 - calculation procedure for the exposure due to ingestion, inhalation (dust and radon), gamma radiation
 - parameters (as far as necessary) for workers and members of the public
 - equations and notes
 - site specific questions
- ➔ advanced modelling allowed

Generic or site specific approach

- “office desk”, even for authority in charge
- graded approach
 - application of equations
 - background subtractions
 - **advanced modelling**
- site specific knowledge and further data essential
 - release by air: particle transport modelling e.g. ARTM (atmospheric radionuclide transport model)
 - public available
 - groundwater transport modelling

Not realisable in calculation guide NORM

Challenges

- detailed knowledge about typical recycling options and disposal
- identification of relevant exposure pathways
- exclusion of certain pathways in some industries
- define altered parameters for gamma exposure with varying geometries
- defining suitable enrichment factors in dust
- lung absorption classes



Thank you for your attention!