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# Corrected waste volumes in radionuclide transport models used in SR-PSU

## 1 Background

The radionuclide transport models used in the calculations supporting the application for the extension of SFR (SR-PSU) (SKB 2015a, b) used incorrect volumes for three types of waste package:

1. Steel moulds with cement conditioned waste or waste embedded in concrete were considered to be 1.0 $m^3$ instead of 1.7 $m^3$ (SKB 2014)
2. Tetramoulds were considered to be 1.0 $m^3$ instead of 6.8 $m^3$ (SKB 2014)
3. Steel drums were considered to be 1.0 $m^3$ instead of 0.238 $m^3$ (SKB 2014).

The incorrect volumes affect the estimated amounts of waste-conditioning materials and grout present in 1BMA, 2BMA and Silo. This memo presents the peak doses and doses over time when these errors have been corrected, and assesses the impact of the errors on the results presented in SR-PSU.

# 2 Corrected dose calculations

The global warming calculation case (SKB 2015a, b) was used to investigate the impact of the incorrect waste package volumes on the peak doses and doses over time.

Table 2-1shows the peak doses from 1BMA, 2BMA, Silo and the entire extended SFR using the incorrect waste package volumes in the calculation. This calculation is similar to the calculation used in SR-PSU, but has been corrected with respect to an error in the implementation of barrier degradation; this is further discussed in Åstrand et al. (2017). This calculation is denoted the **reference case**. Table 2-2 shows the doses for the calculation after correction of the waste volumes. This calculation is denoted the **corrected case**. The information in Table 2-1 and Table 2-2 is further described in SKB (2015b, Chapter 5).

Table 2-1 and Table 2-2 show that the correction of the waste package volumes has a negligible effect on the peak doses calculated. In the model, any volume inside the concrete structure that is not filled with waste packages is filled up with grout. Thus the change in the waste package volumes mainly affects the relative amounts of different cement-based materials inside the concrete structures (e.g. grout, waste form and waste packaging). Since these materials have similar properties with regard to radionuclide sorption and pore volume, the changes in the waste package volumes do not affect the results significantly.

**Table 2-1. Peak annual doses and the time at which the peak occurs for releases from 1BMA, 2BMA, Silo and from the entire extended repository in the *reference case*. The radionuclides with the highest contribution to the peak are indicated.**

| Waste vault | Annual dose [µSv] | Year [AD] | Biosphere object | Exposed group | Most contributing radionuclide (%) |
|---|---|---|---|---|---|
| 1BMA | 1.82 | 66,500 | 157_2 | DM | Ni-59 (65.9) |
| 2BMA | 1.06 | 28,500 | 157_1 | DM | Ca-41 (57.0) |
| Silo | 3.55 | 7,200 | 157_2 | DM | Mo-93 (49.2) |
| Total SFR | 7.69 | 6,500 | 157_2 | DM | Mo-93 (57.7) |

**Table 2-2. Peak annual doses and the time at which the peak occurs for releases from 1BMA, 2BMA, Silo and from the entire extended repository in the corrected case. The radionuclides with the highest contribution to the peak are indicated.**

| Waste vault | Annual dose [µSv] | Year [AD] | Biosphere object | Exposed group | Most contributing radionuclide (%) |
|---|---|---|---|---|---|
| 1BMA | 1.81 | 66,500 | 157_2 | DM | