Graded Approach to Regulation in the NORM - Sector

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Current NORM Regulations in the EU

EU-BSS (1996):

Distinction between ‚Work activities' ./. ‚Practices'

Much flexibility to MS how to regulate NORM (as practice / work activity)

→

Very different regulatory approaches, e.g.

- specific regulations on natural radiation /NORM (Austria, Germany)
- NORM regulations ‚embedded' in existing regulations in other countries

New Developments in the EU

European Commission Service, 'Considerations with Regard to Natural Radiation Sources in BSS Directive', 16 January 2009:

- Distinction between ‚work activities' and ‚practices' planned to be given up
- Same regulatory Approach for NORM and ‚artificial radioactivity', including graded approach to regulation (notification > registration > licensing – depending on risk) → More stringent / binding regulation

Licensing from juridical point of view

License requirement forms a restriction on the basic right of ‘freedom of trade’ (constitution) → needs justification

In case of radioactivity / ionizing radiation: Legislators judged another basic right (physical integrity) higher than the ‘freedom of trade’ (high health risks)

→ Classical approach (Atomic Law): Use of radioactivity is principally forbidden: can be allowed by authority on application (if preconditions fulfilled) → License

Other examples: certain biological / genetic experiments

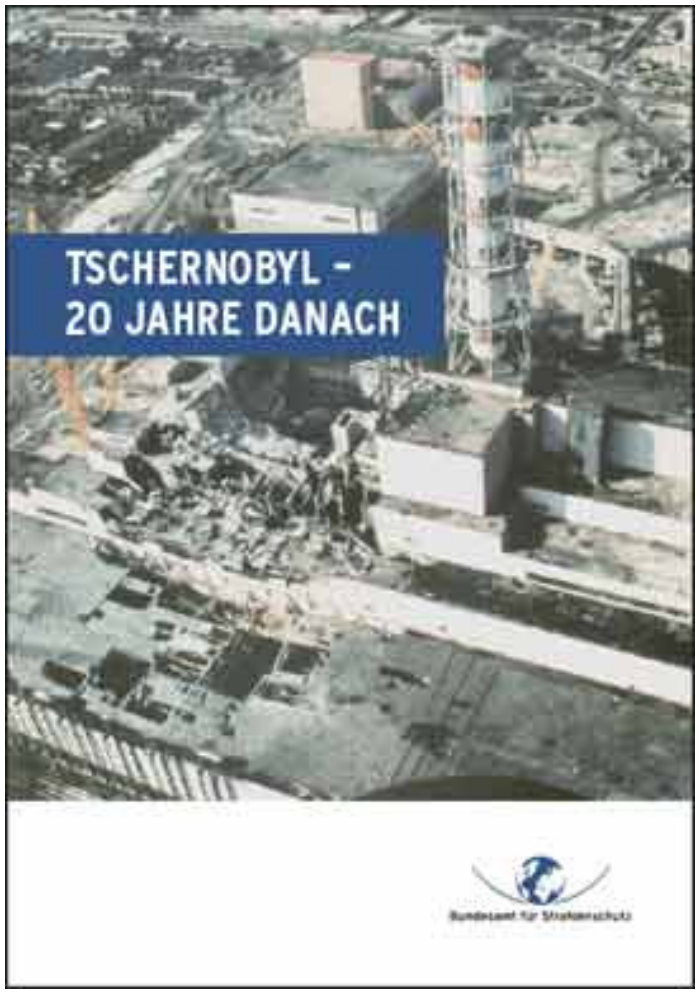
Examples of high risk activities / radiation accidents

Nenot, J.C.; 'Radiation Accidents over the past 60 years'
J. Radiol. Prot. 29 (2009) 301-320.

- > 600 events caused significant exposures of ~ 6000 individuals
- ~ 70 accidents resulted in one or more death each
- a total of ~ 200 deaths due to acute radiation syndrom

Apart from reactor - / criticality accidents, almost ever HRS involved! (> 10^{10} Bq) → industrial irradiation facilities, radiotherapy devises

Catastrophic events – Tschernobyl 1986



Whole northern hemisphere affected

Relocation of > 135 000 individuals

~ 645 000 ‚liquidators' (average dose: 100 mSv)

~ 30 deaths of rescue workers directly attributable to the accident

4000 .. 5000 thyroid cancers in Children ....

