Australian Government
Australian Radiation Protection and Nuclear Safety Agency

arpansa

Exemption and Clearance webinar

ARTWORK BY
Natalie L. Simmons

Acknowledgement of Country

Opening remarks

Agenda

Introduction and opening remarks

IAEA Safety Standards and Australia's participation

Draft Guidance on the Application of Exemption and Clearance of Radioactive Material in Australia

Ten-minute break

Exemption and clearance scenarios

Q&A

Next steps

Closing of webinar

We are the Australian Government's primary authority on radiation protection and nuclear safety

Operate under the *Australian Radiation Protection and Nuclear Safety Act 1998*

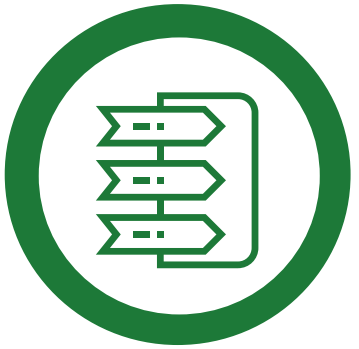
Provide scientific advice, sets standards and regulates Commonwealth entities using radiation

ARPANSA mandate

Promote national uniformity in radiation protection policies and practices

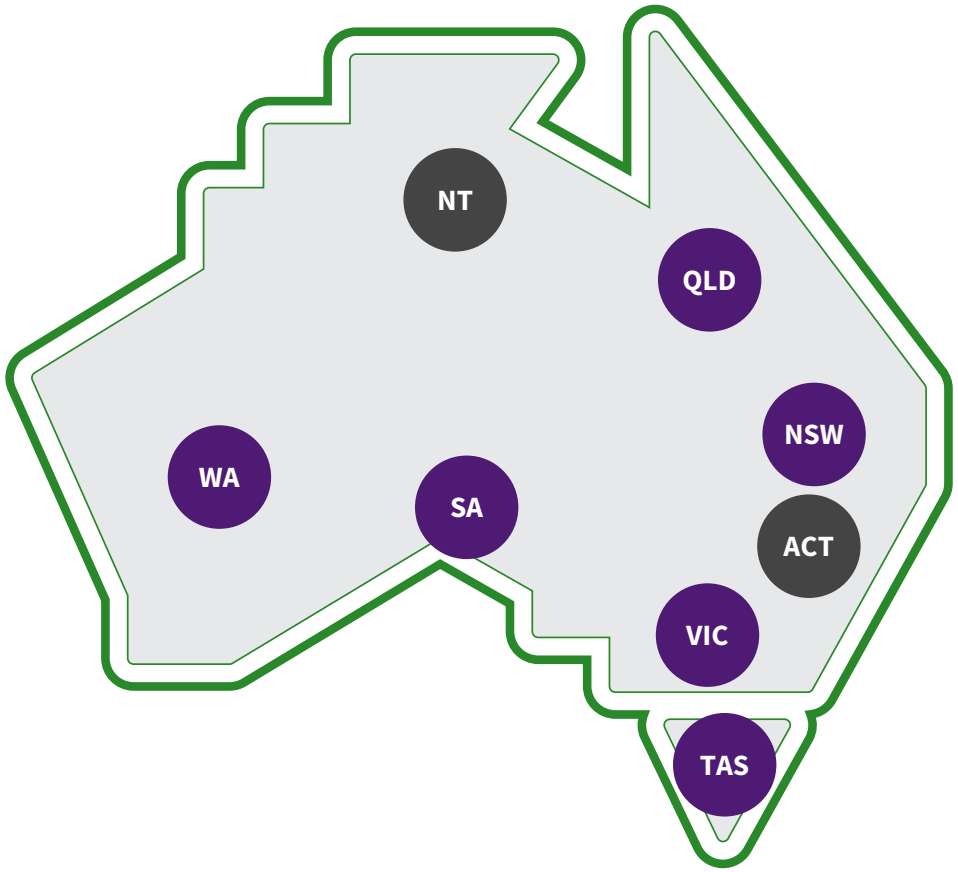
Develop and publish Codes of Practice and Safety Standards

Advice to government and stakeholders on radiation safety



Mandates are defined in ARPANS Act and Regulations

Implementation across Australia



Radiation Protection Series are adopted by *States and Territories*

Form the basis of licensing, compliance and enforcement

National uniformity is achieved through the Radiation Health Committee (RHC)

Importance of the new Safety Guide

Australian Specific Guidance

- Local guidance not currently available
- Progression of national uniformity
- Provides relevant examples in an Australian context

Currently relevant

- 2018 IRRS Mission to Australia recommendation
- National Directory for Radiation Protection 2
- Publication of IAEA GSG-17 and GSG-18

Efficient implementation of Safety Assessment

- Required under RPS C-1
- Can be resource intensive – optimise balance between risk and benefit
- Insights and experience

IAEA Safety Standards and Australia's participation

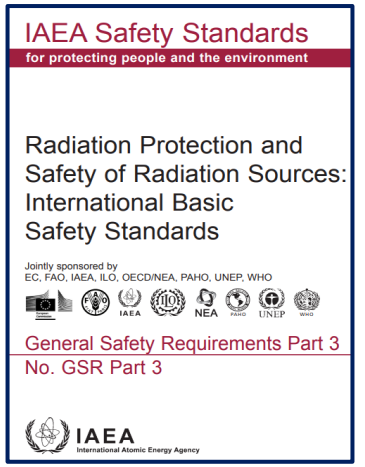
How Does Australia Implement Exemption and Clearance?

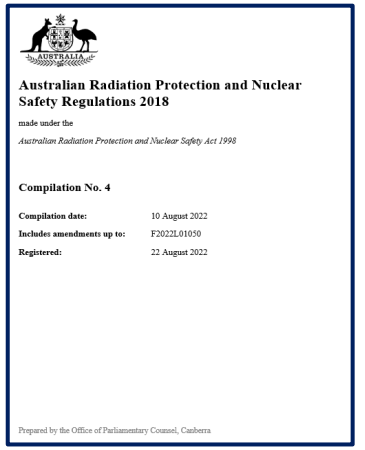
IAEA General Safety Requirements Part 3 2014

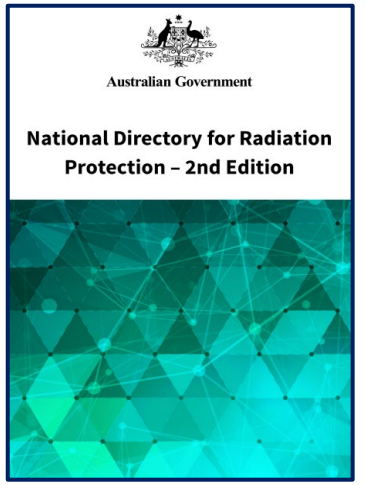
- Adopted by the Commonwealth
- States and Territory adoption/alignment varies

Exemption and Clearance levels included in

- ARPANS Regulations 2018 and
- National Directory for Radiation Protection and Nuclear Safety 2021



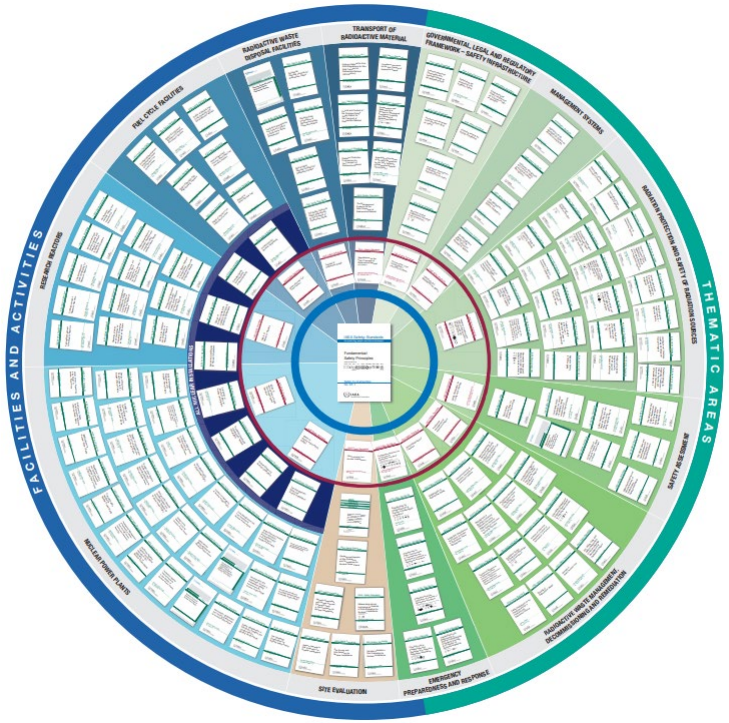




International Atomic Energy Agency

- Central intergovernmental forum for global scientific and technical co-operation
- Promotes nuclear safety and security
- Contributes to international peace and the UN Sustainable Development Goals
- Protection of people, society and the environment from the harmful effects of radiation

IAEA Safety Standards Committees



Commission on Safety Standards
Dr Gillian Hirth

- **Waste Safety Standards Committee**
- **Radiation Safety Standards Committee**
- **Nuclear Safety Standards Committee**
- **Transport Safety Standards Committee**
- **Emergency Preparedness and Response Standards Committee**
- **Nuclear Security Guidance Committee**

International

National

IAEA Safety Standards

RHC and NSC

RHSAC

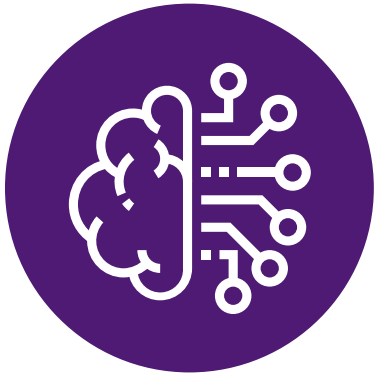
ARPANSA

Australian Public

Australian Representatives

Regulations
Codes
Standards
Guidance

Development of the IAEA exemption and clearance publication



IAEA 14-step publication process

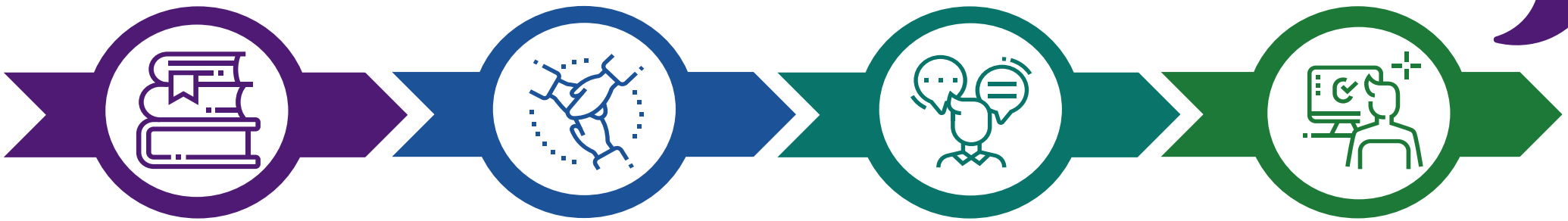
Australia advocated for industry feedback

Australia did not block international consensus

National guidance tailored to local needs

Development of the Radiation Protection Series (RPS) in Australia

For more details, attend the ARPS Conference, where two talks will cover this process



RPS Publications developed through Radiation Health Committee (RHC)

Working Groups may be formed under the RHC or NSC for specific topics (e.g. exemption and clearance)

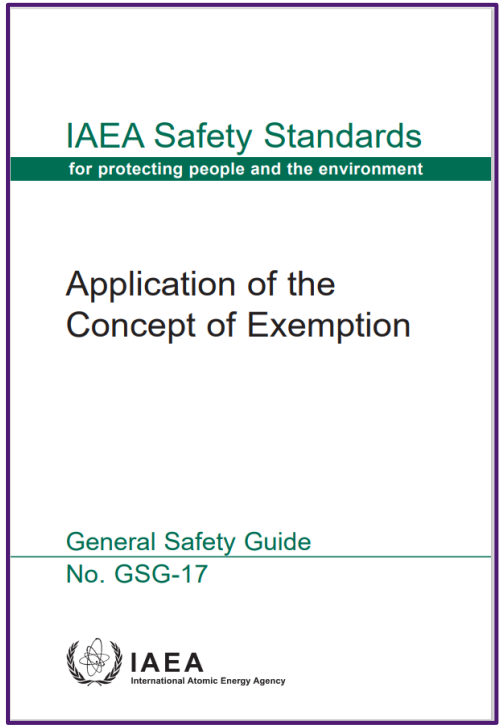
All documents undergo public consultation as required by the ARPANS Act

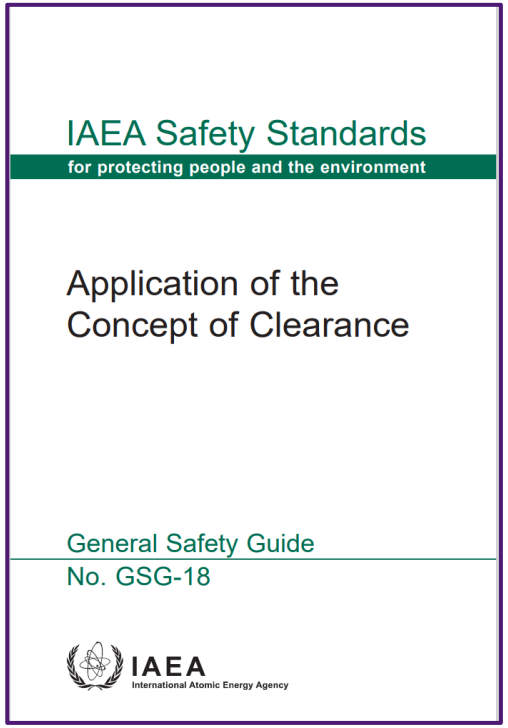
Final publications are released as part of the Radiation Protection Series on the ARPANSA website

What's next…

IAEA Publications

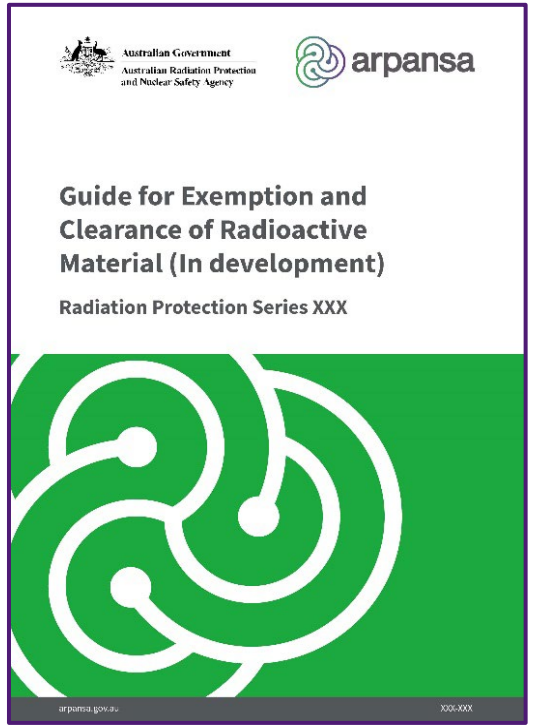
GSG-17 and GSG-18, IAEA 2023





RPS Publication

In development



Draft Guidance on the application of exemption and clearance of radioactive material in Australia

Based on international best practice

Australia needs guidance on exemption and clearance

IRRS 2018 [IAEA 2nd Integrated Regulatory Review Service mission]

Recommendation #22:

Commonwealth to adopt and implement uniform clearance levels.

No.	Recommendations	Responsible committee	Key Stakeholders	Proposed Actions
R22	The Commonwealth Government, in conjunction with the state and territory Governments, should progress the adoption and implementation of uniform clearance levels.	enHealth	ARPANSA, S/T regulators, Commonwealth Department of Health, S/T policy agencies	• NDRP2 to be updated with the requirement for jurisdictions to adopt the clearance levels in Schedule 1 of GSR Part 3. • enHealth will provide guidance on the application of clearance levels in accordance with Schedule 1 of GSR Part 3.

ACTION PLAN: **Develop exclusion, exemption & clearance guidance** for Australian jurisdictions.

ALIGN WITH: **GSR Pt3** + GSG-17/18 (new guidance) + local context + experience.

STATUS: **Project commenced** via enHealth and Radiation Health Committee (RHC).

