Occupational Radiation Protection:
Stability and challenges in the view of the IAEA Basic Safety Standards.

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International Basic Safety Standards

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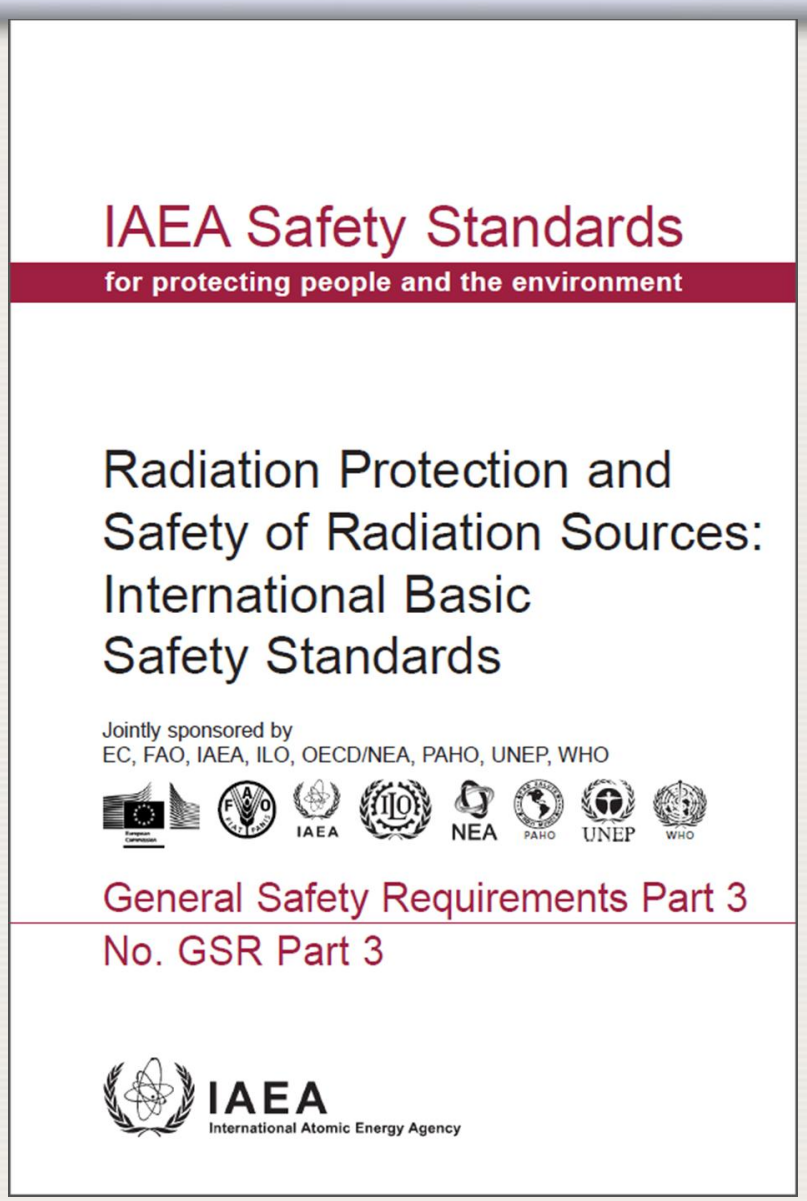

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TOWARDS ENSURING APPROPRIATE LEVEL OF RADIATION PROTECTION AND SAFETY

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Limits … optimization … constraints

Para 1.17: For planned exposure situations, exposures and risks are subject to control to ensure that the specified **dose limits for occupational exposure** …. **are not exceeded**, and **optimization is applied** to attain the desired level of protection and safety.

Para 1.22: **Dose constraints** are applied to occupational exposure and to public exposure in planned exposure situations.

Para 3.25: For occupational exposure and public exposure, registrants and licensees shall ensure, as appropriate, that **relevant constraints are used in the optimization of protection and safety** for any particular source within a practice.

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If compared with 1996 BSS and 2014 BSS: What is the same (STABILITY) and What is principally different (CHALLENGES)?