Catastrophic events: Goiania (Brazil, 1987)

- Loss of control over radiotherapy source (Cs-137; 51 TBq)
- Dismantling of sourse by scrap merchants, large dissemination of radioactive powder
- Children especially exposed
- 4 deaths, large economic consequences

Graded Approach: IAEA – BSS (1996)

Notification alone:

- Normal exposure unlikely to exceed a small fraction of the limits
- likelihood and expected amount of potential exposure negligible.

Registration:

- safety largely ensured by design of the facilities and equipment
- operating procedures are simple to follow
- safety training requirements are minimal
- history of few problems with safety operations.

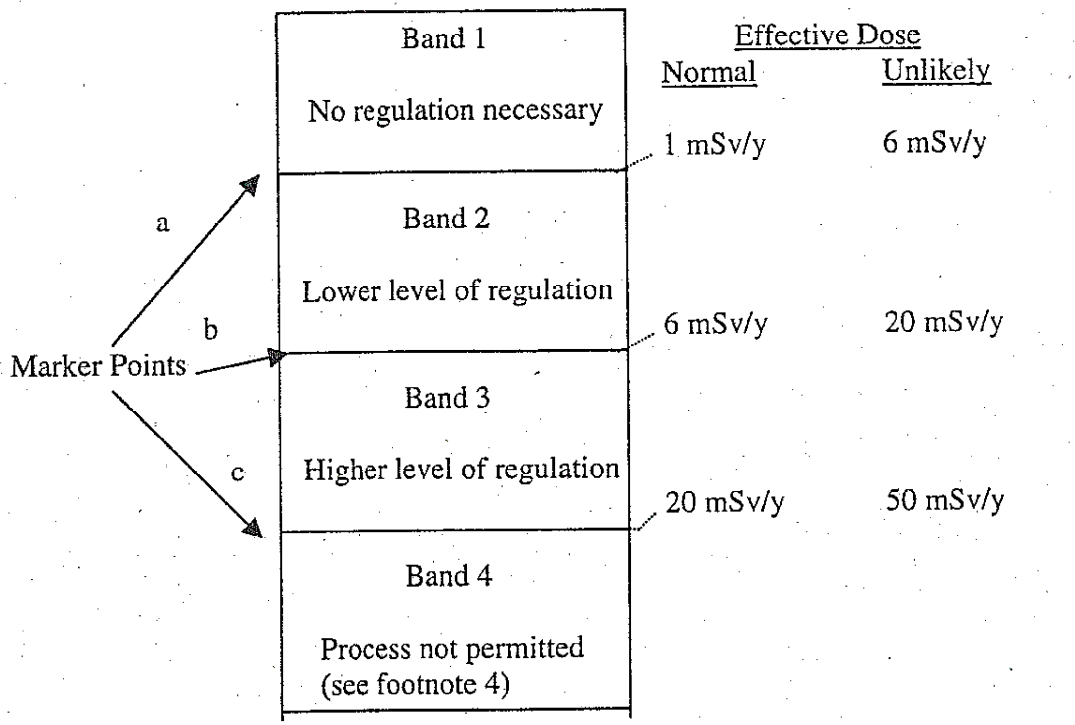
Graded Approach: IAEA (2)

Registration is best suited to practices of low or moderate risks and for which operations do not vary significantly.