Concepts: Exclusion, exemption and clearance

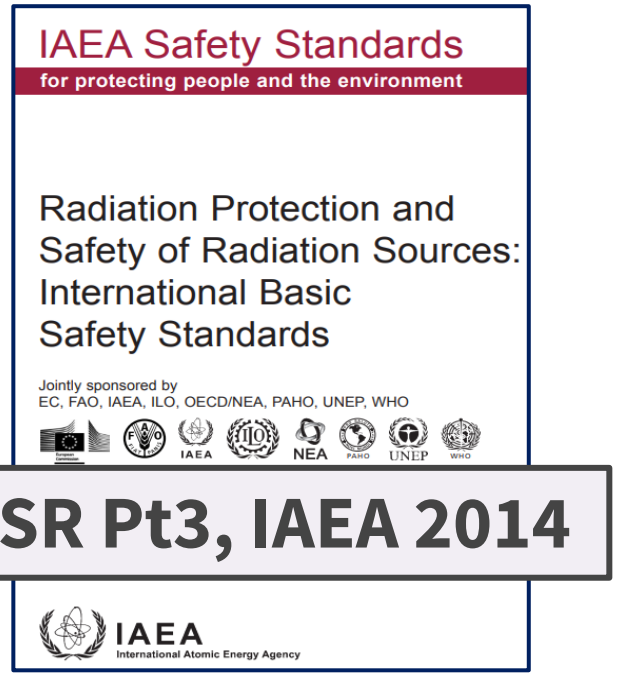
- Processes to determine the nature and extent of regulatory control
- Integral to optimisation of radiation protection

Concept	Application	
Exclusion	Exposures deemed **not amenable to control,** regardless of exposure magnitude	Decision that regulatory control is not practically possible – **Set aside 'trivial category'**
Exemption	A **source or practice** that need **not be subject** to some or all regulatory control	Typically determined **before** activities start
Clearance	A **source** within a regulated practice that is **removed from regulatory control**	Typically approved **after** regulated activities start

IAEA Standards: Applying exemption and clearance

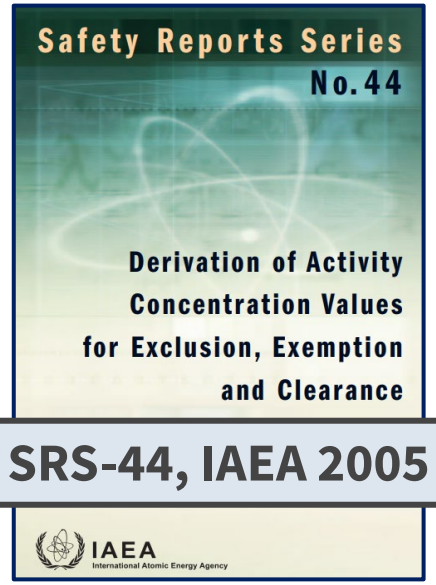
Exemption and **clearance** are enshrined in IAEA publications:

REQUIREMENTS + CRITERIA + LEVELS



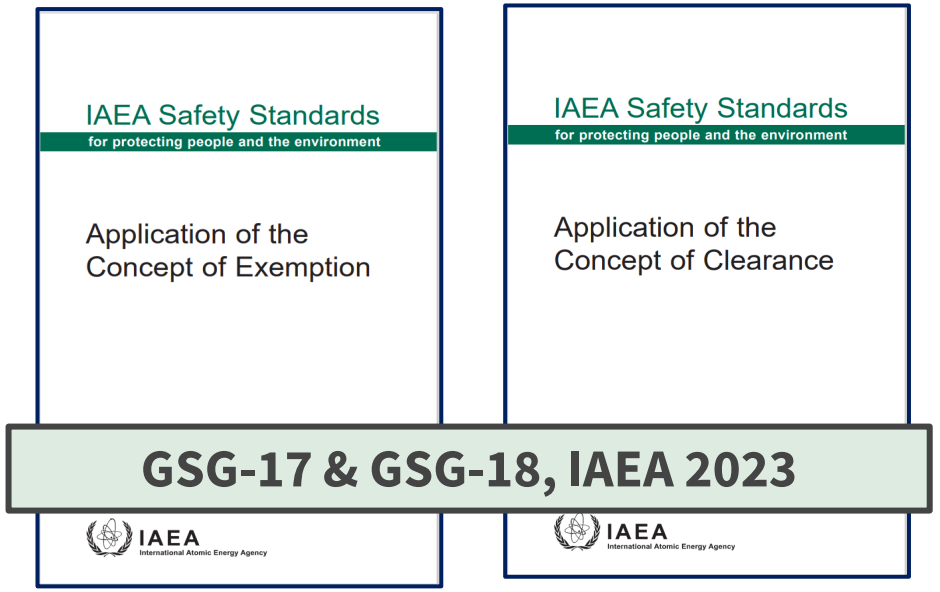
GSR Pt3, IAEA 2014

SCENARIOS + DERIVATION OF LEVELS



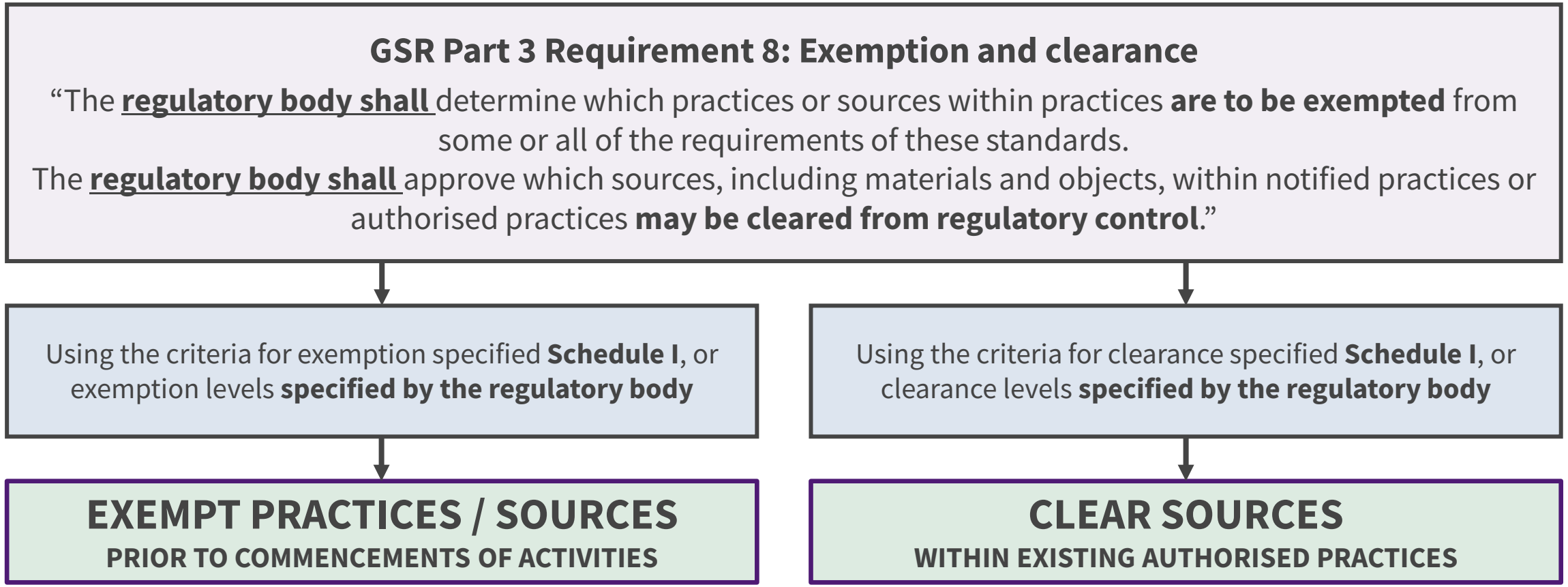
SRS-44, IAEA 2005

APPLICATION GUIDANCE



GSG-17 & GSG-18, IAEA 2023

GSR Part 3: Requirement 8 - Exemption and clearance

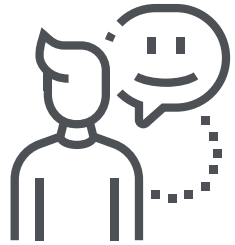


GSR Part 3: Schedule I – Primary exemption criteria

The **general criteria for exemption** of a practice or a source within a practice from some or all od the requirements of GSR Part 3 are that:

Radiation risks arising from the practice or from a source are **sufficiently low as to not warrant regulatory control** (para I.1(a))

Regulatory control of the practice or source would yield no net benefit (para I.1(b))



The **effective dose** expected to be incurred by any individual **is of the order of 10 µSv/year** (para I.2)

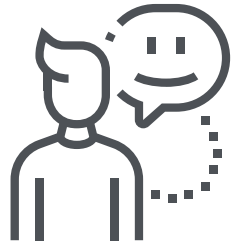
Further criteria (para I.3 (a) and (b)) point to **radionuclide exemption values**, below which **exemption may be applied without further consideration**

GSR Part 3: Schedule I – Primary clearance criteria

The **general criteria for exemption** of a practice or a source within a practice from some or all od the requirements of GSR Part 3 are that:

Radiation risks arising from the practice or from a source are **sufficiently low as to not warrant regulatory control** (para I.1(a))

Regulatory control of the practice or source would yield no net benefit (para I.1(b))



The **effective dose** expected to be incurred by any individual **is of the order of 10 µSv/year** (para I.2)

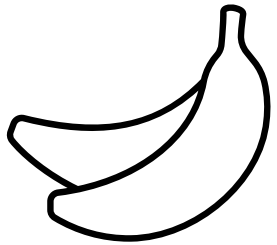
Further criteria (para I.3 (a) and (b)) point to **radionuclide clearance values**, below which **clearance may be applied without further consideration**

GSR Part 3: Para 3 – Naturals and planned exposure

Exposure due to natural sources is generally considered an **existing exposure situation,** where exemption and clearance do not apply. However, exemption and clearance do apply in **planned exposure situations,** where:

There is exposure to natural radionuclides exceeding 1 Bq/g

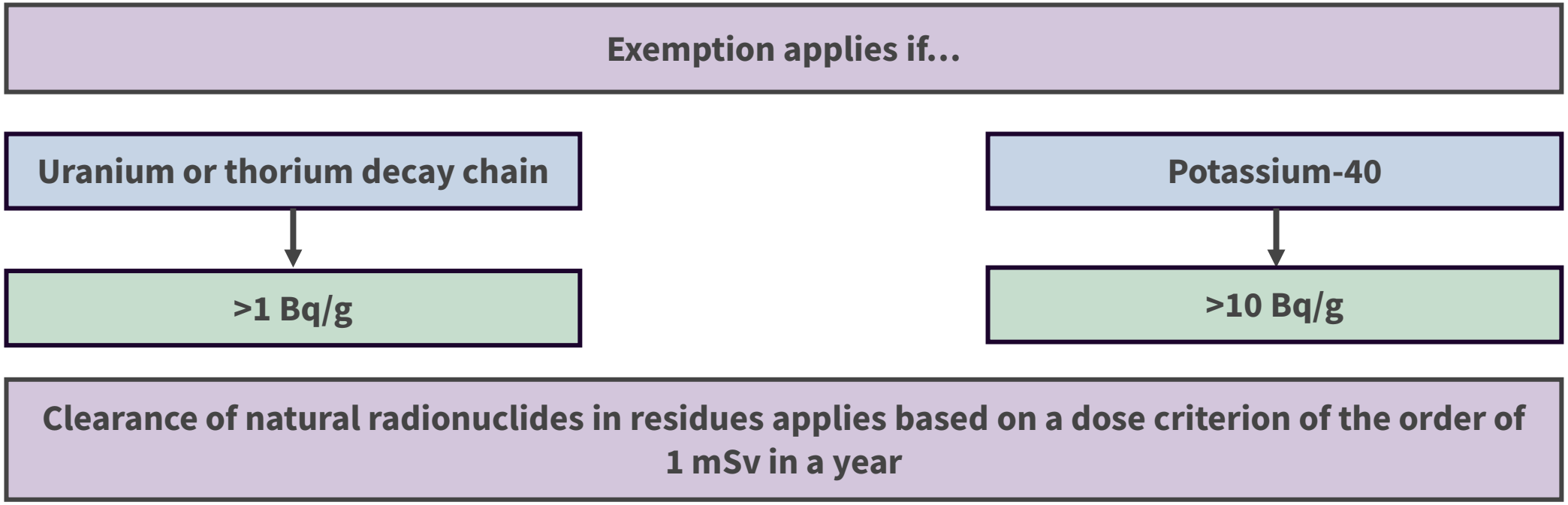
OR



There is exposure to Potassium-40 exceeding 10 Bq/g

GSR Part 3: Sch. I – Bulk naturals; exemption and clearance

For radionuclides of natural origin, exemption of bulk amounts of material is necessarily considered on a case-by-case basis by using a dose criterion of the order of 1 mSv in a year, commensurate with typical doses due to natural background levels of radiation.- IAEA GSR Part 3



GSR Part 3: Exemption and clearance levels – origins

Exemption


Commission of the European Communities

radiation protection - 65

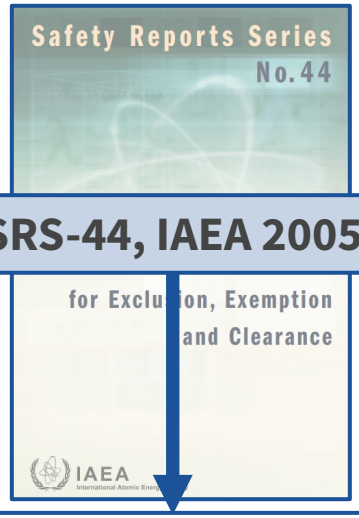
Principles and Methods for Establishing Concentrations and Quantities (Exemption values)

RP-65, EU 1993

TABLE I.1. LEVELS FOR EXEMPTION OF MODERATE AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION: EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES

Radionuclide[a]	Activity concentration (Bq/g)	Activity (Bq)	Radionuclide[a]	Activity concentration (Bq/g)	Activity (Bq)
H-3	1×10^6	1×10^9	Sc-45	1×10^2	1×10^7
Be-7	1×10^3	1×10^7	Sc-46	1×10^1	1×10^6
Be-10	1×10^4	1×10^6	Sc-47	1×10^2	1×10^6
C-11	1×10^1	1×10^6	Sc-48	1×10^1	1×10^5
C-14	1×10^4	1×10^7	Sc-49	1×10^3	1×10^5
N-13	1×10^2	1×10^9	Ti-44	1×10^1	1×10^5
Ne-19	1×10^2	1×10^9	Ti-45	1×10^1	1×10^6
O-15	1×10^2	1×10^9	V-47	1×10^1	1×10^5
F-18	1×10^1	1×10^6	V-48	1×10^1	1×10^5
Na-22	1×10^1	1×10^6	V-49	1×10^4	1×10^7
Na-24	1×10^1	1×10^5	Cr-48	1×10^2	1×10^6
Mg-28	1×10^1	1×10^5	Cr-49	1×10^1	1×10^6
Al-26	1×10^1	1×10^5	Cr-51	1×10^3	1×10^7
Si-31	1×10^3	1×10^6	Mn-51	1×10^1	1×10^5
Si-32	1×10^3	1×10^6	Mn-52	1×10^1	1×10^5
P-32	1×10^3	1×10^5	Mn-52m	1×10^1	1×10^5

Clearance


Safety Reports Series No. 44

SRS-44, IAEA 2005

for Exclusion, Exemption and Clearance

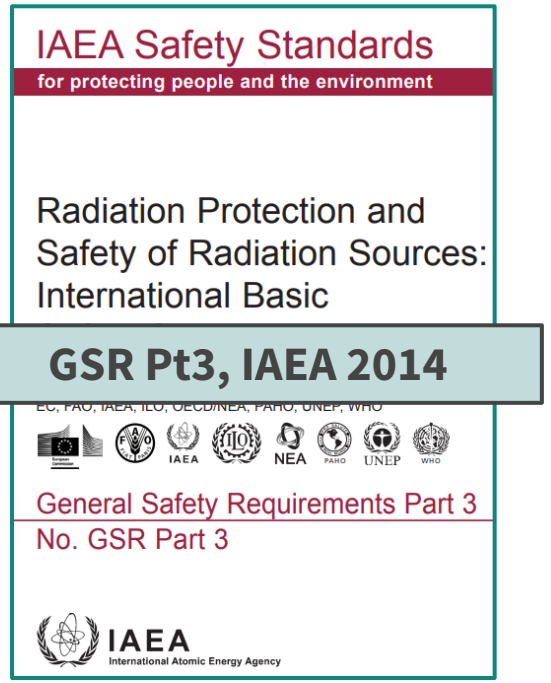
IAEA

TABLE I.2. LEVELS FOR EXEMPTION OF BULK AMOUNTS OF SOLID MATERIAL WITHOUT FURTHER CONSIDERATION AND FOR CLEARANCE OF SOLID MATERIAL WITHOUT FURTHER CONSIDERATION: ACTIVITY CONCENTRATIONS OF RADIONUCLIDES OF ARTIFICIAL ORIGIN

Radionuclide	Activity concentration (Bq/g)	Radionuclide	Activity concentration (Bq/g)
H-3	100	Co-58	1
Be-7	10	Co-58m	10 000
C-14	1	Co-60	0.1
F-18	10	Co-60m	1 000

TABLE I.3. LEVELS FOR CLEARANCE OF MATERIAL: ACTIVITY CONCENTRATIONS OF RADIONUCLIDES OF NATURAL ORIGIN

Radionuclide	Activity concentration (Bq/g)
K-40	10
Each radionuclide in the uranium decay chain or the thorium decay chain	1


IAEA Safety Standards

for protecting people and the environment

Radiation Protection and Safety of Radiation Sources: International Basic

GSR Pt3, IAEA 2014

EC, FAO, IAEA, ILO, OECD/NEA, PAHO, UNEP, WHO

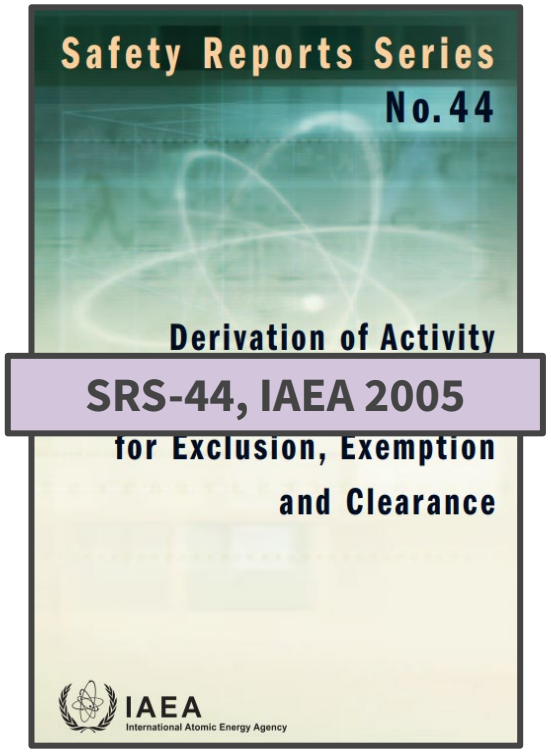
General Safety Requirements Part 3

No. GSR Part 3

IAEA International Atomic Energy Agency

- **Exemption & Clearance levels**
- **Moderate & bulk solid masses**
- **Artificial & natural RN's**

SRS-44: Clearance levels for bulk amounts of material



SRS-44, IAEA 2005

General approach

- Calculation methods
- Exposure scenarios
- Solid contamination
- Artificial and natural RNs

Realistic parameter values

10 µSv/year criterion

Low probability values

1 mSv/year criterion

Development of levels

- Dose coefficients
- Limiting pathways
- Parameter values

Bulk activity levels (Bq/g)

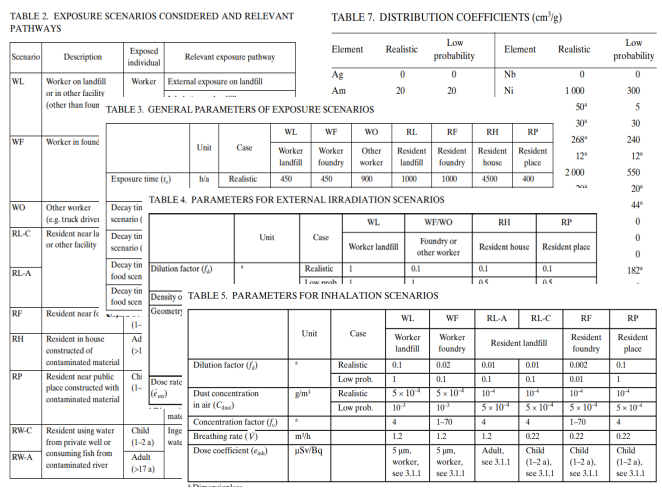


TABLE 2. EXPOSURE SCENARIOS CONSIDERED AND RELEVANT PATHWAYS

Scenario	Description	Exposed individual	Relevant exposure pathway
WL	Worker on landfill or in other facility (other than foun	Worker	External exposure on landfill
WF	Worker in found		
WO	Other worker (e.g. truck drives		
RL-C	Resident near la or other facility		
RL-A			
RF	Resident near fc		
RH	Resident in house constructed of contaminated material		
RP	Resident near public place constructed with contaminated material		
RW-C	Resident using water from private well or consuming fish from contaminated river	Child (1–2 a)	Inge wate
RW-A		Adult (>17 a)	

TABLE 7. DISTRIBUTION COEFFICIENTS (cm^3/g)

Element	Realistic	Low probability	Element	Realistic	Low probability
Ag	0	0	Nb	0	0
Am	20	20	Ni	1 000	300
				50[a]	5
				30[a]	30
				268[a]	240
				12[a]	12[a]
				2 000	550
					20[a]
					44[a]
					0
					0
					0
					182[a]

TABLE 3. GENERAL PARAMETERS OF EXPOSURE SCENARIOS

	Unit	Case	WL Worker landfill	WF Worker foundry	WO Other worker	RL Resident landfill	RF Resident foundry	RH Resident house	RP Resident place
Exposure time (t_e)	h/a	Realistic	450	450	900	1000	1000	4500	400

TABLE 4. PARAMETERS FOR EXTERNAL IRRADIATION SCENARIOS

	Unit	Case	WL Worker landfill	WF/WO Foundry or other worker	RH Resident house	RP Resident place
Dilution factor (f_d)	*	Realistic	1	0.1	0.1	0.1

TABLE 5. PARAMETERS FOR INHALATION SCENARIOS

	Unit	Case	WL Worker landfill	WF Worker foundry	RL-A Resident landfill	RL-C Resident landfill	RF Resident foundry	RP Resident place
Dilution factor (f_d)	*	Realistic	0.1	0.02	0.01	0.01	0.002	0.1
		Low prob.	1	0.1	0.1	0.1	0.01	1
Dust concentration in air (c_{air})	g/m³	Realistic	5×10^{-4}	5×10^{-4}	10^{-4}	10^{-4}	10^{-4}	10^{-4}
		Low prob.	10^{-3}	10^{-3}	5×10^{-4}	5×10^{-4}	5×10^{-4}	5×10^{-4}
Concentration factor (f_c)	*		4	1–70	4	4	1–70	4
Breathing rate (V)	m³/h		1.2	1.2	1.2	0.22	0.22	0.22
Dose coefficient (e_{inh})	µSv/Bq		5 µm, worker, see 3.1.1	5 µm, worker, see 3.1.1	Adult, see 3.1.1	Child (1–2 a), see 3.1.1	Child (1–2 a), see 3.1.1	Child (1–2 a), see 3.1.1

TABLE 15. ACTIVITY CONCENTRATION VALUES FOR BULK AMOUNTS OF RADIONUCLIDES OF ARTIFICIAL ORIGIN

Radionuclide	Concentration	Radionuclide	Concentration

TABLE 16. ACTIVITY CONCENTRATION VALUES (Bq/g) FOR RADIONUCLIDES OF NATURAL ORIGIN

Radionuclide	Concentration
K-40	10
All other radionuclides of natural origin	1

GSR Part 3: Tabulated exemption and clearance levels

Exemption	Clearance
Moderate solid mass Any radionuclides Bq/g & Bq	**Moderate** solid mass Any radionuclides Bq/g & Bq

TABLE I.1. LEVELS FOR EXEMPTION OF MODERATE AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION: EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES (cont.)