Same:

three fundamental principles of radiation protection (ICRP26, 1971)

- **justification** (all exposure situations)
- **optimization** of protection (all exposure situations)
- **dose limitation** (planned exposure situations, except for patients)

Different:

from: subdivision of RP system into **Practices** and **Intervention**

to: **holistic approach** (i.e. to cover **ANY** exposure situation)

- Planned exposure situations ⇐ **Constraints, Limits**
- Emergency exposure situations ⇐ **Reference levels**
- Existing exposure situations ⇐ **Reference levels**

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Occupational exposure as in BSS Chapter 3: **Planned Exposure Situations**

Requirements for occupational exposure

- **Responsibilities** of **regulatory body**
- **Monitoring and recording** of exposures
- **Responsibilities** of **employers and licensees**
- **Compliance** by workers
- **Classification** of (work) areas: controlled and supervised
- **Local rules** and **personal protective equipment**
- **Assessment** of occupational exposure
- **Information, instruction and training**
- **Special arrangements** – pregnant and breast-feeding women, persons under 18 years of age

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STABILITY

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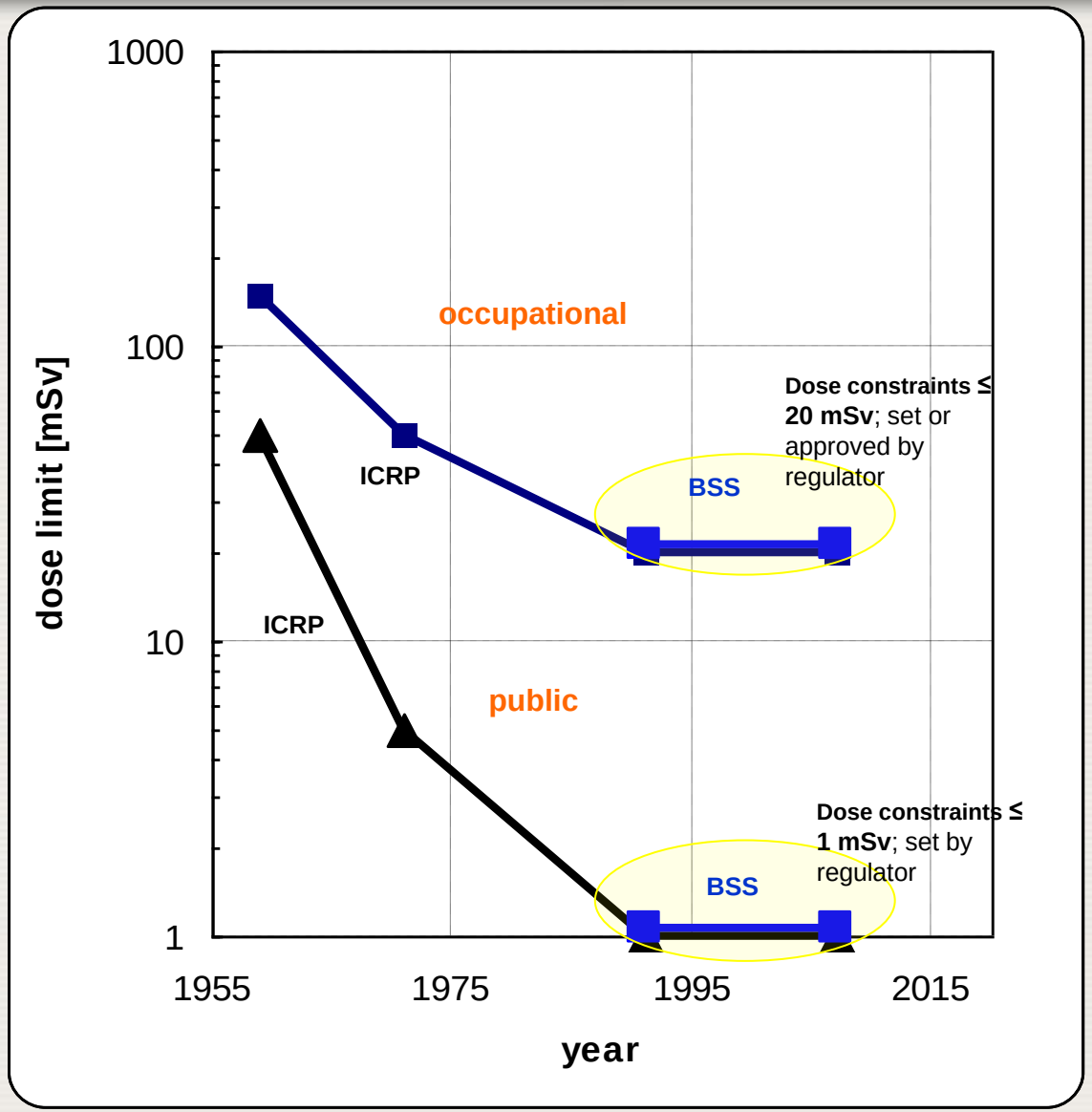
Development of dose limits