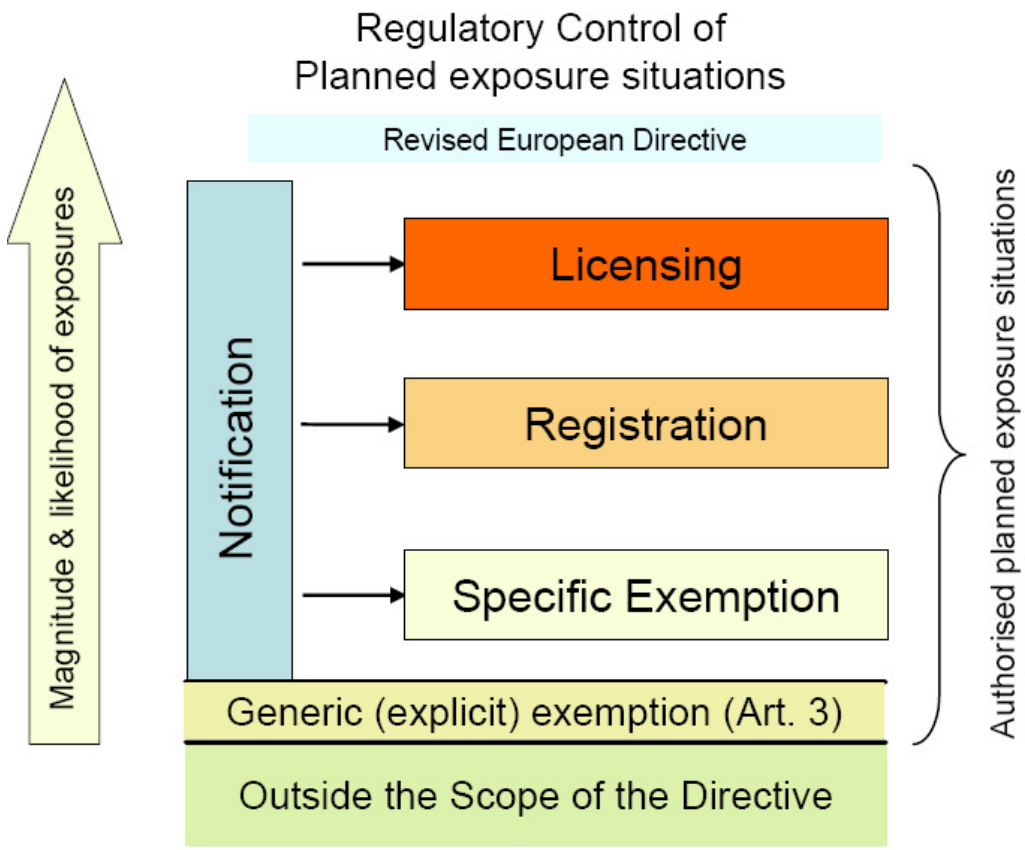
“The legal person responsible for any use of a source which the Regulatory Authority has not designated as suitable for registration, shall apply to the Regulatory Authority for an authorization that shall take the form a licence.”

Registration as well as a licence have to be applied to and granted by the regulatory authority.

Radiation Protection RP 95 (Reference Levels for Workplaces .. NORM)