Radionuclide[a]	Activity concentration (Bq/g)	Activity (Bq)	Radionuclide[a]	Activity concentration (Bq/g)	Activity (Bq)

Exemption	Clearance
Bulk mass **Artificial** radionuclides Bq/g	**Any (bulk)** solid mass **Artificial** radionuclides Bq

TABLE I.2. LEVELS FOR EXEMPTION OF BULK AMOUNTS OF SOLID MATERIAL WITHOUT FURTHER CONSIDERATION AND FOR CLEARANCE OF SOLID MATERIAL WITHOUT FURTHER CONSIDERATION: ACTIVITY CONCENTRATIONS OF RADIONUCLIDES OF ARTIFICIAL ORIGIN

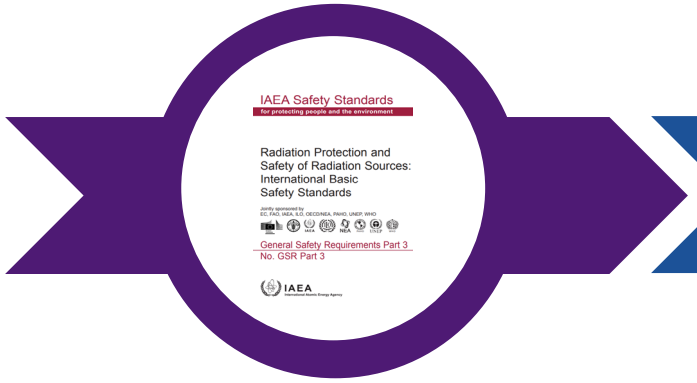
Radionuclide	Activity concentration (Bq/g)	Radionuclide	Activity concentration (Bq/g)

Exemption	Clearance
Bulk mass **Natural** radionuclides Bq/g	**Any (bulk)** solid mass **Natural** radionuclides Bq/g

TABLE I.3. LEVELS FOR CLEARANCE OF MATERIAL: ACTIVITY CONCENTRATIONS OF RADIONUCLIDES OF NATURAL ORIGIN

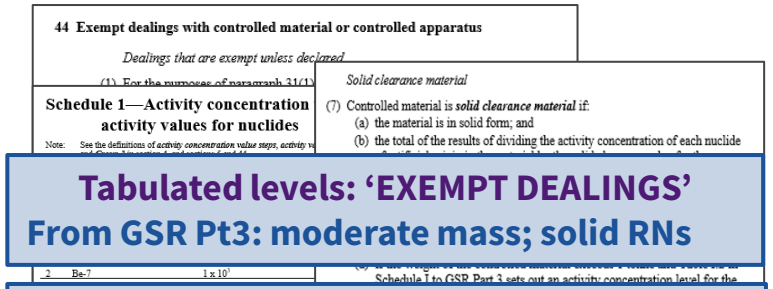
Radionuclide	Activity concentration (Bq/g)
K-40	10
Each radionuclide in the uranium decay chain or the thorium decay chain	1

How does Australia implement exemption and clearance?



IAEA GSR Part 3 (2014)

ARPANS Regs (2018)



Tabulated levels: 'EXEMPT DEALINGS'
From GSR Pt3: moderate mass; solid RNs

Referenced levels: 'SOLID CLEARANCE MATERIALS'
Points to GSR Pt3: any mass; solid RNs

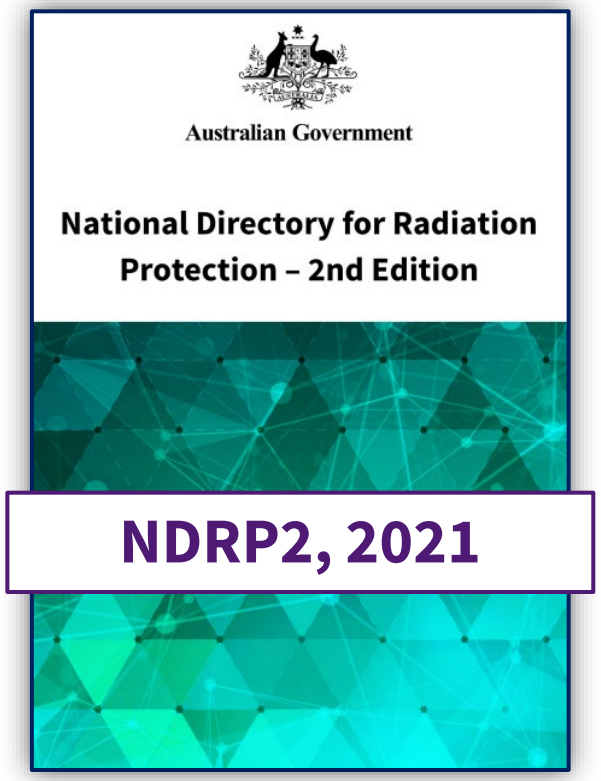
NDRP2 (2021)

References GSR Part 3 exemption & clearance levels

Adopted by the Commonwealth

States & Territory adoption / alignment varies

NDRP2: Implementation of exemption and clearance



Exemption	"The determination by a regulatory body that a source or **practice need not be subject to some or all aspects of regulatory control** on the basis that the exposure and the potential exposure due to the source or practice are **too small to warrant the application** of those aspects or that **exemption is the optimum option for protection** irrespective of the actual level of the doses or risks"

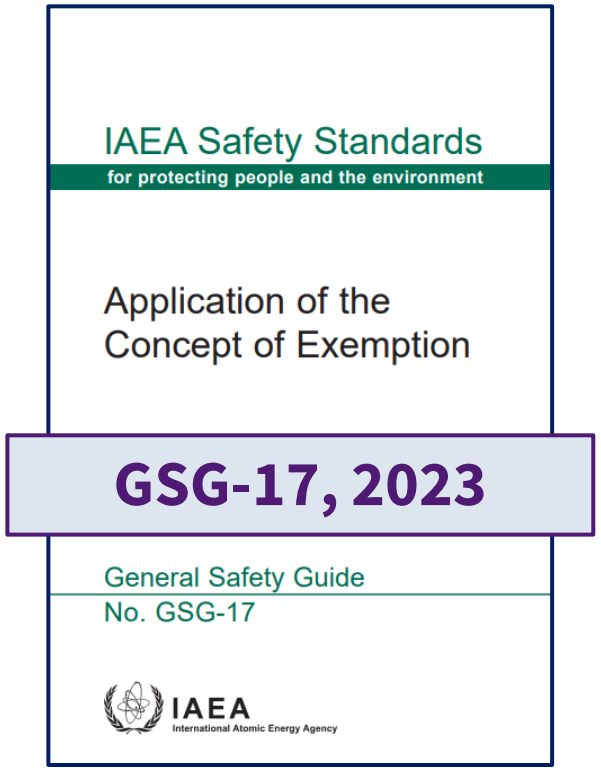
Jurisdictions agree to exempt from notification, licensing and registration requirements those sources that meet Requirement 8, paragraphs 3.10 and 3.11 of the International Atomic Energy Agency, GSR Part 3 and Schedule 2 of this document.

Clearance	"**Removal of regulatory control** by the Authority from radioactive material or radioactive objects within notified or authorised facilities and activities (from page 22 of the IAEA Safety Glossary 2016)"

Jurisdictions agree to clear from regulatory control those sources, including materials and objects, within notified or authorised practices, in accordance with Requirement 8, paragraph of GSR Part 3.

GSR Part 3 Reference: **REQ #8, Paras 3.10, 3.11, 3.1 > Schedule I Criteria > Tabulated Levels**

GSG-17: International guidance for exemption



2. THE CONCEPTS OF EXCLUSION, EXEMPTION AND CLEARANCE (2.1) 5

Exposure situations (2.2–2.6) 5
The concept of exclusion (2.7, 2.8) 7
The concept of exemption (2.9–2.13) 7
The concept of clearance (2.14, 2.15) 9
The role of exemption in planned exposure situations (2.16–2.30) . . . 10

3. ROLES AND RESPONSIBILITIES IN RELATION TO THE EXEMPTION OF PRACTICES AND SOURCES 14

Government and regulatory body (3.1–3.6) 14
Applicant (3.7–3.9) 15

4. GENERIC EXEMPTION OF PRACTICES OR SOURCES (4.1–4.11) 16

Generic exemption levels for moderate amounts of material (4.12–4.15) 18
Generic exemption levels for bulk amounts of solid material (4.16–4.22) 19
Generic exemption levels for mixtures of radionuclides (4.23–4.28) . 20
Limitations of applicability of generic exemption levels (4.29–4.31) . 22
Dilution (4.32) 22
Generic exemption of practices using radiation generators (4.33–4.35) 23

5. SPECIFIC EXEMPTION OF PRACTICES OR SOURCES (5.1–5.3) 23

Safety assessment (5.4–5.9) 24
Examples of the application of specific exemption (5.10–5.24) 25
Summary flow charts (5.25) 29

6. VERIFICATION, REVISION AND REVOCATION OF EXEMPTION 31

Verification of compliance with exemption levels (6.1–6.4) 31
Revocation and revision of exemptions (6.5–6.7) 31

7. USE OF SCREENING VALUES IN EXISTING EXPOSURE SITUATIONS (7.1–7.14) 32

APPENDIX I EXEMPTION LEVELS FROM SCHEDULE I OF GSR PART 3 . . . 37

APPENDIX II: VERIFICATION OF COMPLIANCE WITH EXEMPTION LEVELS 98

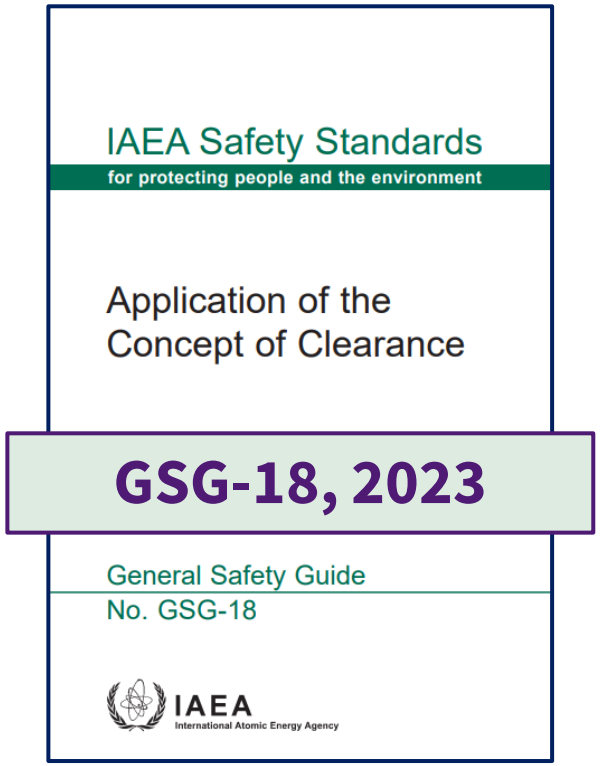
REFERENCES 105

ANNEX I: EXAMPLES OF DETERMINING EXEMPTION FOR MATERIALS CONTAINING MORE THAN ONE RADIONUCLIDE 109

ANNEX II EXAMPLES OF DOSIMETRIC MODELS FOR SURFACE CONTAMINATED ITEMS . . . 111

ANNEX III: EXAMPLES OF SCREENING VALUES APPLIED IN CASES OF EXISTING EXPOSURE SITUATIONS 116

GSG-18: International guidance for clearance



REGULATORY FRAMEWORK FOR CLEARANCE (2.1–2.12)

The concept of exclusion (2.13)
Responsibilities of the regulatory body in relation to clearance (2.14–2.28)
Responsibilities of the operating organization for clearance (2.29–2.36)
Organization and implementation of the clearance process (2.37–2.39)
Application of a graded approach to clearance (2.40–2.44)

GENERAL ASPECTS OF CLEARANCE (3.1, 3.2)

Consideration of clearance for materials containing more than one radionuclide (3.3–3.8)
Characterization of material for clearance purposes (3.9–3.24)
Management of the clearance process (3.25–3.35)

CLEARANCE OF SOLID MATERIAL (4.1, 4.2)

Activity concentration criteria for generic clearance (4.3–4.11)
Conservatism in the derivation of generic activity concentration clearance levels (4.12–4.16)
Surface contamination clearance levels (4.17–4.22)
Averaging masses and areas for clearance purposes (4.23–4.37)
Implementation of clearance measurements (4.38–4.56)
Consideration of uncertainties in clearance measurements (4.57, 4.58)
Mixing and dilution of materials being considered for clearance (4.59–4.63)

5. CLEARANCE OF LIQUIDS . . . 45
Differences between the discharge and clearance of liquids (5.1–5.3) . . . 45
Aspects of liquids relevant to clearance (5.4–5.7) . . . 47
Nature and scope of clearance for liquids (5.8–5.10) . . . 47
Practical application of the concept of clearance to liquids (5.11–5.15) . . . 49
Dilution of liquids being considered for clearance (5.16, 5.17) . . . 50
Background radiation in the clearance of liquids (5.18) . . . 50

6. CLEARANCE OF GASES . . . 51
Differences between the discharge and clearance of gases (6.1, 6.2) . . . 51
Practical application of concept of clearance to gases (6.3–6.5) . . . 51

7. THE APPLICATION OF SPECIFIC CLEARANCE (7.1–7.7) . . . 52
Specific clearance as an additional option for management of material (7.8, 7.9) . . . 54
Derivation and use of specific clearance levels (7.10–7.14) . . . 54
Surface contamination clearance levels for specific clearance (7.15–7.22) . . . 55
Meeting the conditions attached to specific clearance (7.23–7.29) . . . 57

8. ENGAGING INTERESTED PARTIES AND ENHANCING PUBLIC UNDERSTANDING OF CLEARANCE (8.1–8.7) . . . 59

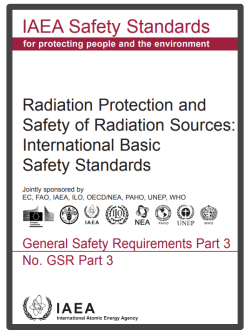
APPENDIX: SCREENING LEVELS FOR RECYCLING OR DISPOSAL IN LANDFILLS OF MATERIAL AND WASTE IN A POST-EMERGENCY SITUATION . . . 63

REFERENCES . . . 65

ANNEX I: DOSIMETRIC MODELLING FOR DERIVATION OF RADIONUCLIDE SPECIFIC VALUES FOR CLEARANCE BASED ON SURFACE CONTAMINATION MEASUREMENTS . . . 69

ANNEX II: EXAMPLES OF SURFACE CONTAMINATION VALUES FOR GENERIC CLEARANCE . . . 80

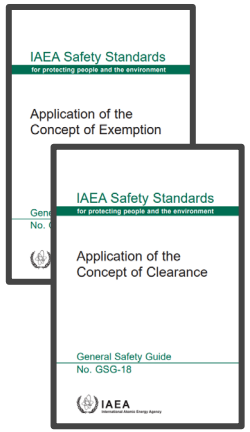
GSR Part 3 vs GSG-17/18 terminology



GSR Part 3

"Radioactive material within a notified practice or an authorized practice may be cleared **without further consideration** provided that:…"

On the basis of GSR Part 3 Activity Limits



GSG-17
GSG-18

"**Generic clearance:** clearance on the basis of the clearance levels provided in schedule I of GSR Part 3 or of any set of values […]"
"**Specific clearance:** clearance on the basis of any other clearance levels derived for specific situations, materials […]"

Generic:
On the basis of GSR Part 3 Activity Limits

Specific:
Limits derived on a case-by-case basis

Draft Australian guidance – exemption outline

Criteria for generic and specific exemption

Specific exemption criteria for other sources:
- **Surface-contaminated objects (SCOs)**
- **Consumer products**
- **Type-approved equipment**

