Working group on the rule of the 20 %
Background

• **SSR-6 requirement:** after NCT tests, the maximum dose rate at any external surface of the package shall not increase by more than 20% for Types IP-2, IP-3, A, B and C packages.

• **Basis and benefits of this requirement:**
  – Basis seems to be that precision of the measurement devices is 20% according to an ISO standard (dated from 1976)
  – The requirement ensures the workers protection by guaranteeing adequacy (at +/- 20 %) of the dose assessment in the radiation protection programme and of the labelling of the package, even if an undetected incident has occurred during transport.
  – The requirement also ensures that the shielding of the package stays effective after NCT test.
Difficulties with the rule of the 20 %

• The following difficulties have been reported:
  – Difficulties to demonstrate compliance with this requirement, for packages with a heterogeneous content (bulk waste, non-certified packages with a content that is not exactly known at the design stage), mainly because of the internal movement of the content;
  – As the criteria is proportional to the dose rate, increasing the shielding makes the requirement more difficult to comply with. In general, the lower the dose rate, the more difficult it is to comply.

• Even in routine conditions of transport, the dose rate can increase by more than 20 %, for example in case of precipitation of radionuclides in a liquid.
Several possible alternatives for the rule have been discussed by the working group.

The working group has agreed on the following:
If the dose rate at the surface of the package is below 50 µSv/h, then an increase of 10 µSv/h is allowed after the NCT tests.

This proposal can be submitted to the next SSR-6 review cycle.
Technical justification

• We considered a scenario with a worker carrying by hand after their transport small packages with low dose rate (5 µSv/h), 7 hours a week.

• Without NCT incidents, the annual dose of the worker would be 1.65 mSv/year.

• We assumed that undetected NCT incidents occur in 1% of the transport.
  – With the current 20% rule, this will result in an increase of 3 µSv/year to the worker annual dose, which will become 1.653 mSv/year.
  – With the proposed alternative rule, this would result in an increase of 33 µSv/year to the worker annual dose, which would become 1.683 mSv/year.
Proposal to change SSG-26

• One of the main difficulty to demonstrate compliance is due to the possible internal movements of the content.

• Internal movements can occur in routine conditions of transport or in NCT.

• If we consider that the internal movements that can occur in routine conditions of transport are already taken into account in the dose rate determination, then only the additional movements that can occur in NCT should be taken into account when demonstrating compliance with the rule of the 20 %.

• This may facilitate the demonstrations without any negative impact of safety.

• No modification of the regulation is needed, only additional guidance: then there is no need to wait for the next SSR-6 revision cycle.
Proposal to change SSG-26

624.4. The limit on dose rate increase under the normal conditions of transport is a design requirement to verify appropriateness of shielding design, i.e., there is something wrong in the shielding design of the package when the dose rate increases in excess of 20% under the normal conditions of transport. The compliance to this requirement can be demonstrated normally by calculations using shielding analysis code to the model simulating the deformation of package and, as appropriate, movement of radioactive contents and, as appropriate, change of state of contents including segregation and precipitation of the radionuclides, which may occur in addition to the routine conditions of transport. These parameters could be obtained through reasoned arguments, calculations or demonstration tests with the simulated contents without radioactivity.
Proposal to change SSG-26

• Dose rate around the package can increase during transport because of the internal movement of the content due to transport vibrations or precipitations / segregations in liquid.

• Para 516.5 of SSG-26 (also referenced in 528.1 and 529.1) recommends then to take into account these phenomena when determining the dose rate at the surface of the package.

• Guidance in SSG-26 is not clear enough and only applies for determination of dose rate at the surface of packages. To ensure consistency, it should also apply to the TI and the dose rate around the vehicle.

• Finally, it would be better to have this text in the regulations.
Proposal to change SSG-26

516.5. The maximum dose rate should be determined taking into account potential amplifying phenomena such as internal movement of contents, or, in the case of packages containing liquids, segregation and precipitation of the radionuclides. These phenomena may be taken into account by applying a correction factor to the maximum dose rate measured at the surface of the package or by using a maximum value instead. In this last case, a dose rate measurement at the point of consignment should nevertheless be performed. This correction factor or maximum value should be provided in the package instructions of use. The radiation protection programme should then take into account the corrected dose rates.

• The same text has to be copied in paras 523.7 (TI determination), 528.1 and 529.1 (dose rate for non-expected packages) and 573.1 (dose rate for the vehicle).
Thank you for your attention