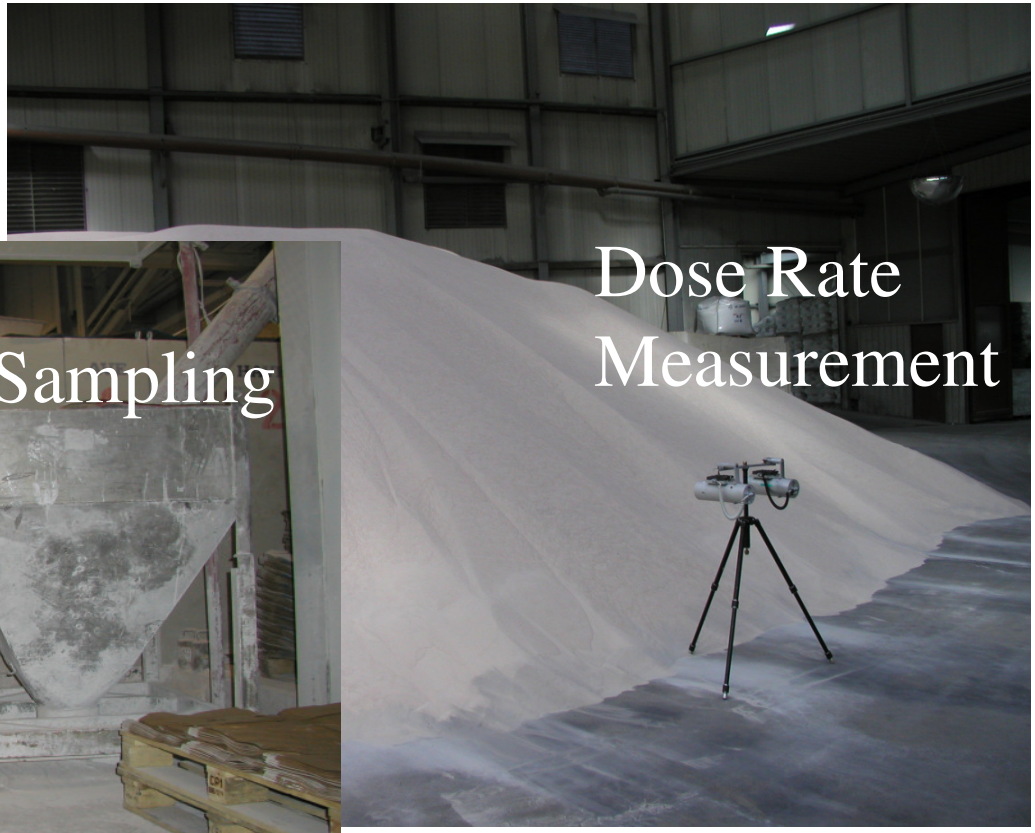
Graded Approach: New EU-concept



„Higher Level of Regulation“
→
„Licensing“

Source: A. Jansens, 2008 IAEA RASSC Meeting

Typical exposure situations in NORM industries: Zircon sand storage



Zircon sand: Estimate of effective dose

Effective Dose = external Dose + internal Dose

$$E = E_{ext} + E_{inh}$$

external Dose = $E_{ext} = f \cdot H^*(10) \cdot t_W$

internal Dose = $E_{inh} = b \cdot e \cdot c \cdot t_W$

f	Conversion factor of ambient dose to effective dose, 1.0
H*(10)	Ambient dose rate, 1.5 µSv/h
b	Standard breathing rate of a person, 1.2 m^3/h
e	Dose-coefficient, fraction of nuclides: U-nat ≈ 0,67; Th-nat ≈ 0,33 occupational, S-class, ⇒ effective dose-coefficient e = 8,0 µSv / Bq
c	Average total-alpha-activity concentration at the work place, 29 mBq/m^3
t_W	Working hours at the work place, 2000 h

Zircon sand: Results

Effective Dose (max) $E = H^*(10) \cdot t_w + b \cdot e \cdot c \cdot t_w$

Annual effective dose (max): $E = 3$ mSv + 0.65 mSv

external internal (inhalation)