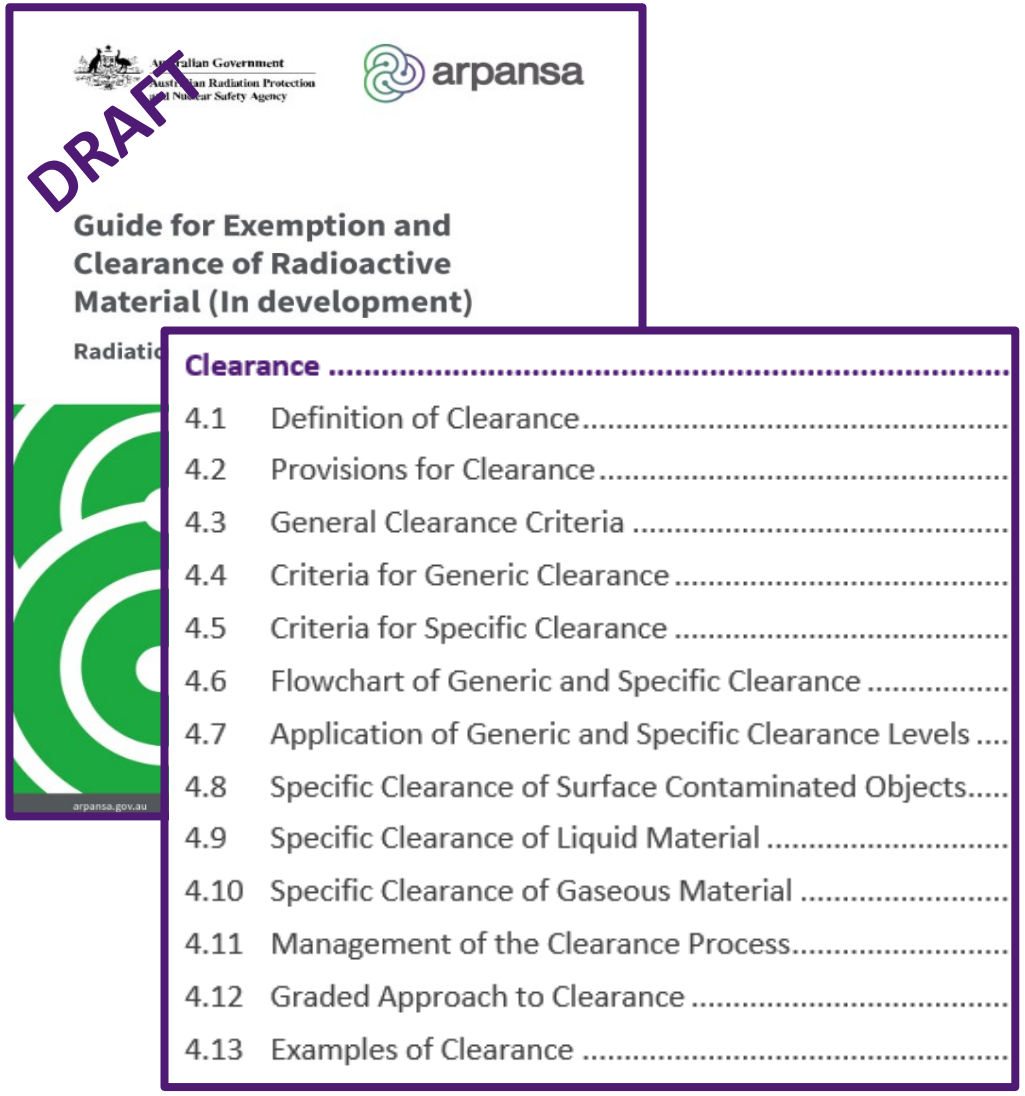
Management of the exemption process, flowcharts

Graded approach to exemption

Safety assessments for exemption

Example determination of exemption levels:
- **Solids, SCOs, liquids, gases**
- **Specific scenarios and material of interest**

Draft Australian guidance – clearance outline



Criteria for generic and specific clearance

Specific clearance criteria for other sources:
- **Surface-contaminated objects (SCOs)**
- **Liquids and gases**

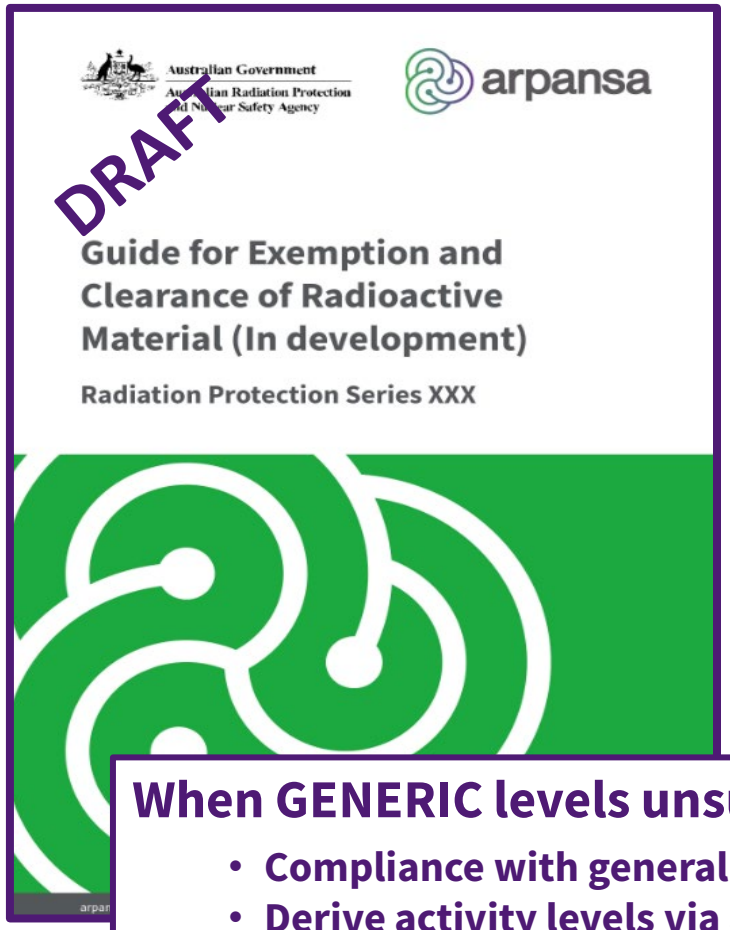
Management of the clearance process, flowcharts

Graded approach to clearance

Safety assessments for clearance

Example determination of clearance levels:
- **Solids, SCOs, liquids, gases**
- **Specific scenarios and material of interest**

Draft Australian guidance – specific exemption and clearance



Application of Specific Exemption Criteria

In case a practice or source within a practice does not comply with generic **exemption** requirements, or they cannot be applied, the regulator will consider a case-by-case (specific) **exemption**. Examples of specific **exemption** cases include, but are not limited to, bulk amounts of solid materials with radionuclides of natural origin, bulk amounts of liquids and gases with radionuclides of any origin, surface-contaminated commodities, and certain consumer products.

To qualify for specific **exemption**, a person or organization should demonstrate that the intended practice:

- is justified, and
- complies with the general criteria for **exemption** as per GSR Part 3 paragraph I.1 (i.e. radiation risks are sufficiently low, and regulatory control would yield no benefit), and
- complies with other relevant general criteria for **exemption** of GSR Part 3 Schedule I, such as dose criteria specified in paragraphs I.2 (10 µSv per year for all cases) and I.4 (1 mSv per year for bulk amounts of material containing natural radionuclides).

To be granted a specific **exemption**, planned activities must be analysed via an appropriate safety assessment for compliance with these general criteria for **exemption**. See [Appendix II – Safety Assessment] for general guidance on safety assessments.

When GENERIC levels unsuitable, case-by-case SPECIFIC levels may be derived:

- **Compliance with general criteria of GSR Pt3**
- **Derive activity levels via a Safety Assessment**
- **Use first principles / best-practice examples / regulatory guidance**

Draft Australian guidance – example generic scenarios

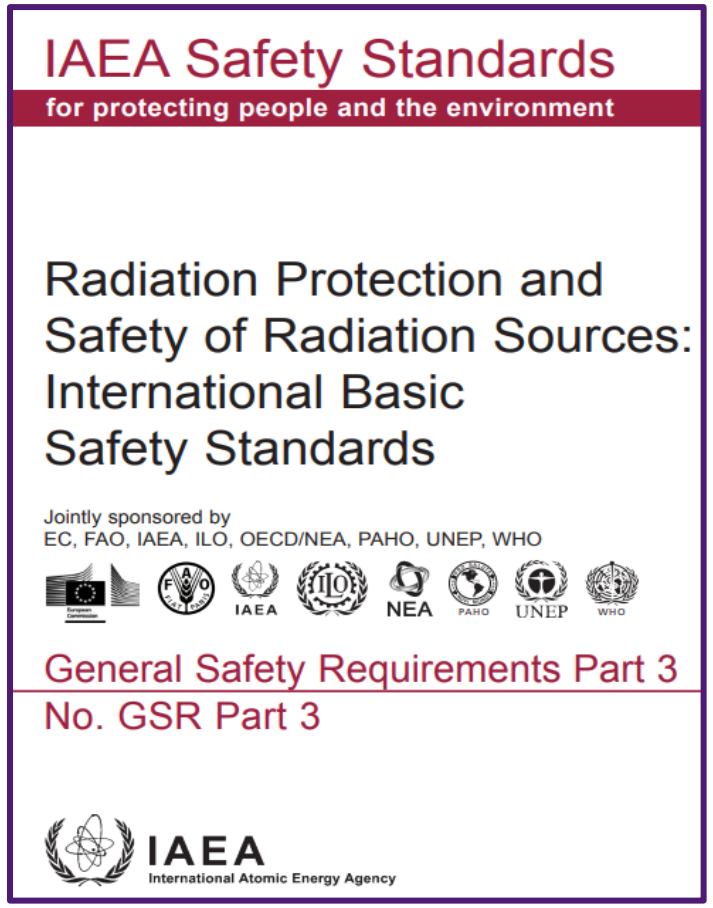


TABLE I.1. LEVELS FOR EXEMPTION OF MODERATE AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION: EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES

Radionuclide[a]	Activity concentration (Bq/g)	Activity (Bq)	Radionuclide[a]	con
H-3	1×10^6	1×10^9	Sc-45	
Be-7	1×10^3	1×10^7	Sc-46	
Be-10	1×10^4	1×10^6	Sc-47	
C-11	1×10^1	1×10^6	Sc-48	
C-14	1×10^4	1×10^7	Sc-49	
N-13	1×10^2	1×10^9	Ti-44	
Ne-19	1×10^2	1×10^9	Ti-45	
O-15	1×10^2	1×10^9	V-47	
F-18	1×10^1	1×10^6	V-48	
Na-22				
Na-24				
Mg-28				
Al-26				
Si-31				
Si-32				
P-32				

TABLE I.2. LEVELS FOR EXEMPTION OF BULK AMOUNTS OF SOLID MATERIAL WITHOUT FURTHER CONSIDERATION AND FOR CLEARANCE OF SOLID MATERIAL WITHOUT FURTHER CONSIDERATION: ACTIVITY CONCENTRATIONS OF RADIONUCLIDES OF ARTIFICIAL ORIGIN

Radionuclide	Activity concentration (Bq/g)	Radionuclide	Activity concentration (Bq/g)
H-3	100	Co-58	1
Be-7	10	Co-58m	10 000
C-14	1	Co-60	0.1
F-18	10	Co-60m	1 000
		Co-61	100
		Co-62m	10
		Ni-59	100
		Ni-63	100
		Ni-65	10
		Cu-64	100
		Zn-65	0.1
		Zn-69	1 000
		Zn-69m[a]	10
		Ga-72	10
		Ge-71	10 000
		As-73	1 000
		As-74	10

I.14. For clearance of radioactive material containing more than one radionuclide of artificial origin, on the basis of the levels given in Table I.2 (p. 124), the condition for clearance is that the sum of the activity concentrations for individual radionuclides is less than the derived clearance level for the mixture (X_m), determined as follows:

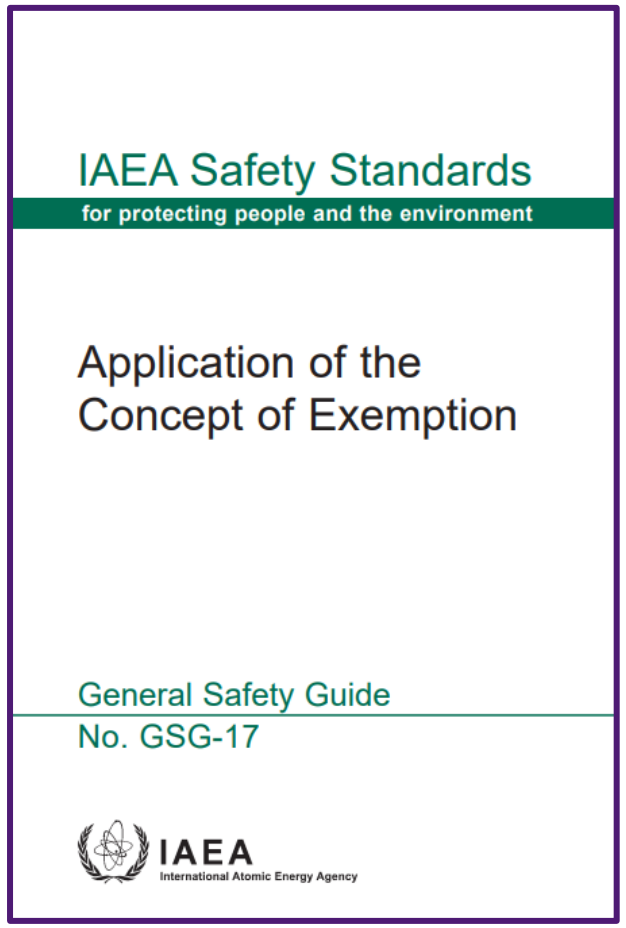
$$X_m = \frac{1}{\sum_{i=1}^{n} \frac{f(i)}{X(i)}} \qquad (I.2)$$

where

$f(i)$ is the fraction of activity concentration of radionuclide i in the mixture;
$X(i)$ is the applicable level for radionuclide i as given in Table I.2;

and n is the number of radionuclides present.

Draft AU guidance – example specific exemption scenarios

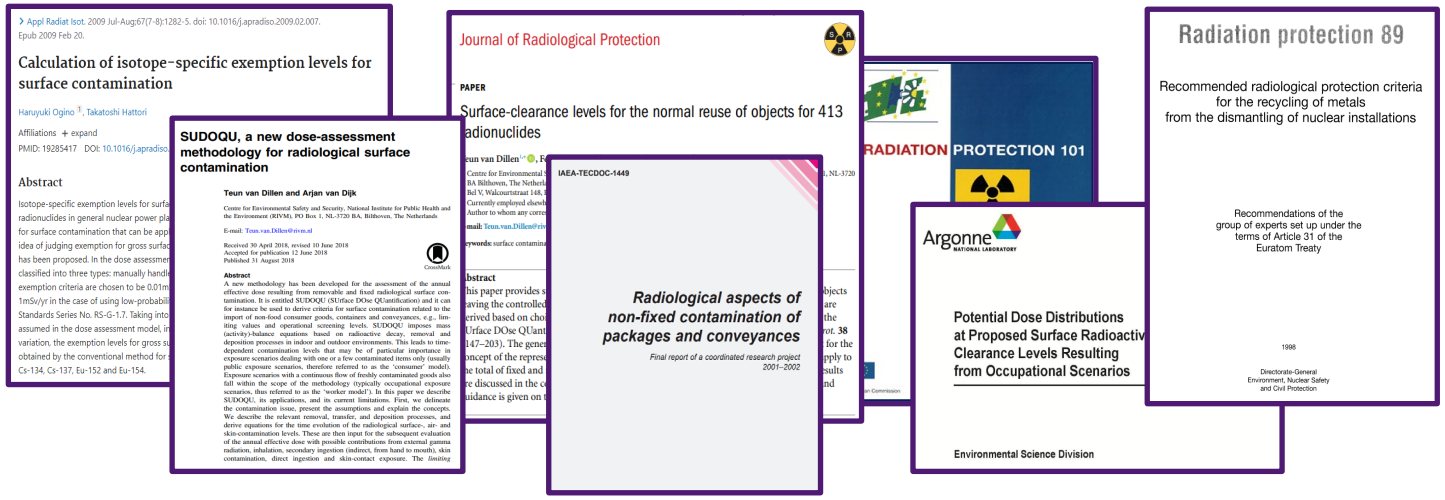


ANNEX II EXAMPLES OF DOSIMETRIC MODELS FOR SURFACE CONTAMINATED ITEMS 56

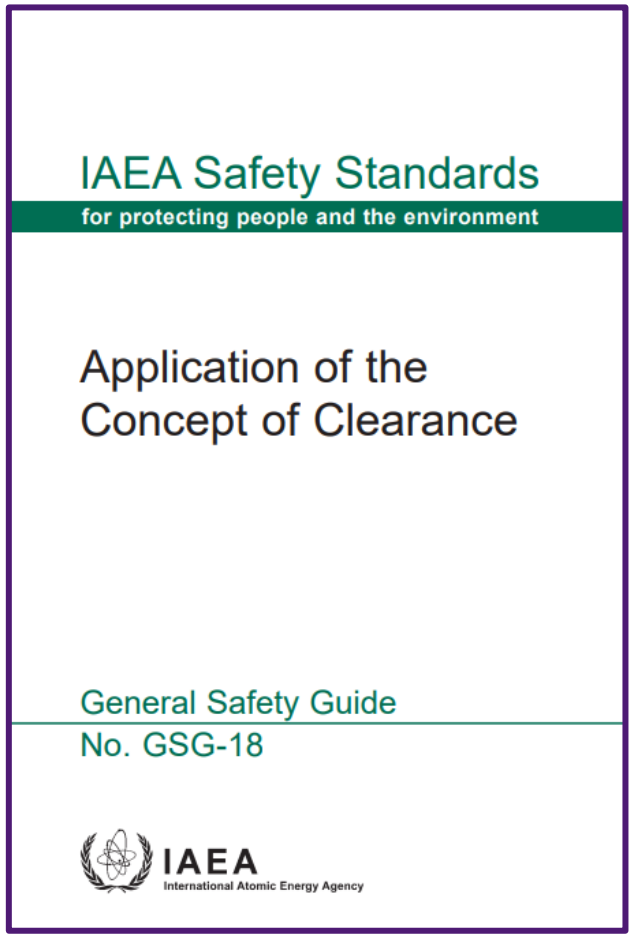
ANNEX III EXAMPLES OF SCREENING VALUES APPLIED IN CASES OF EXISTING EXPOSURE SITUATIONS 61