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DOSE LIMITS

	Occupational exposure		Public exposure
	over 18 years of age	16 to18 years of age	
Whole body	**20** mSv averaged over 5 years max **50** mSv in a single year	**6** mSv	**1** mSv
Lens of the eyes	**20** mSv	**20** mSv	**15** mSv
Skin, extremities	**500** mSv	**150** mSv	**50** mSv

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CHALLENGES:

Selected Issue I:

Responsibility

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Responsibility for protection and safety

To establish and maintain a legal, regulatory and organizational framework

- Government

To establish or adopt regulations and guides

- Regulatory body

Prime responsibility

- Person or organization responsible for facilities and activities
- Principal parties

Specified responsibility

- Other parties

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Selected Issue II:

OPTIMIZATION

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1. Optimization – as being formulated in the BSS

- **SP5 of the IAEA Safety Fundamentals:** Protection must be optimized to provide the **highest level of safety that can reasonably be achieved**.
- **Optimization linked to ALARA:** The optimization of protection and safety, when applied to the exposure of workers, members of the public and comforters and caretakers of patients undergoing radiological procedures, **is a process** for ensuring that the **magnitudes and likelihood of exposures** and the numbers of individuals exposed are **as low as reasonably achievable**, taking social and economic factors into account… (1.15)

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2. Optimization – is it "process" or "end point"?

- …Optimization is a **forward-looking iterative process** requiring both qualitative and quantitative judgments… (ICRP Publ.103)
- In the optimization process, **the intended outcome** would be that **ALL exposures reach levels that are** as low as reasonably achievable, social and economic factors being taken into account…

⇓

Optimization must satisfy both:

to be processed, and (this process) to be finished (i.e. reach levels) by leading to the expected conditions (e.g. ALARA)

however …

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… there is the legal issue too

- obligation "**to be processed (i.e. subject of optimization process**)" is **ALREADY MET** by **starting** the process
- however, obligation "**to be optimized**" is met **ONLY IF the process ends** with an optimized status

⇓

And then requirement(s) for optimization must read as:

In all exposure situations, **each party** with responsibilities for protection and safety **shall ensure that protection and safety is optimized**. (***and NOT - "is subject to optimization process"***)

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Both: "process" and "end point"!

Exposure to individual **BEFORE** optimization of protection and safety

WAY how to meet LEGAL OBLIGATION

PROCESS of optimization of protection and safety (ICRP Publ.101), *inter alia* to ensure equity of distribution of exposure by

- Shielding
- Distance from source
- Layout of facility
- Time of work with the source
- Number of workers, etc.

Exposure to individual **AFTER** optimization of protection and safety i.e. status when **P&S is optimized**

LEGAL OBLIGATION

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3. Optimization – who is in charge?

Top to down approach:

- The **government or regulatory body** shall **establish and enforce requirements** for optimization of protection and safety. (Req. 11)

⇓

- **Registrants and licensees** shall **ensure** that protection and safety **is optimized.** (para 3.23) ← **i.e. PRINCIPAL PARTY**

⇓

- (Employers, registrants and licensees shall..) involve **workers**, through their representatives if appropriate, **in optimization** of protection and safety (para 3.77(a))

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Selected Issue III:

DOSE CONSTRAINT

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Few thoughts on “dose constraints”

- **What is dose constraint?**
  It is prospective and source related value of individual dose… that is used in for the optimization of protection and safety… and serves as a **boundary** in defining the range of options **in optimization**.

- **Is it dose limit?**
  No.
  Limit is the value that **must not** be **exceeded**, and it is *a priori* set **legally binding** value.