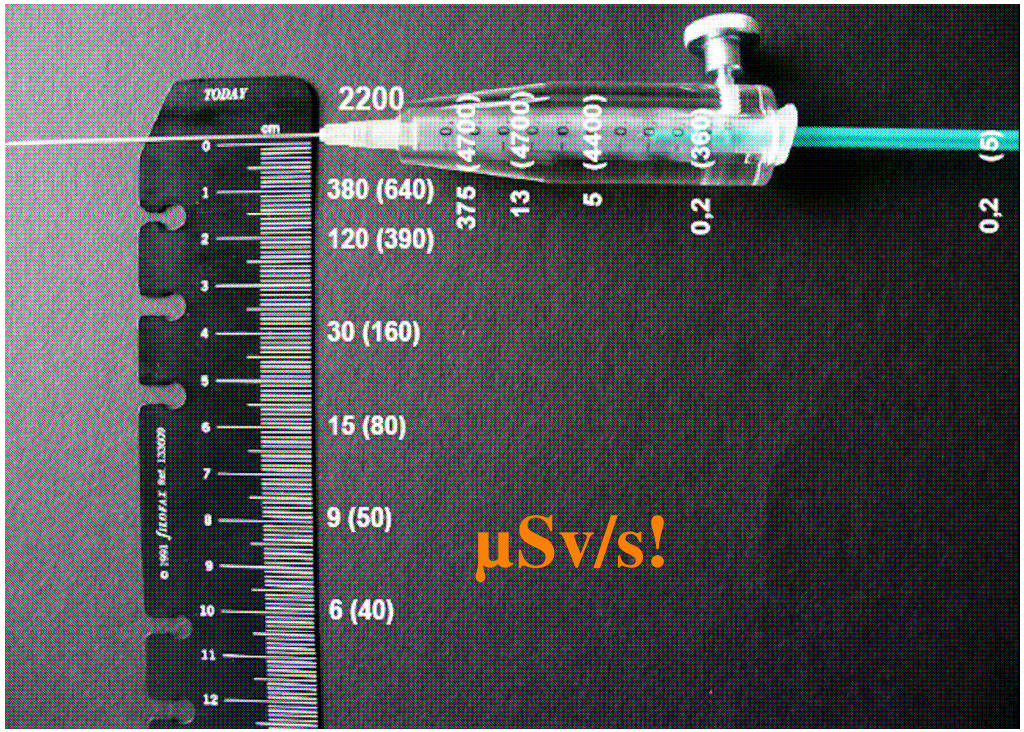
Typical exposure situations in NORM industries: Scale from O&G

Installation for high pleasure water cleaning of metal pipes

H*(10): typical values: 10 µSv/h (surface)

2000 h/a may lead to 300 .. 600 µSv/a

For comparison: an example from radiotherapy (1):



Unsealed beta sources (e.g. Y-90)

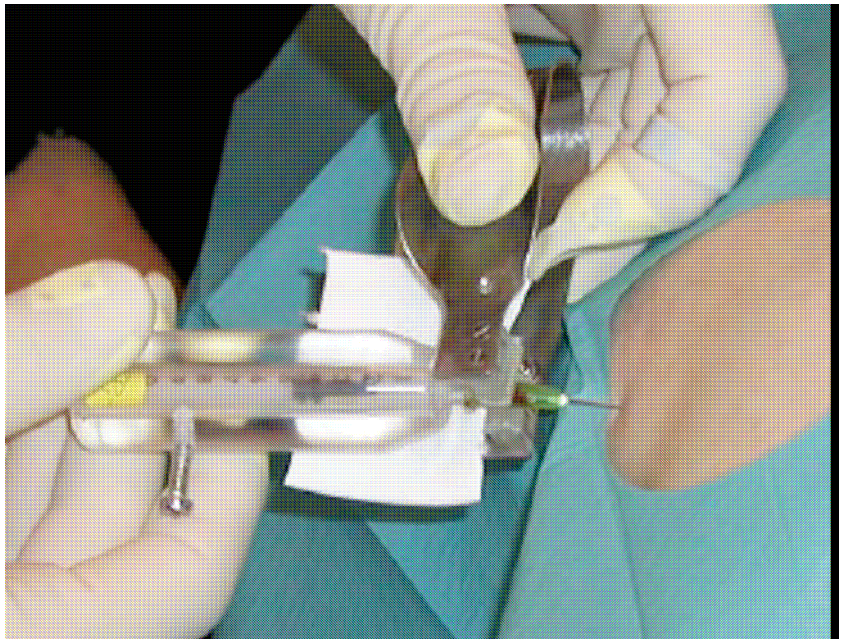
Handling of high activities at small distances to skin

High risk of contamination

High local doses possible (> 500 mSv/a if standards are low)

Radiotherapy example (2)

Protection: avoid direct contact to vials, injections (use handles, plastic shields), raise awareness, training, careful planning to avoid overexposures.



German Experience with NORM Work – Places – Conceptual Framework

- Only selected workplaces controlled (positive lists)
- Essentially based on self-control of the industries
- No authorisation / licensing required; notification only
- Notification required if E > 6 mSv/a; in this case: personal dosimetry, medical survaillance ..)