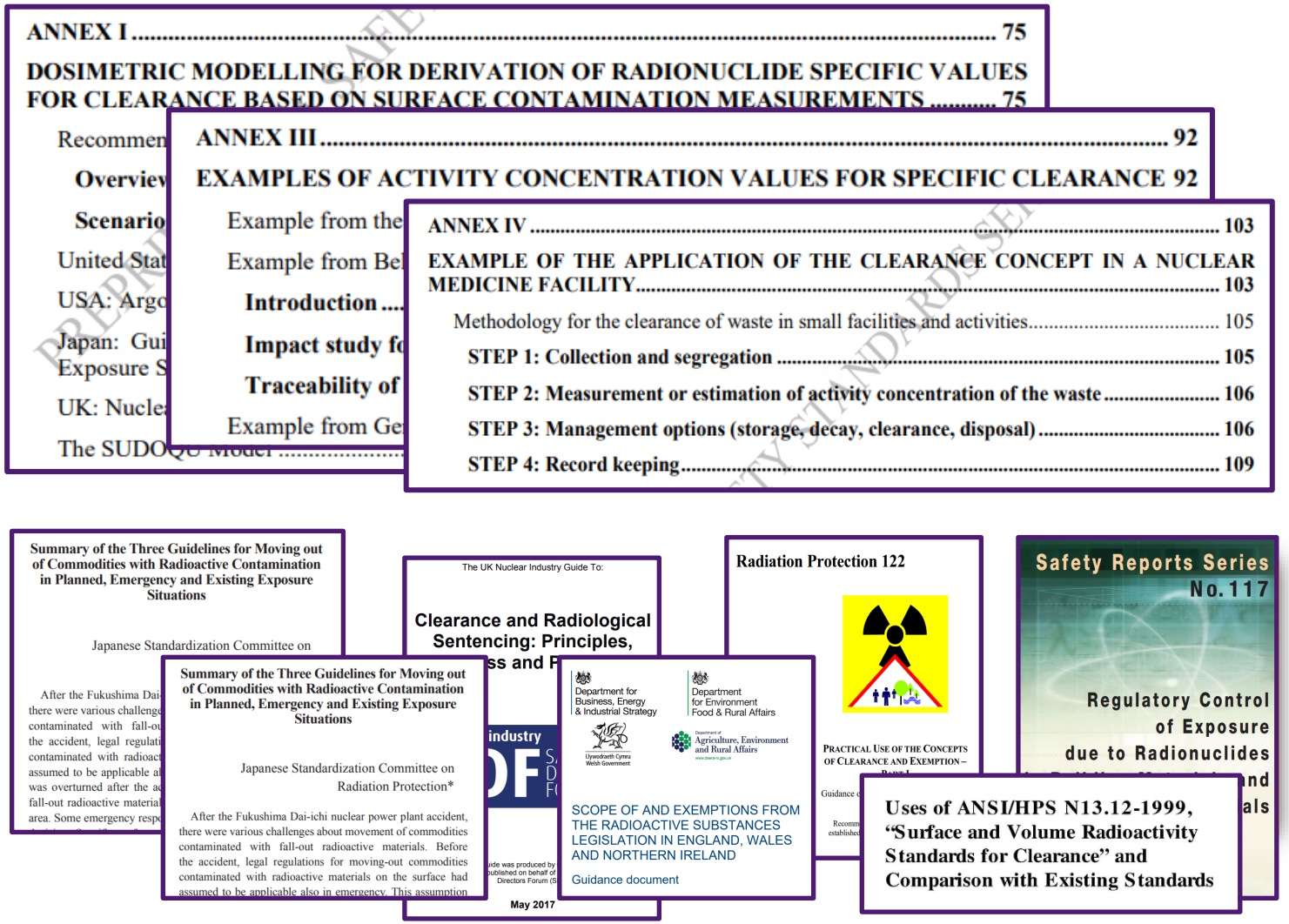
EXAMPLE 1: SCREENING VALUES APPLIED AFTER THE FUKUSHIMA DIIACHI ACCIDENT 61

EXAMPLE 2: SCREENING VALUES APPLIED FOR CONSTRUCTION MATERIALS 67



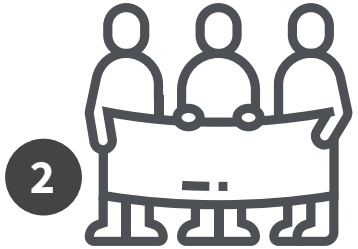
Draft AU guidance – example specific clearance scenarios



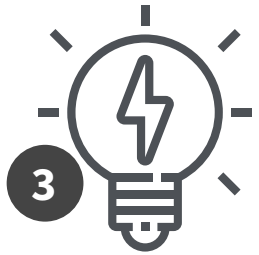


Draft AU guidance – ongoing development

Gather and respond to feedback



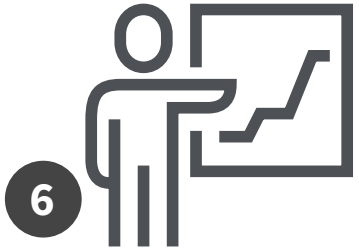
Reference and develop relevant example scenarios



Optimise the balance: detail vs external references

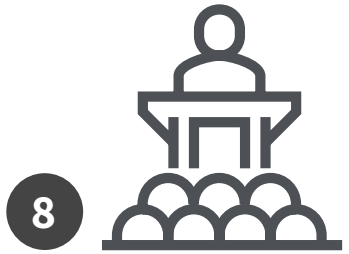
Clarify expectations and processes

Detail aspects of the Safety Assessment



Clarify the graded approach

Investigate related scenario / dose assessment software



Promote awareness

Engage with experts and establish focus groups

Australian Government

Australian Radiation Protection and Nuclear Safety Agency

arpansa

Exemption and clearance scenarios

GSR Part 3 Exemption and clearance values

- Schedule I of GSR Part 3 provides **safety requirements for exemption, clearance and exclusion**.
  - Values of activity concentration for exemption and clearance are determined so that individual effective doses are in the order of 10 μSv/year (realistic) and 1 mSv/year (low probability).
- **Clearance Derivations are in IAEA's SRS-44**.
  - Provides a set of radiological scenarios for different exposure pathways that relate activity concentration to individual doses.
- **Exemption Derivations are in EU-RP-65**.
  - Provides a set of radiological scenarios for different exposure pathways that relate activity concentration to individual doses.

GSR Part 3 Clearance values

Exposure pathways and scenarios in SRS-44

Exposure scenarios and pathways in SRS-44

Scenario	Description	Exposed individual	Relevant exposure pathway
WL	Worker on landfill or in other facility (other than foundry)	Worker	External exposure on landfill
			Inhalation on landfill
			Direct ingestion of contaminated material
WF	Worker in foundry	Worker	External exposure in foundry from equipment or scrap pile
			Inhalation in foundry
			Direct ingestion of contaminated material
WO	Other worker (e.g. truck driver)	Worker	External exposure from equipment or the load on the truck

Exposure scenarios and pathways in SRS-44

Scenario	Description	Exposed individual	Relevant exposure pathway
RL-C	Resident near landfill or other facility	Child (1-2 a)	Inhalation near landfill or other facility
			Ingestion of contaminated foodstuffs grown on contaminated land
RL-A		Adult (>17 a)	Inhalation near landfill or other facility
			Ingestion of contaminated foodstuffs grown on contaminated land
RF	Resident near foundry	Child (1-2 a)	Inhalation near foundry
RH	Resident in house constructed from contaminated material	Adult (>17 a)	External exposure in house

Exposure scenarios and pathways in SRS-44

Scenario	Description	Exposed individual	Relevant exposure pathway
RP	Resident near public place constructed with contaminated material	Child (1-2 a)	External exposure
			Inhalation of contaminated dust
			Direct ingestion of contaminated material
RW-C	Resident using water from private well or consuming fish from contaminated river	Child (1-2 a)	Ingestion of contaminated drinking water, fish and other foodstuffs)
RW-A		Adult (>17 a)	

Limiting scenarios in SRS-44

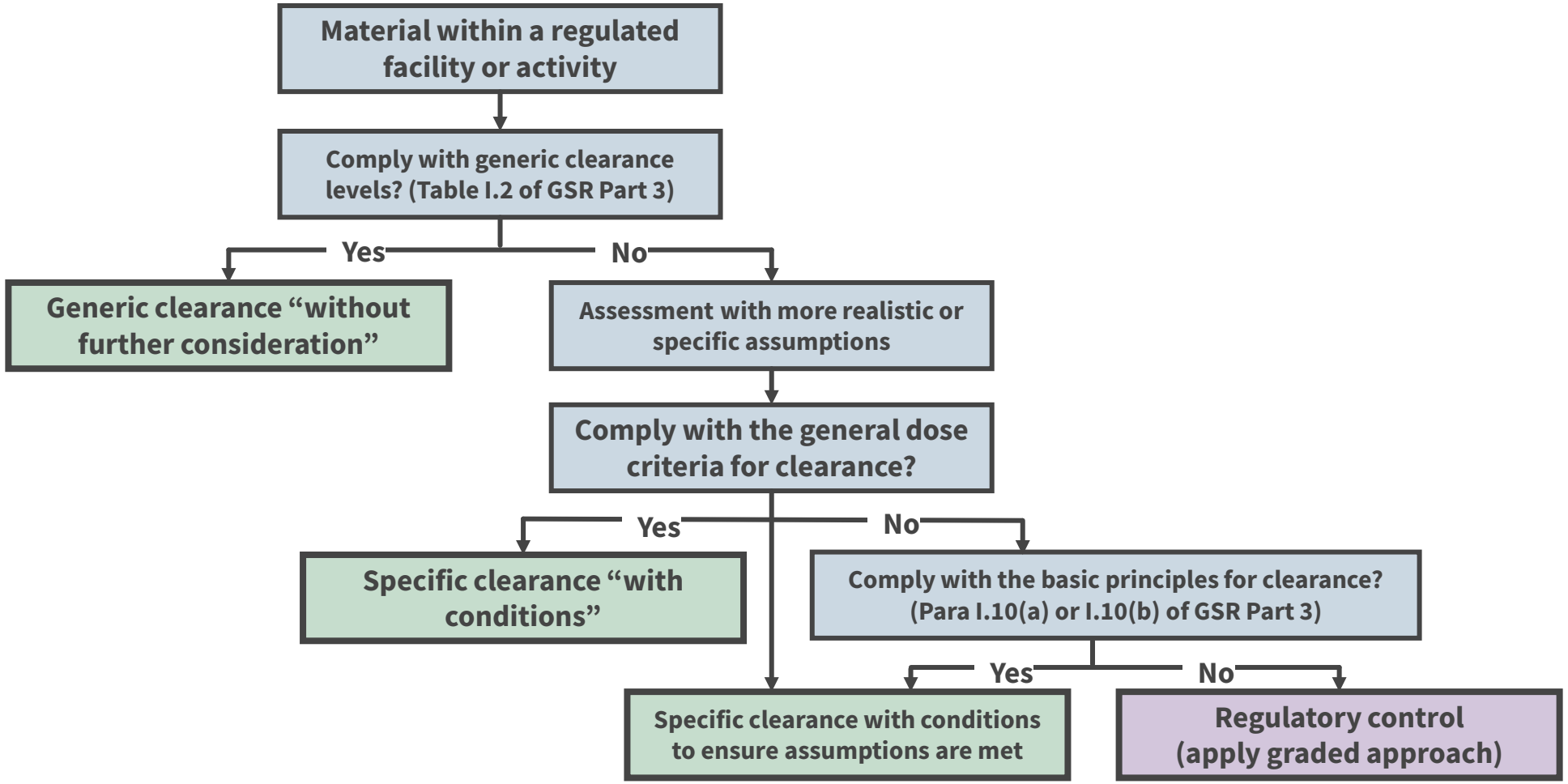
Radionuclide	Maximum effective dose	Corresponding scenario
Co-60	3.23E+02	RH
Cs-137	8.43E+01	RH
Ra-226	N/A	N/A
U-232	1.88E+02	RH

Realistic scenario

Radionuclide	Maximum effective dose	Corresponding scenario
Co-60	3.15E+03	RH
Cs-137	8.20E+02	RH
Ra-226	N/A	N/A
U-232	1.83E+03	RH

Low-probability scenario

Clearance application flowchart



GSR Part 3 Exemption values

Exposure pathways and scenarios in EU-RP-65

Exposure scenarios and pathways in EU-RP-65

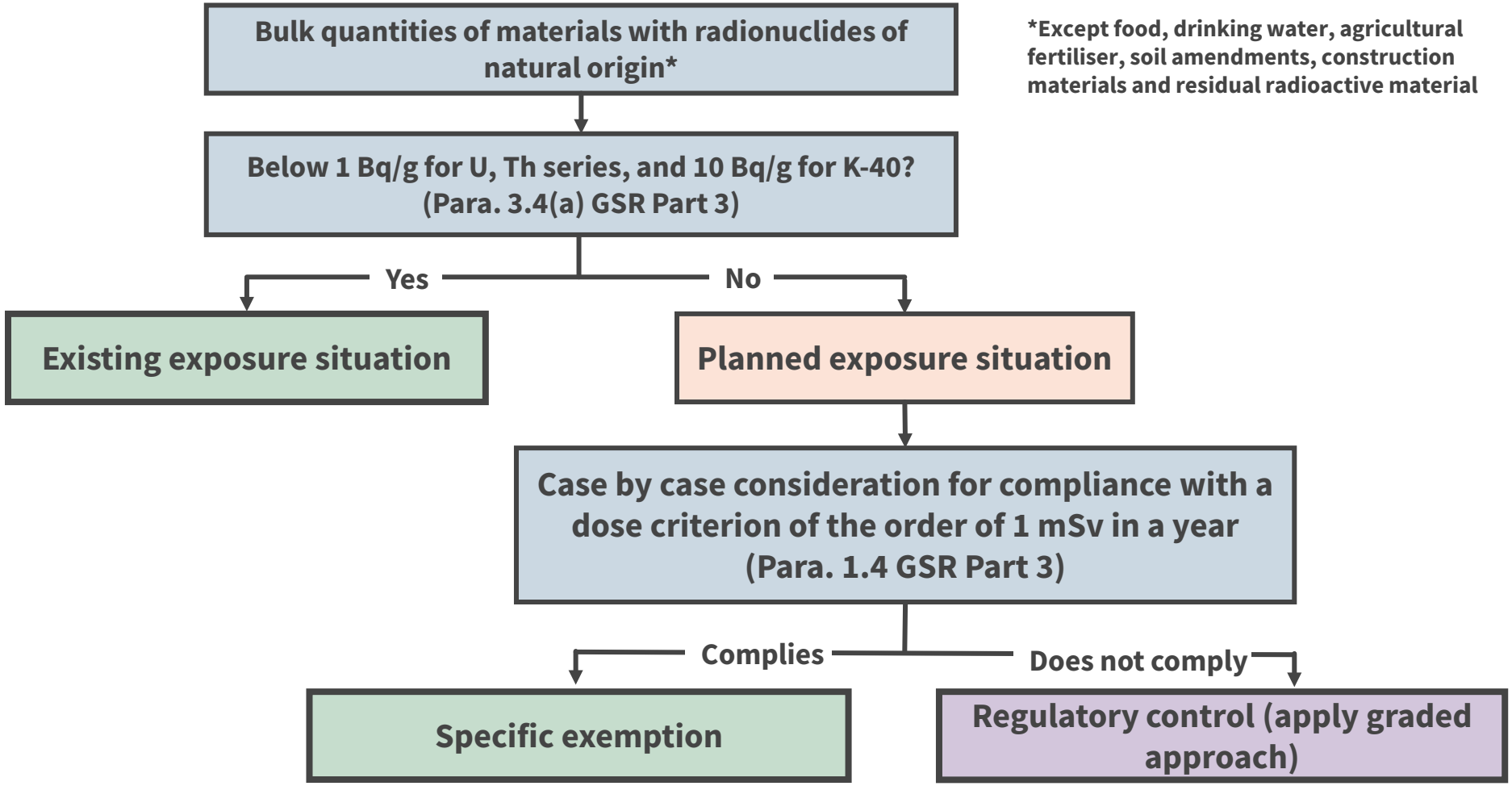
Scenario	Description	Exposed individual	Relevant exposure pathway
Normal use scenario	This scenario represents normal use of the source by an operator in the course of the individuals work. Only doses to the person(s) using the source.	Adult (>17)	External exposure
			Inhalation of contaminated dust
			Direct ingestion of contaminated material
Accidental (workplace) scenario	This scenario represents exposure arising from accidents and misuse in the workplace.	Adult (>17)	External exposure
			Inhalation of contaminated dust
			Direct ingestion of contaminated material
Disposal (public) scenario	The disposal scenario for activity concentrations considers the exposure of a member of the public who is visiting a landfill site in which a radioactive source has been disposed.	Adult (>17)	External exposure
			Inhalation of contaminated dust
			Direct ingestion of contaminated material

Radionuclides of natural origin

*"For radionuclides of natural origin, exemption of bulk amounts of material is necessarily considered on a **case-by-case basis** by using a **dose criterion of the order of 1 mSv in a year**, commensurate with typical doses due to natural background levels of radiation."*

GSR Part (3) Para. 3.4(a)- any practice involving material with an activity concentration of any radionuclide in the uranium or thorium decay chain **above 1 Bq/g, or above 10 Bq/g for 40K**, is required to be treated as a **planned exposure situation**.