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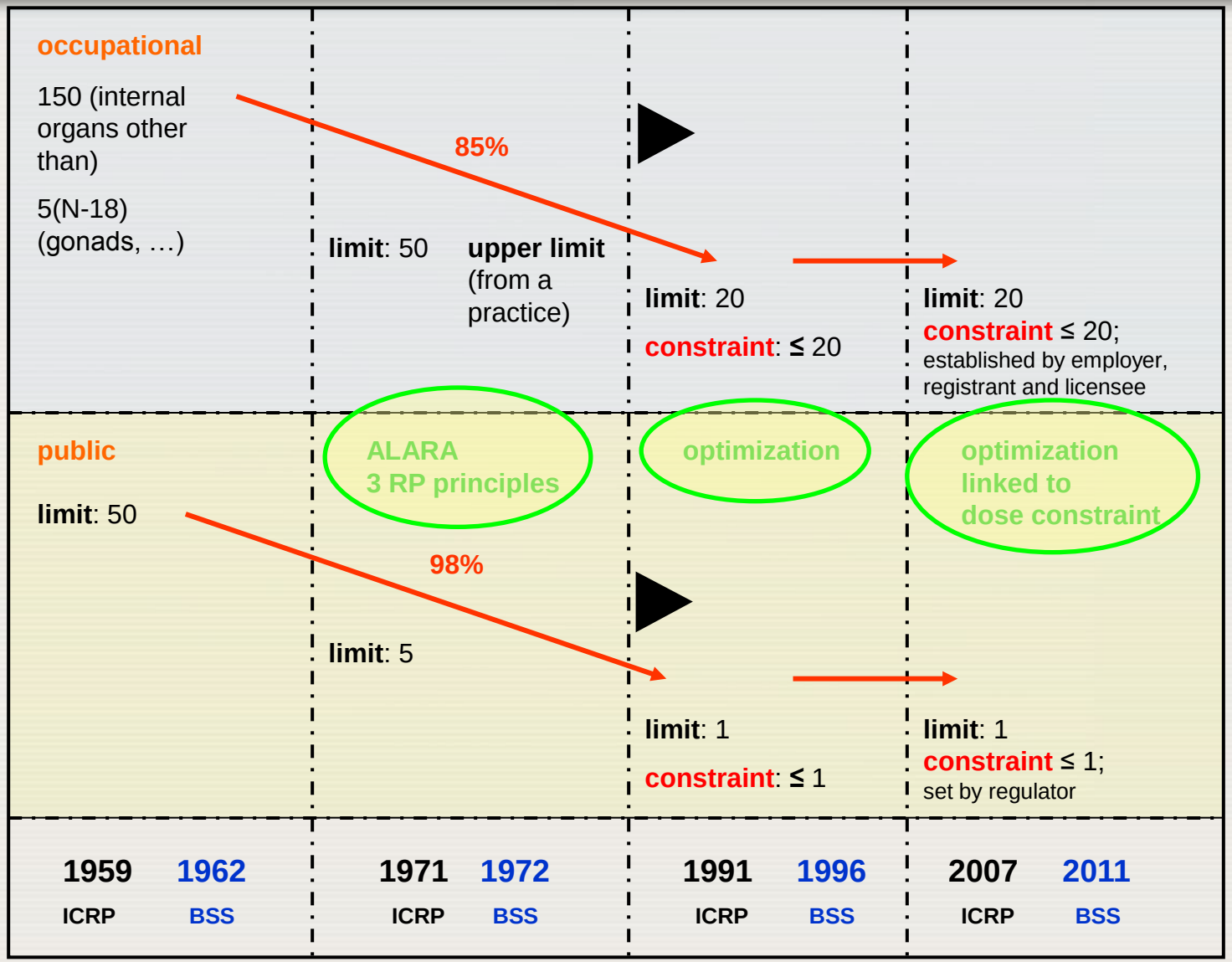
When were dose constraints introduced?



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Implementation … - Issues to be Considered

(1) Constraint *versus* limit – only a **linguistic problem**?

(2) Dose constraints in prospective evaluations and as one means of **initiating investigations** of actual operations

(3) Risk of dose constraint being interpreted as an **"additional" limit** or as a **new "standard of care" for workers**

(4) Dose constraint as only **one of many factors** in total **risk management**

(5) Dose constraint in the process of **optimisation**

(6) Need for **education and training** specifically addressing dose constraint?

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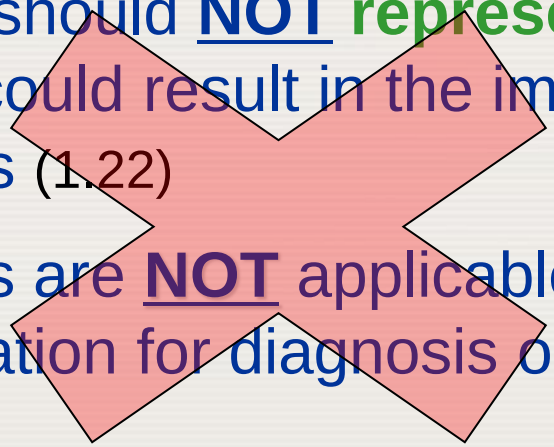
Use and "*not-use*" of dose constraints