German Experience with NORM Work – Places – The Concept of Self Control

Self control requires high degree of responsibility on the part of the industries/ the ‚obliged persons'

At the beginning, no personnel specially qualified in radiation protection available

→ assistance provided by consultants, authorities (guidelines etc.), industrial associations

Materials of Industrial Associations

BGI 746

Umgang mit thoriumoxidhaltigen Wolframelektroden beim Wolfram-Inertgasschweißen (WIG)

(bisher ZH 1/522)
Vereinigung der Metall-Berufsgenossenschaften
2002

Vorwort

Die vorliegende BG-Information wurde mit Unterstützung des Arbeitskreises "Schadstoffe in der Schweißtechnik" im Fachausschuss "Metall und Oberflächenbehandlung" der Berufsgenossenschaftlichen Zentrale für Sicherheit und Gesundheit – BGZ des Hauptverbandes der gewerblichen Berufsgenossenschaften in Zusammenarbeit mit dem Fachbereich "Strahlenschutz" der Berufsgenossenschaft der Feinmechanik und Elektrotechnik aktualisiert und wird von der Vereinigung der Metall-Berufsgenossenschaften in neuer Fassung herausgegeben.

Die Aktualisierung des bisherigen Merkblattes "Umgang mit thoriumoxidhaltigen Wolframelektroden beim Wolfram-Inertgasschweißen (WIG)" (ZH 1/522) aus dem Jahre 1998 wurde aufgrund der Novellierung der Strahlenschutzverordnung erforderlich. Die Neufassung berücksichtigt die diesbezüglichen Forderungen aus der neuen Verordnung.

Diese BG-Information richtet sich in erster Linie an den Unternehmer und soll ihm Hilfestellung bei der Umsetzung seiner Pflichten aus staatlichen Arbeitsschutzvorschriften, Unfallverhütungsvorschriften und ggf. Regeln geben sowie Wege aufzeigen, wie Arbeitsunfälle, Berufskrankheiten und arbeitsbedingte Gesundheitsgefahren vermieden werden können.

Sie enthält Hinweise zum sicheren Umgang mit thoriumoxidhaltigen Wolframelektroden für das Wolfram-Inertgasschweißen und beschreibt die notwendigen Schutzmaßnahmen, die ergriffen werden müssen, um mögliche Gefährdungen beim Umgang mit diesen Elektroden auszuschließen oder auf ein vertretbares Maß zu minimieren.

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Exposures in NORM industries in Germany

Estimated numbers of exposed workers (1997)

	6 .. 20 mSv/a	> 20 mSv/a
Waterworks	2.000	300
Welding	5.000	

Radiation Protection Registry (BfS, 2005)

> 6 mSv/a: ca. 30 persons

> 20 mSv/a: rare cases (waterworks)

All exposures > 6 mSv caused by radon!

Reasons for Reductions?

- realistic rather than conservative dose estimates
- specific measures to reduce exposures
- technical progress (automation)
- substitution (welding rods, gas mantles)

Example: Thoriated Gas Mantles

Original assumptions:

t_A: 1000 – 2000 h / year
10.000 pieces stored
highest measured activity

! highly conservative !

Trend: ~~Th~~ ⇨ Y

Source: Wikipedia

Conclusions (1)

Any restriction on basic rights (freedom of trade) must be justified → degree of regulation only as high as necessary

Graded aproach to regulation for NORM is adequate, but higher level of Regulation (RP 95) must not necessarily translate into ‚Licensing'

Registration as defined by IAEA will be sufficient as highest level of regulation for NORM workplaces:

Conclusions (2)

Registration (IAEA):

- safety largely ensured by design of the facilities and equipment
- operating procedures are simple to follow
- safety training requirements are minimal
- history of few problems with safety operations.

According to German experience even notification might be sufficient!

Conclusions (3)

The only reported exposures > 6 mSv/a in the NORM sector in Germany originate from ‚radon-workplaces'.

Radon work places are planned to be classified as ‚existing situation' → not subject to any authorisation!

In Germany, more stringent regulations will not lead to better protection but possibly result in more bureaucracy → flexibility of MS in regulating NORM workplaces should be maintained!