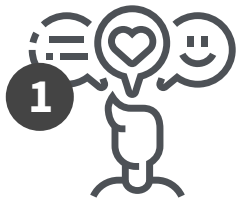
Exemption application for materials with radionuclides of natural origin



*Except food, drinking water, agricultural fertiliser, soil amendments, construction materials and residual radioactive material

Coffee break

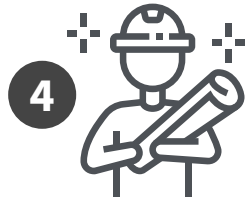
Background



Working group requested scenarios from RHC representatives for what they would like to see in the Safety Guide

ARPANSA reviewing 8 of the 13 scenarios submitted to assess for applicability in Australian regulatory context

Scenarios assessed and benchmarked against international equivalents to ensure global alignment



RHC members asked to provide list of stakeholders to participate in webinar and future consultation activities

Scenario overview

Clearance of surface contaminated scrap metal and building materials

Recycled and reused material used in construction of a home

Check sources for quality control purposes

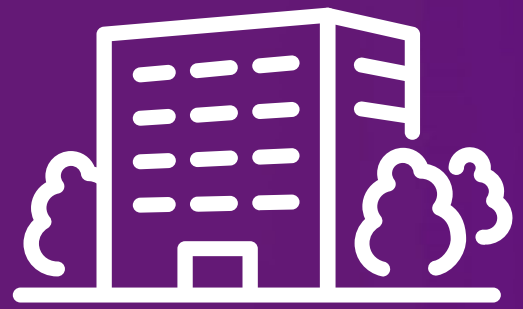
Sealed source for therapeutic purposes

Clearance of solid waste materials

Clearance of liquid waste materials

Clearance process in a hospital setting

Clearance process in a small laboratory



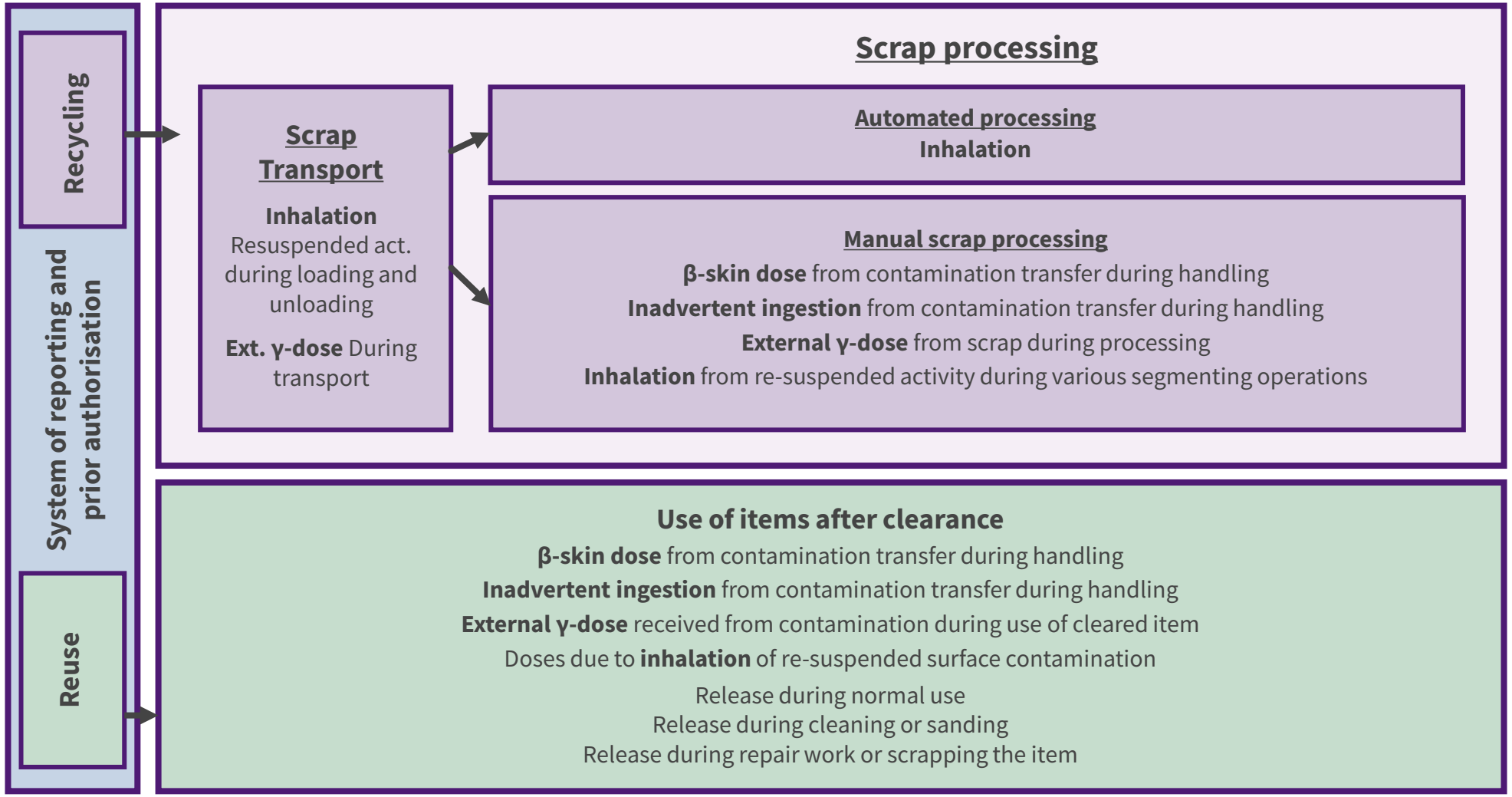
Clearance of surface contaminated scrap metal and building materials

Surface contaminated scrap metal and building materials

How can the Safety Guide be applied to the clearance of surface contaminated scrap metal and buildings?

- Scenario from European Commission report '*Basis for the definition of surface contamination clearance levels for the recycling or reuse of metals arising from the dismantling of nuclear installations*'.
- **Recycling and reuse are considered separately**.

Recycling and reuse flowchart



Surface contaminated scrap metal and building materials

NUREG-1640 (USA)

- Aimed at deriving activity concentration clearance levels for the **recycling and disposal of scrap metals and concrete**.
- Uses a **mass to surface ratio conversion factor**.
- Used by regulatory body to assist with evaluating exposure scenarios, but not to make decisions.

Argonne National Laboratory (USA)

- Evaluates **potential dose distribution from surface contamination** against **occupational dose limit**.
- Considers **multiple exposure pathways for two scenarios** – workers using a large warehouse and small office, and workers using a desk.
- Dose criteria in the range of **50-100 µSv per year**.

Japanese Health Physics Society

- Focus on **removing objects from controlled areas and the handling of small objects**.
- Three scenarios considered, objects contaminated with **Cs137 and Co60**.
- Surface contamination clearance levels for large objects determined too conservative for small objects.

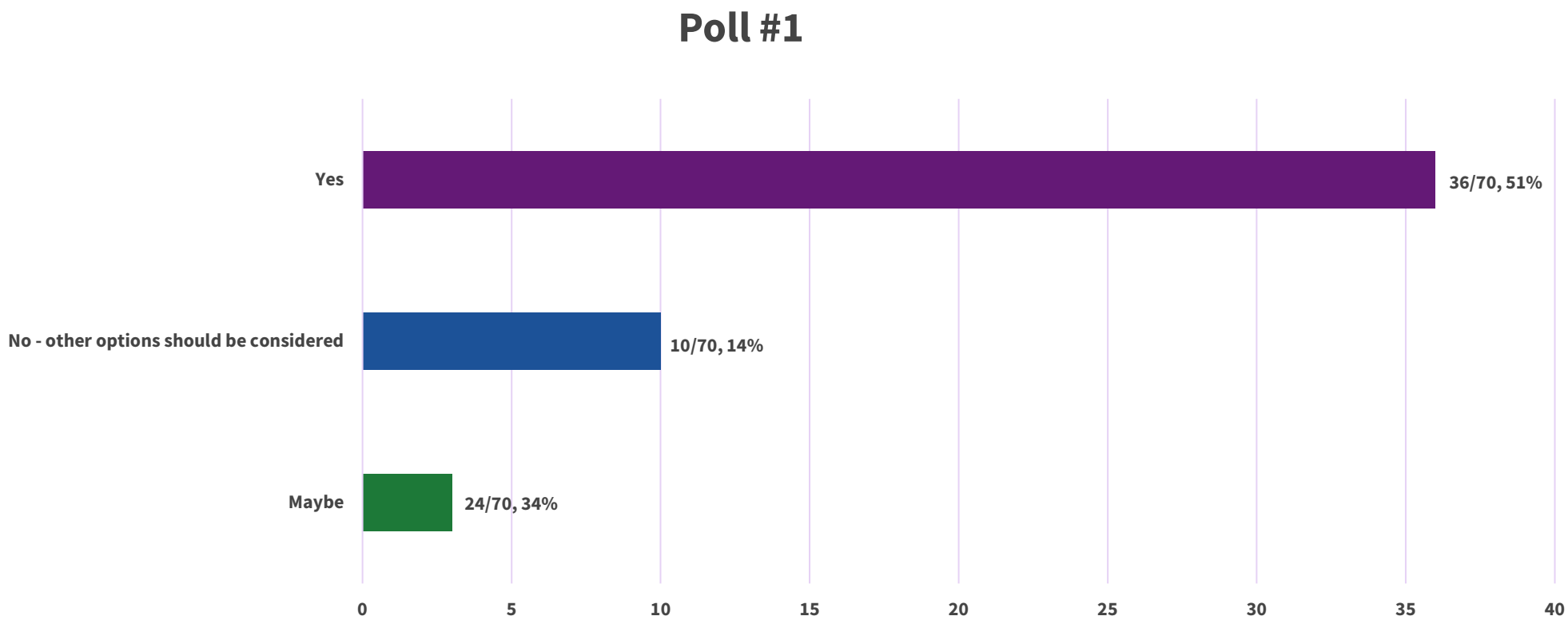
Surface contaminated objects

- **NUREG/CR-5512 – *Residual Radioactive Contamination from Decommissioning (USA):***
  - Provides details generic scenario and modelling analysis.
  - Considers individual who is assumed to occupy a contaminated commercial facility and receives chronic exposure over a full work year.
- **SUDOQU model – SUrface DOse QUantification (Belgium)**
  - Evaluates annual effective dose to **members of the public** resulting from exposure to surface contaminated objects.
  - Multiple scenarios used to calculate surface contamination levels and compared to an effective dose of 10 µSv per year.

Poll #1

Are the scenarios presented for clearance of surface contaminated scrap metal and buildings suitable for inclusion in the Guide?

Poll #1 Results



Recycled and reused material used in construction of a home

Recycled and reused material used in construction of a home

How can the Safety Guide be applied to the clearance of materials from an operation that may give rise to doses in excess of the public limit?

IAEA

IAEA GSR Part 3-Requirement 51:

*"the **regulatory body** or other relevant authority **establish reference levels for building and construction materials."***

Reference level not exceeding 1 mSv/year for existing buildings and newly constructed ones.

Germany

Requirements for building and construction materials, including a **reference level of 1 mSv/year for external exposure from natural radionuclides.**

Measured by **activity concentration index-** estimate **whether the use of a material might lead to an annual dose exceeding 1 mSv/year.**

Radiation Protection Ordinance

Nordic Countries

Developed a screening tool for a simple calculation of an activity index based on activity concentrations.

If the calculation is below a threshold set in the national regulations, the use of the construction material is expected to comply with the **reference level of 1 mSv/year**

Radiation Protection Authorities in Denmark, Finland, Iceland, Norway and Sweden

Recycled and reused material used in construction of a house

How can the Safety Guide be applied to the clearance of materials from an operation that may give rise to doses in excess of the public limit?

- SRS-44 (RH Scenario).
- Contaminated building materials (building rubble, scrap metal, etc) used in construction of a house.
- **Adult occupies house for 4500 hours per year and receives external exposure.**

European Union approach – excess exposure

Annual excess effective dose received by a worker or an occupant due to radiation emitted from construction materials

Scenario 1: Member of Public whole year outdoors	**Outdoors 8750 h**	**External gamma radiation from ground (terrestrial) External cosmic radiation**
Scenario 2: Member of Public whole year indoors	**Indoors 8750 h**	**External gamma radiation from construction and building materials**
Scenario 3: Member of Public Representative of the population	**Outdoors: 1750 h Indoors: 7000 h**	**External gamma radiation from construction and building materials**

Excess dose =

Occupancy factor= 0.9

X

Effective dose from Scenario 2

- 1 (Attenuation$_{terrestrial}$)

X

Effective dose from Scenario 1- terrestrial exposure

- 1 (Attenuation$_{cosmic}$)

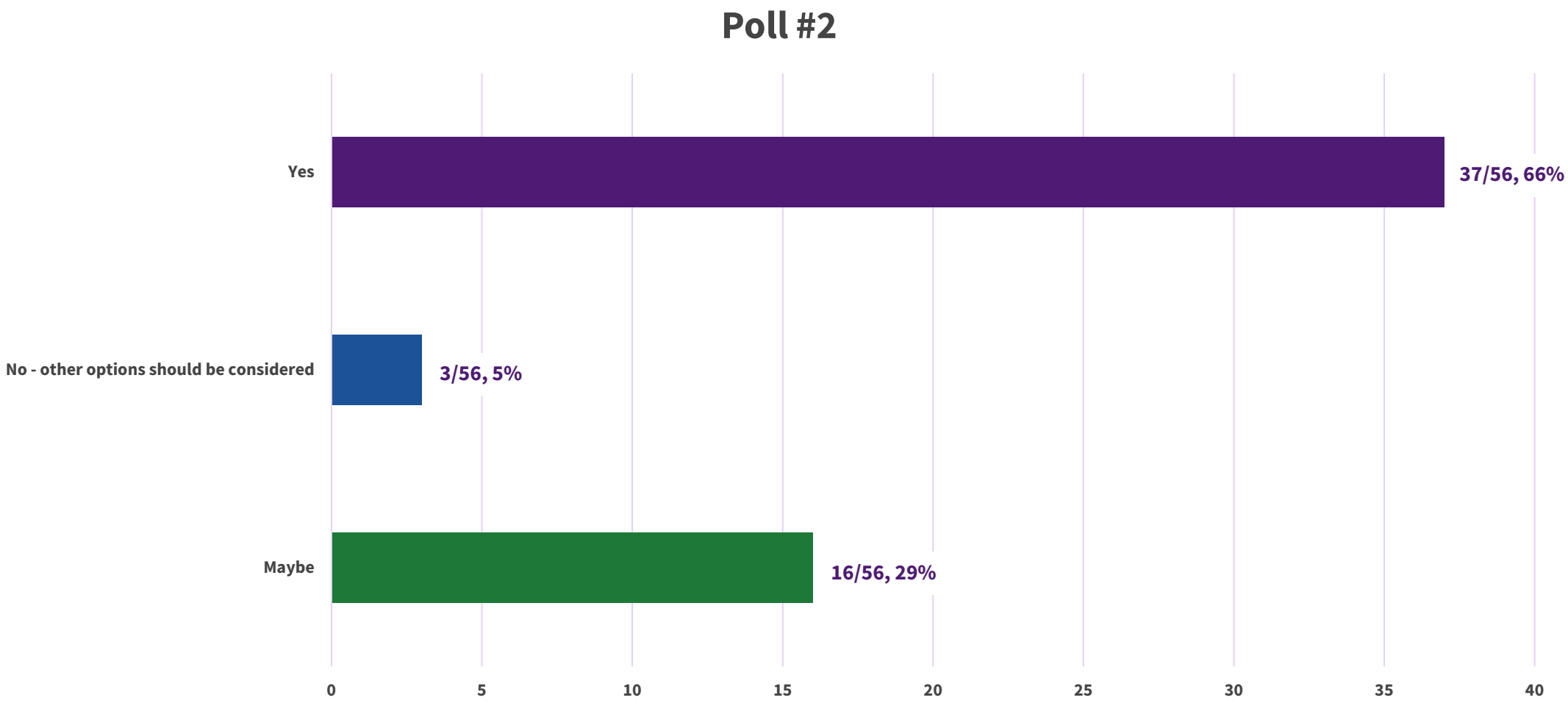
X

Effective dose from Scenario 1- cosmic exposure

Poll #2

Are the scenarios outlined for the use of recycled and reused materials in the construction of a house fit for purpose for the safety guide?

Poll #2 Results



Check sources for quality control purposes

Check sources for quality control purposes

How can the Safety Guide be applied to the exemption of check sources used for quality control purposes?

Germany

The radioactivity of the contained nuclides is **10 times or less than the generic exemption criteria.**

The radiation **dose rate does not exceed 1 µSv per hour at 0.1 m** from the source.

IAEA

IAEA GSG-17 (2023)– Specific Exemption of equipment containing radioactive material:

Sealed source and the equipment **does not cause an ambient dose equivalent rate exceeding 1 µSv/h at a distance of 0.1 m** from any accessible surface of the equipment.

Canada

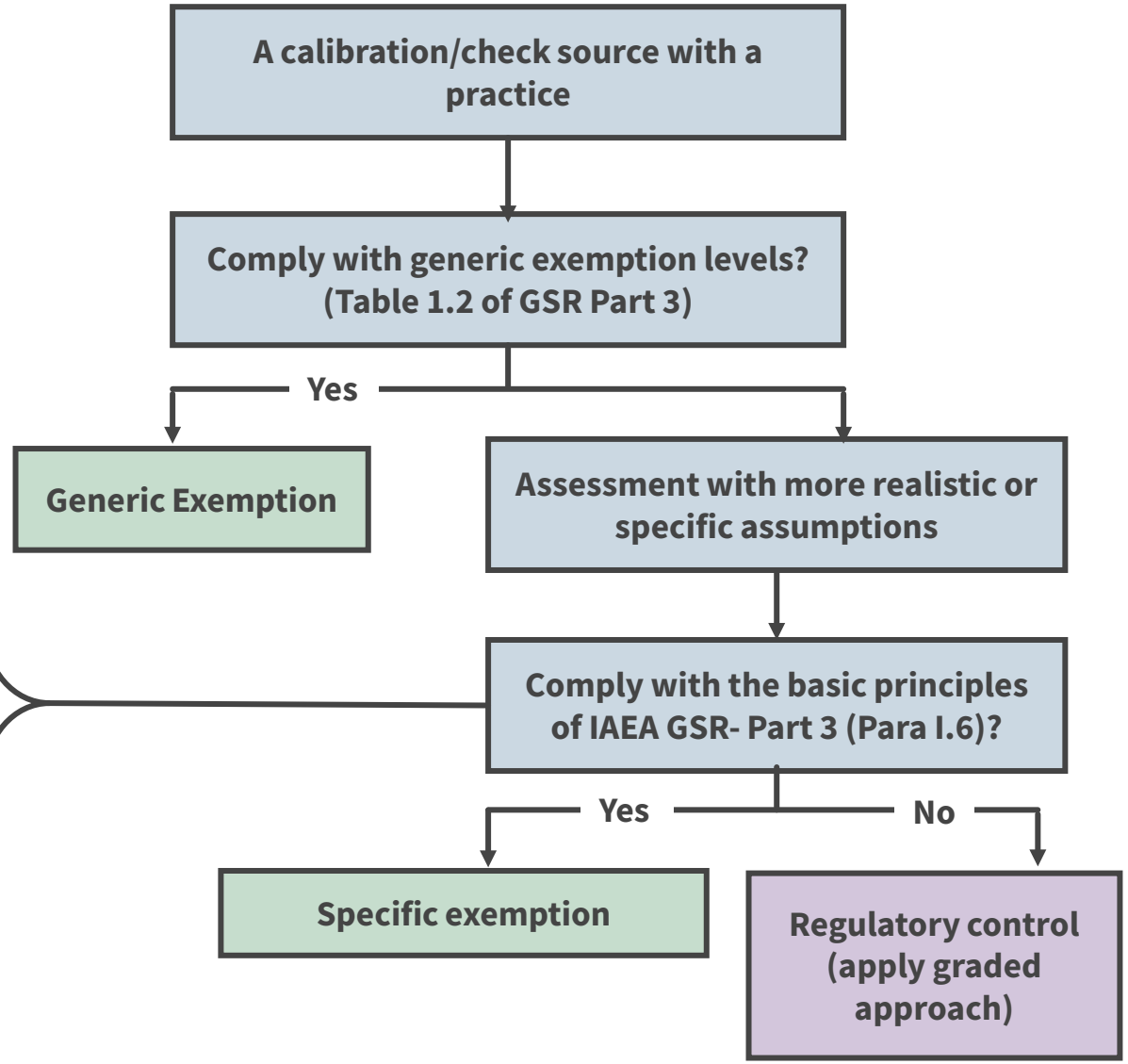
Specific Exemption:

- Check source contains not more than 370 kBq of a nuclear substance and does not emit alpha radiation; or
- Not more than 3.7 kBq of a nuclear substance if the atomic number is greater than 81.
- The radiation **dose rate does not exceed 1 µSv per hour at 0.1 m** from the source.