- Dose constraint serves as:
  1. In planning stage: **tool for optimization** defining the range of options in **optimization** in the operation of any controlled source
  2. In exposure stage: **benchmark** assessing the suitability of the **optimized protection strategy** (1.23)
- Dose constraints are **NOT** **dose limits** and exceeding a dose constraint should **NOT** **represent a regulatory infraction**, but could result in the implementation of follow-up actions (1.22)
- Dose constraints are **NOT** applicable to the **exposure of patients** to radiation for diagnosis or treatment. (1. 30)



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SETTING OF DOSE CONSTRAINTS:

CROSSCUTTING ISSUES BETWEEN RESPONSIBILITY FOR RADIATION SAFETY AND OPERATIONAL EFFECTIVENESS

… and who shall set constraint ?
(for occupational exposure)

The **regulatory body** **shall establish requirements** for optimization of protection and safety, … **and establish or approve constraints,** as appropriate, for dose and risk, **or the process for establishing constraints**, …

Occupational:

Employers, registrants and licensees … shall ensure … **that protection and safety is optimized ….**

⇓

i.e. government or regulatory body is NOT necessarily establishing constraints; AND it is ensuring protection and safety is optimized instead (e.g. by reg. and licensees)

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Dose Constraints in Optimisation – National Regulations (few examples)

Countries of European Union:

- Relatively harmonized approach on adoption of the concept of **dose constraints** as it is recommended by the ICRP.

Northern America:

- Instrument of **action level** is used → level that trigger certain **actions** if it is reached.
- Optimization below action level is not required.
- Dose constraint is **not** directly **linked** to the **optimisation** (USA) and reaching pre-set dose level (dose constraint) **may trigger an action**.

Japan:

- Uniform introduction of dose constraints into **regulatory system based on dose limits** seems to be **not necessary**.
- Current system provides **satisfactory operating flexibility**.

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Selected Issue IV:

SPECIFIC CASE – OCCUPATIONAL EXPOSURE IN EMERGENCY

Exposure of emergency workers

- **Basic principle:**

…*(even in an emergency)* relevant requirements for occupational exposure in planned explore situation shall apply…

→ **ILO: an emergency worker is a worker**

i.e. 20 mSv/year averaged over 5 years

→ **maximum dose = 50 mSv/year**

Exceptions:

- Life saving (<500 mSv)
- Prevent severe deterministic effects (<500 mSv)
- Avert large collective dose (<100 mSv)

- **Principle of voluntarily taken action:**

The value of 500 mSv may be exceeded under special circumstances…and the worker volunteers to take the action and understands the health risk.

[in line with Gsr Part 3: Radiation Protection And Safety Of Radiation Sources: International Basic Safety Standards . Schedule IV, Table IV. 2]

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… example of raising of maxim value for doses to workers undertaking interventions (Japan 2011)

Legal status (in 2011):

- **IAEA BSS ed.1996**: … under specific circumstances (life saving, averting large collective dose and avoiding catastrophic conditions) the value **can exceed 2x single year dose limit**, but should not exceed it 10x , i.e. 10x50 = **500 mSv** …
- **Japanese legislation**: … should not exceed **100 mSv** (2x single year dose limit, i.e. **no exception allowed**)

On the order of the Prime Minister (15 March 2011, 23:48 JST):

100 mSv/y → 250 mSv/y

(still half of max 500 of the BSS)

Justification:

*"Because at Fukushima 1, the level of **radiation is 400 millisieverts per hour**. The previous limit of 100 millisieverts means that workers can work for only 15 minutes; the new limit of 250 millisieverts means that they can work for 30 minutes."*

The ministry (i.e METI-NISA) explained that "*this is an emergency measure, taken in response to **the Prime Minister's request, to prevent this nuclear disaster from escalating**."*

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MOVING FORWARD TO THE IMPLEMENTATION

Development of Safety Standards: SG on Occupational Radiation Protection (in preparation)

- **Following the revised BSS**, jointly developed with ILO
- Combining the current **five existing SGs** on ORP
- **DPP** approved by CSS during in 2011
- **Two CS** held in 2012, overall **review** in the early of 2013
- Presented in the RASSC meeting in November 2013
- Sent to **Member States for comments** early of 2014
- **Resolution of MSs** comments in September 2014
- **Approved at RASSC/WASSC/NUSSC in November 2014 for submission to CSS**

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Thank you for your attention

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