Check sources

Comply with the basic principles of IAEA GSR Part-3 for equipment containing radioactive material- specific exemption

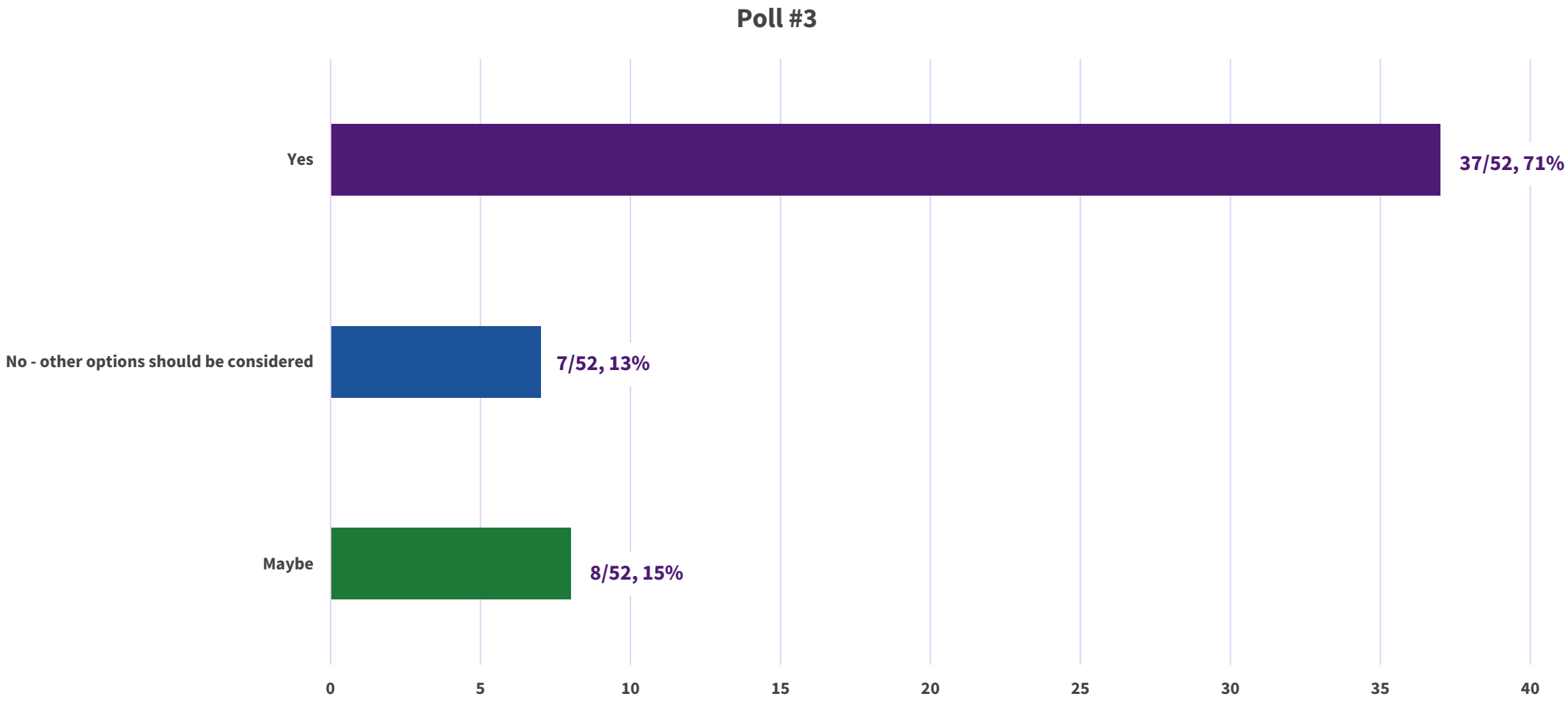
- Equipment containing radioactive material is of a **type approved by the regulator**
- Radioactive material in the form of a **sealed source** or is in the form of an **unsealed source in a small amount**
- Normal operating conditions- ambient dose does not exceed **not exceed 1 µSv per hour at 0.1 m** from the source



Poll #3

Are the scenarios presented for exemption of check sources for quality control purposes suitable for inclusion in the Guide?

Poll #3 Results



Sealed sources for therapeutic purposes

Sealed source for therapeutic purposes

How can the Safety Guide be applied to the clearance of a sealed source used for therapeutic purposes following return to the supplier?

This situation represents a **transfer of regulatory control**, not exemption, clearance, or exclusion.

- Once the transfer is complete, the source is **released from regulatory control within the originating organisation's jurisdiction**.
- **Registered under the supplier's jurisdiction**, meaning it remains subject to regulatory oversight—just under a different authority.
- Source is **not fully cleared from regulatory control**, but rather, its oversight is **reassigned** to the receiving entity.

Solid waste materials

Solid waste materials

How can the Safety Guide be applied to the clearance of solid waste materials originating from planned exposure activities?

- Development of "*Clearance Tool*" for the **derivation of specific clearance levels for different types of landfill and for the reuse and recycling of waste materials**.
- Considered **operational and post-operational phases** of the landfill's lifetime.
  - **Operational phase scenarios:** transport to site, handling of material at landfill, release of radionuclides to atmosphere in case of fire, residents near landfill, controlled/uncontrolled release to groundwater.
  - **Post-operational phase scenarios:** recreational land use, small excavations, houses built on landfill site (intrusion)

Solid waste materials – exposure pathways

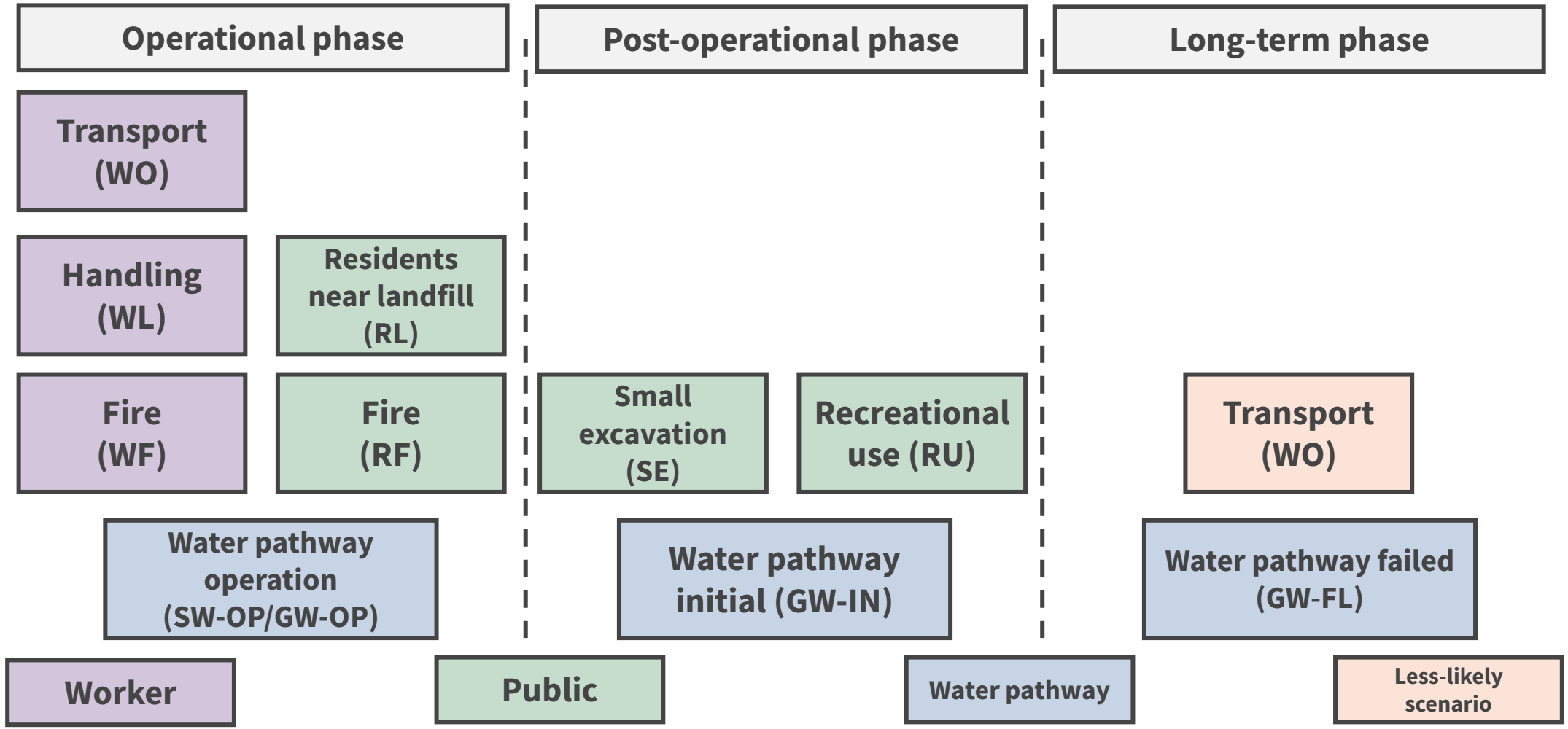


Diagram adapted from Derivation of Specific Clearance Levels in Materials being suitable for Recycling, Reuse or for Disposals in Landfill (Presentation)

Solid waste materials – incineration plant

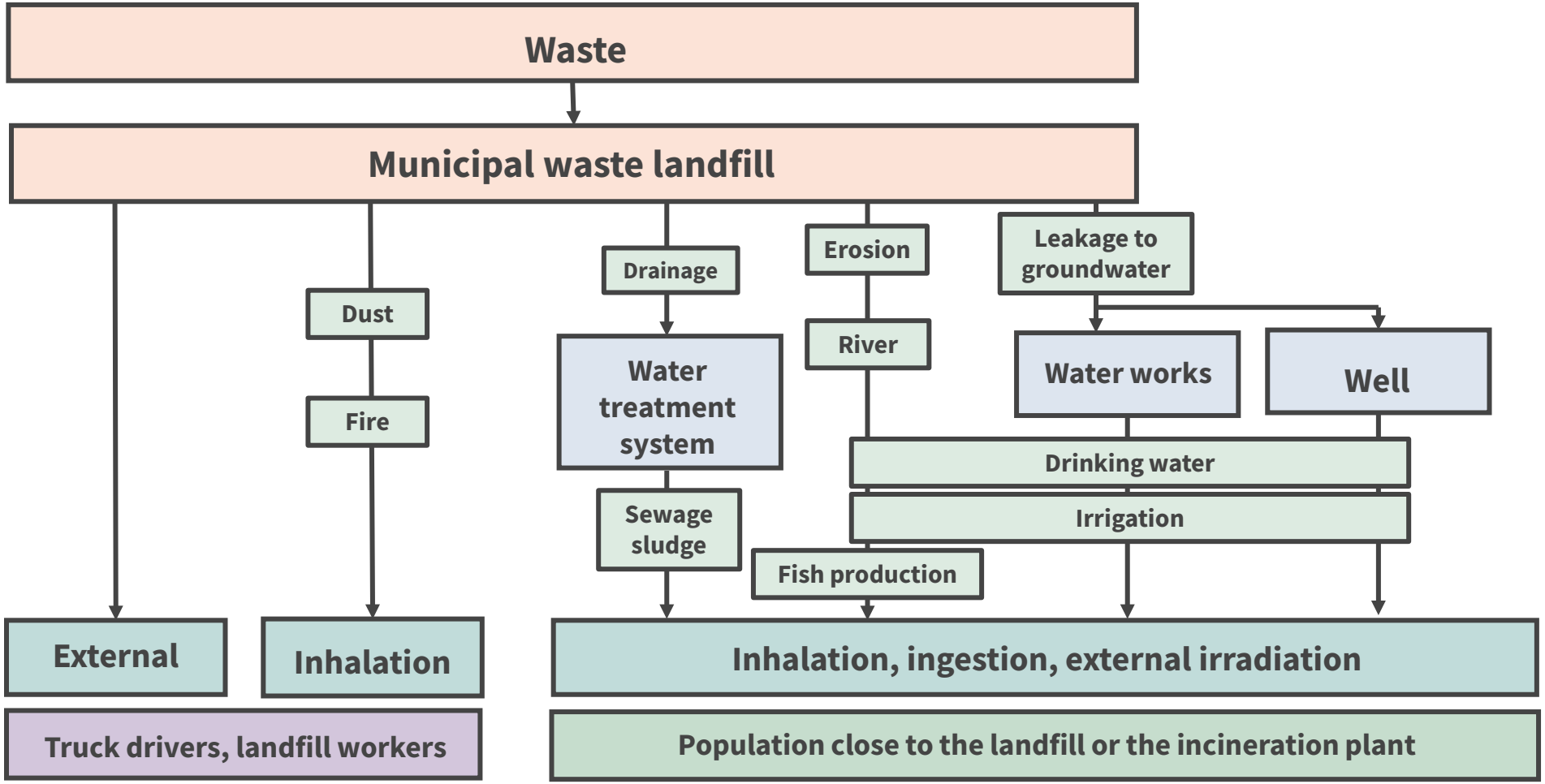
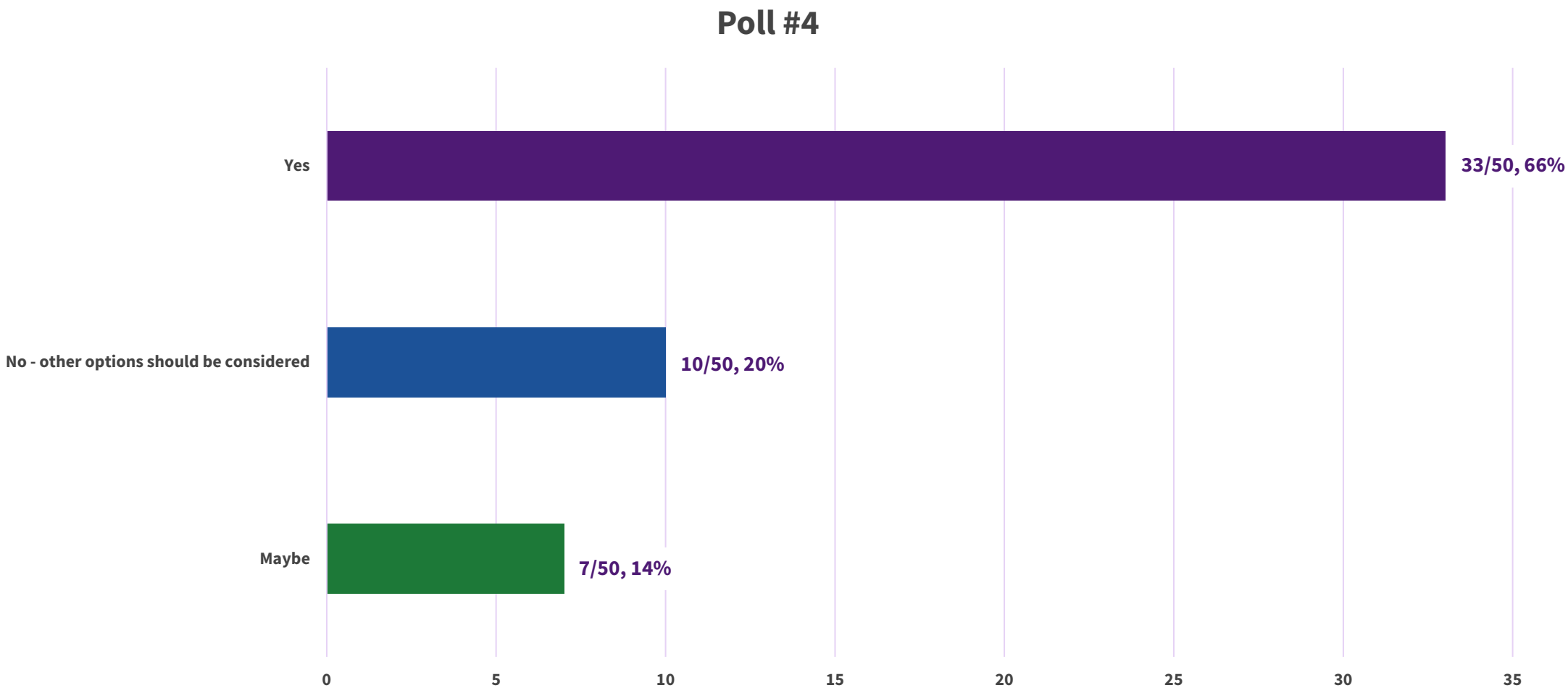


Diagram adapted from Derivation of Specific Clearance Levels in Materials being suitable for Recycling, Reuse or for Disposals in Landfill (Presentation)

Poll #4

Are the scenarios presented for clearance of solid waste materials suitable for inclusion in the Guide?

Poll #4 Results



Liquid waste materials

Liquid waste materials

How can the Safety Guide be applied to the clearance of liquid waste materials originating from planned exposure activities?

IAEA

IAEA GSG-18 (2023)
Apply same principles for clearance of solid materials
Clearance of non-aqueous liquids is an example of **specific clearance**.
Additional conditions can be applied as per GSR Part 3 Para. I.13

Table 1.2 of GSR Part 3 applied for non-aqueous liquids for reuse, recycling or disposal by incinerations and for solid materials in Bq/g and should be **converted into units that are suitable for liquids (Bq/L)**

United Kingdom

Clearance levels for solids are **suitable for use for unconditional clearance of non-aqueous liquids**

Maximum concentrations in liquid discharges are derived on the basis of an **annual dose limit for members of the public of 1 mSv**

Canada

Established generic conditional clearance levels and unconditional clearance levels

Generic CCLs on the condition that **releases occur only through the specified pathway** derived from conservative **public exposure** risk assessment modelling:
Using dose criteria associated with *de minimis* risk ~ **10 µSv/year**
10 µGy/hour for the non-human biota

Liquid waste materials flowchart

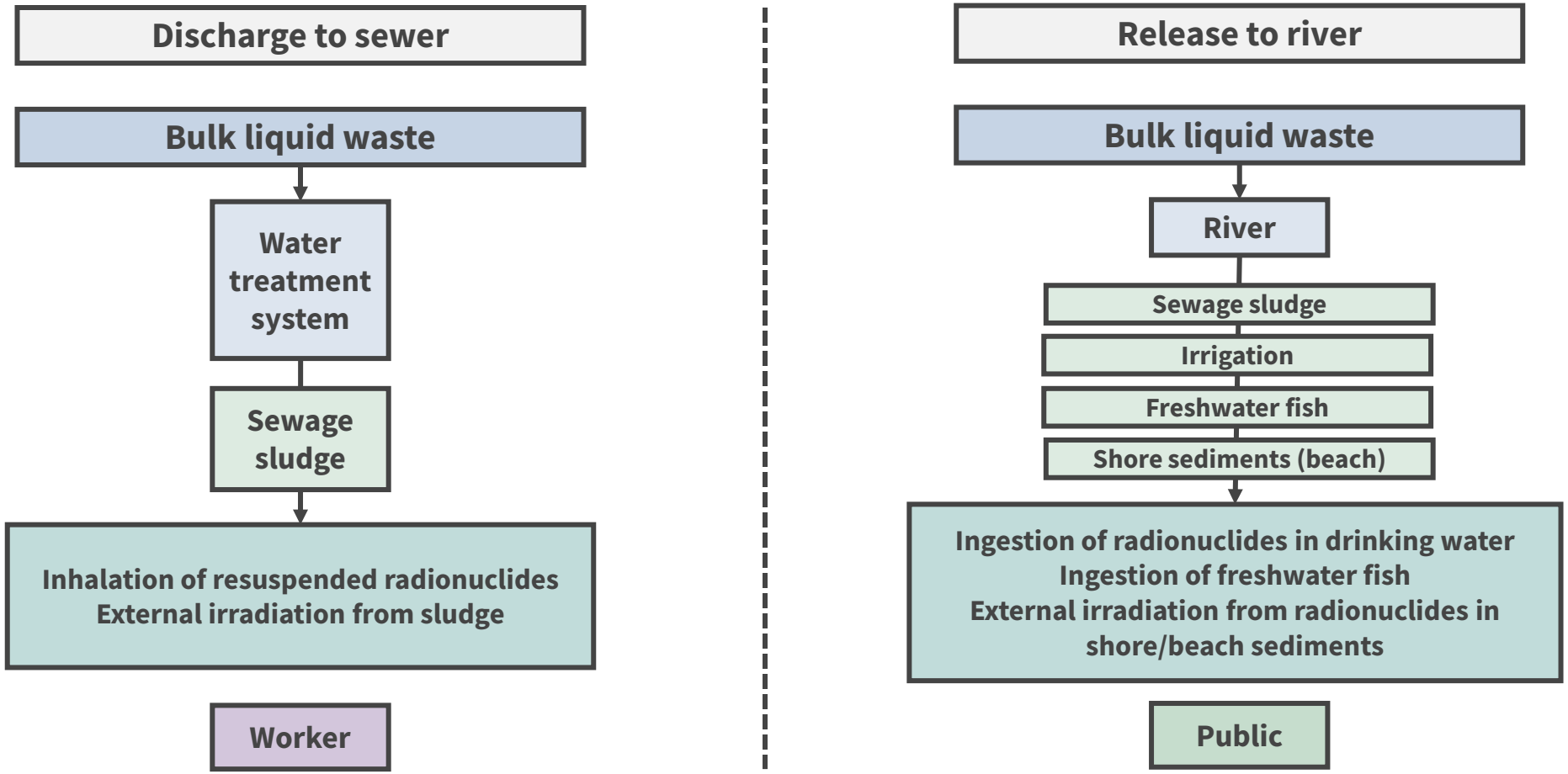
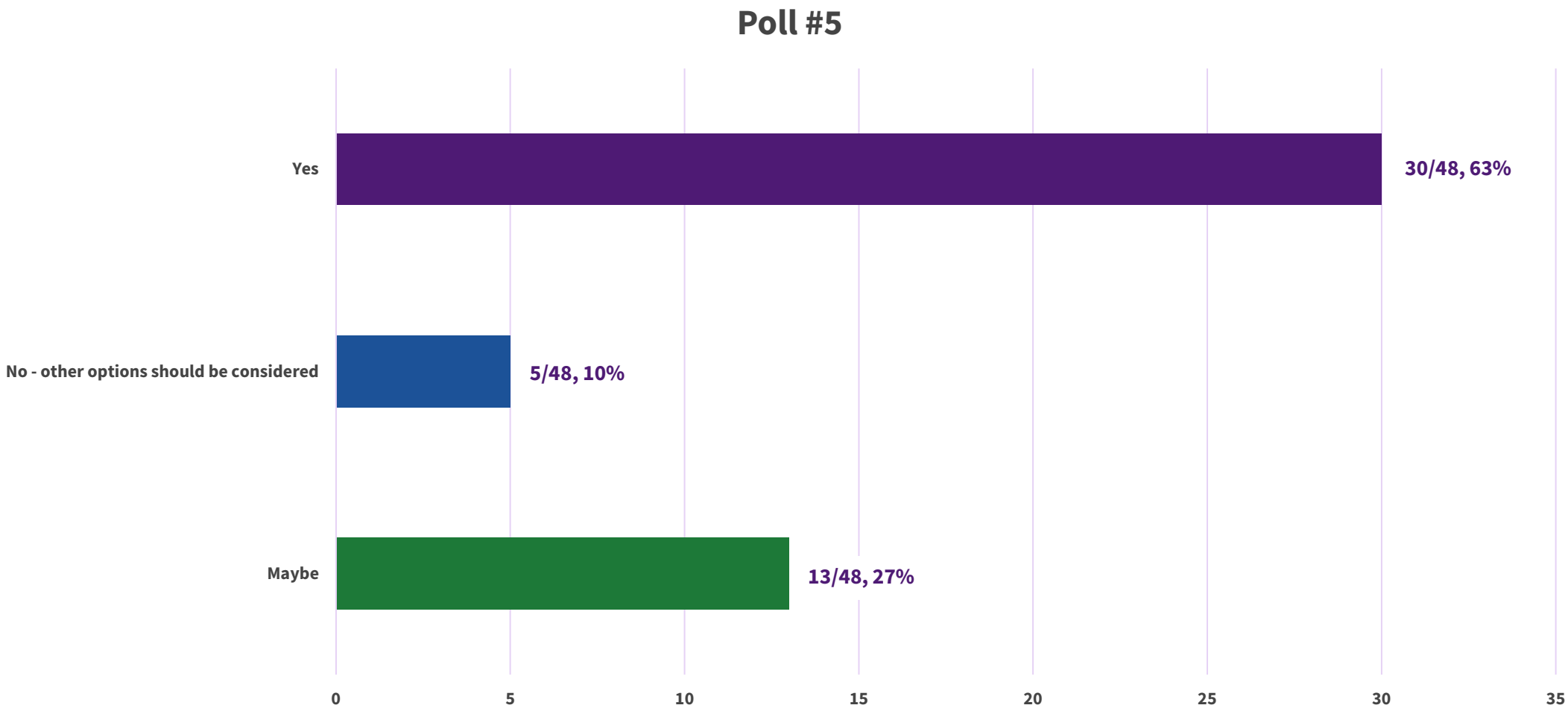


Diagram adapted from Clearance of materials resulting from the use of radionuclides in medicine, industry and research (TECDOC-1000)

Poll #5

Are the scenarios presented for clearance of liquid waste materials suitable for inclusion in the Guide?

Poll #5 Results



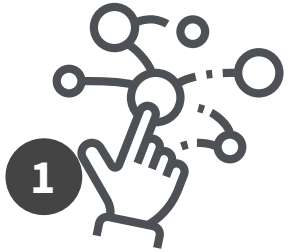
Clearance process in a hospital setting

Clearance process in a hospital setting

How can the Safety Guide be applied to the clearance of a contaminated hospital room?

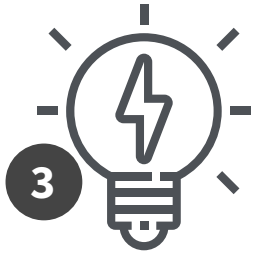
- *Guideline for exemption or clearance of materials that contain, or potentially contain, nuclear substances* (Canadian Standards Association, 2025).
- Clearance of **contaminated room** after discharge of patient who received **Iodine-131** thyroid ablation therapy.
- Clearance of items to be removed from the room covered by a different process.

Clearance process in a hospital setting



Perform an initial assessment – where is most likely to be contaminated? Floors, walls, surfaces and items.

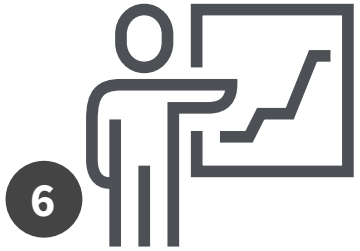
Develop a decision rule - what action level is in place to determine if the room is cleared or not?



Develop a monitoring strategy – complete preliminary survey, identify contamination and way forward.

Select measurement techniques and instrumentation

Perform the clearance surveys



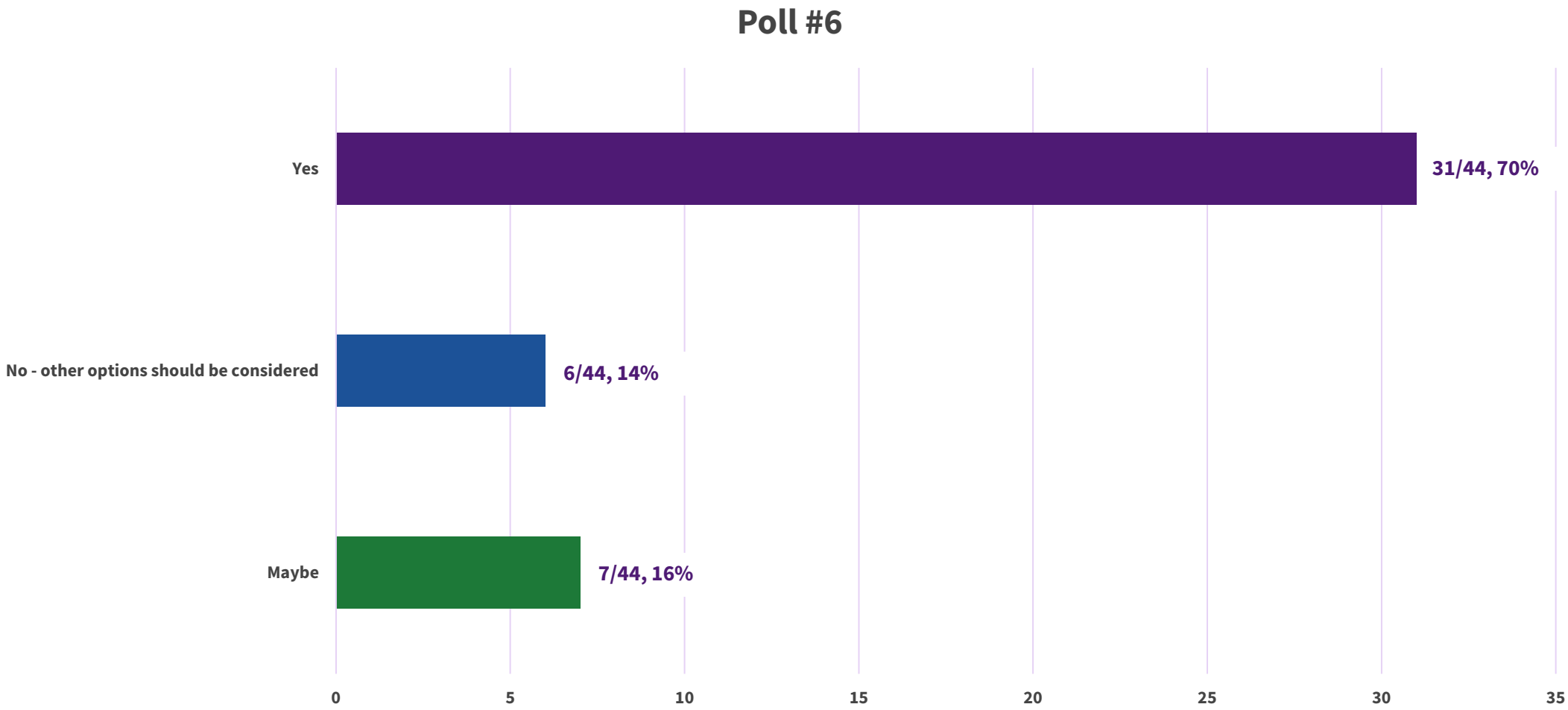
Interpret data and reporting

Finalise the disposition method

Poll #6

Are the scenarios presented for clearance process in a hospital setting suitable for inclusion in the Guide?

Poll #6 Results



Clearance process in a small laboratory

Clearance process in a small laboratory

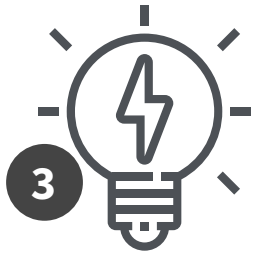
How can the Safety Guide be applied to the clearance of a small laboratory room?

- Canadian Standards Association document – clearance of a small analytical chemistry laboratory.
- Contains low-level radioisotope laboratory, **radioisotope laboratory**, non-radiological laboratory, **radioactive waste processing area**, shipping/receiving area and general-purpose areas, as well as samples and check sources.

Clearance process in a small laboratory

Perform an initial assessment – assess licence conditions and identify likely contaminated areas.

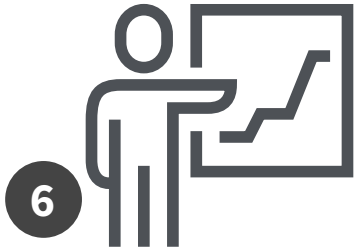
Develop a decision rule - what action level is in place to determine if the room is cleared or not?



Develop a monitoring strategy, determine survey units and classes, finalise and survey requirements

Select measurement techniques, instrumentation and locations.

Perform the clearance surveys



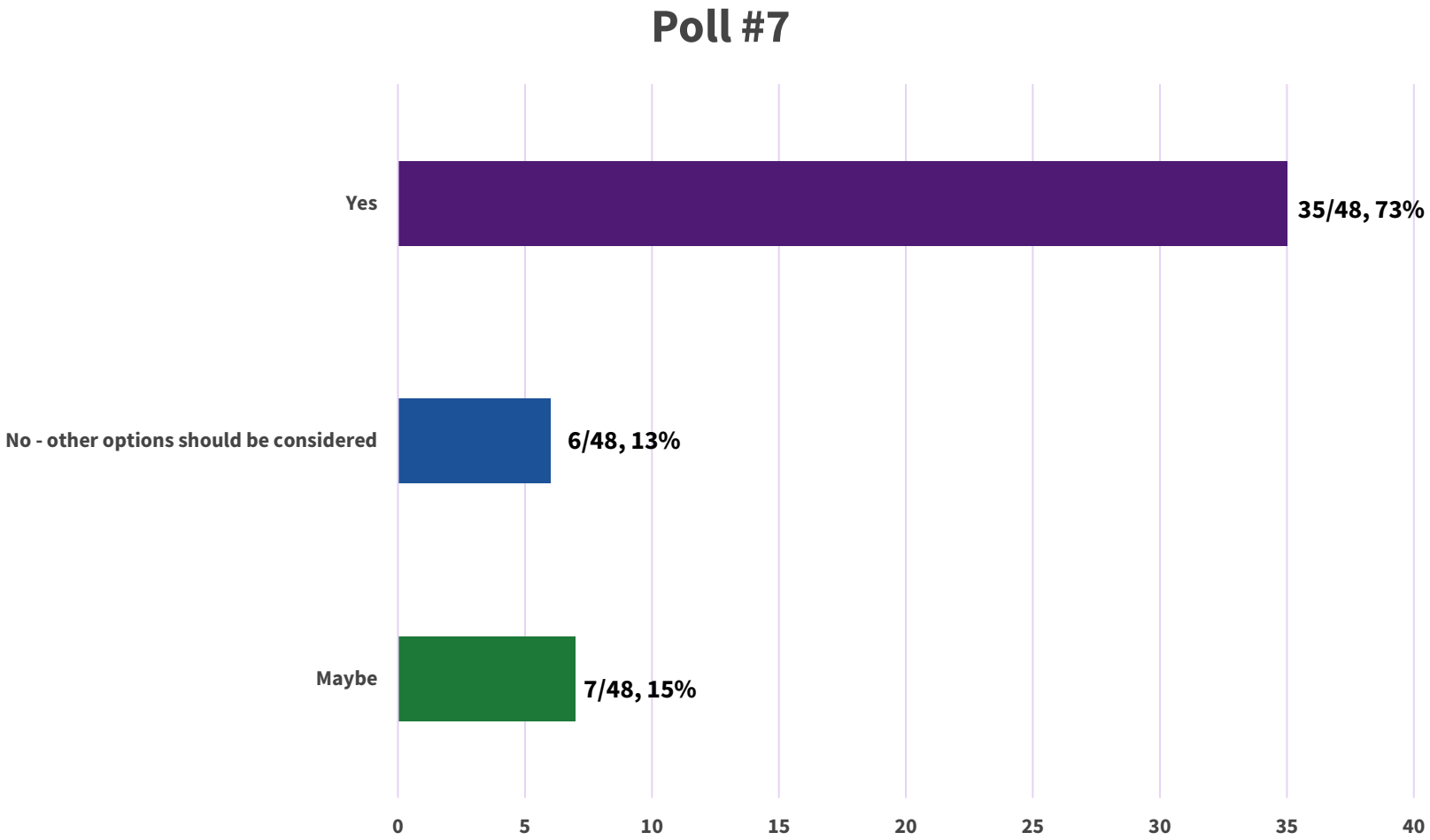
Interpret data and reporting

Finalise the disposition method

Poll #7

Are the scenarios presented for clearance process in a small laboratory suitable for inclusion in the Guide?

Poll #7 Results



Q&A

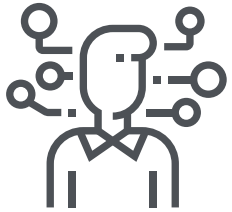
Themes

Will there be any changes to RPS C-2 (Transport Code)?

Transport

There will not be any changes to the packaging and transport requirements
RPS C-2 must be applied

Will there be guidance on the methodology for performing calculations?



Calculations

The Safety Guide will provide relevant examples of the methodology for calculating exemption and clearance employed in international best practice

Will there be guidance on clearance of NORM containing mixtures?

NORM

The Safety Guide will provide guidance and application for scenarios where there are mixtures of radionuclides, both NORM and artificials

Themes

Will there be guidance given on volume/mass averaging for clearance?

Measurement

IAEA Safety Report Series 67 provides guidance on measurement

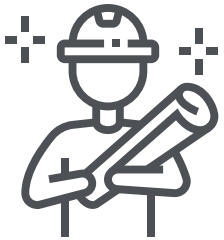
Inclusion of Annex on measurement

How will the Guide achieve consistent national approaches?

National Uniformity

Guidance material only to promote uniformity of radiation protection and nuclear safety policy and practices

For facilities with limited abilities, what tools can they use to meet the requirements?



Resourcing

The Guide will provide examples, and the application of a graded approach

Themes

Dose Criteria

Aligned with IAEA's GSR Part 3

Safety Guide will incorporate graded approach

Dose criteria for exemption and clearance will follow Schedule 1 of GSR Part 3

Consistent with international standards

Themes

Medical- Trace amounts of radioisotopes

Dose limits alone are insufficient

RPS C-6 guidelines should be used

Activity estimates of the waste should be implemented

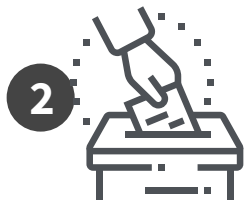
Dose measurements for small doses over long durations may not be possible

Questions from today's session

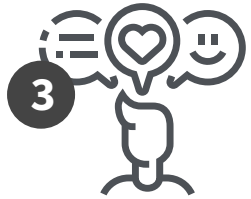
Next steps

Next steps

Recording of webinar and presentation made available



Survey to further inform the direction of the draft Guide



Call for a focus group

See you at the ARPS Conference in October 2025!

Australian Government
Australian Radiation Protection and Nuclear Safety Agency

arpansa

Closing statements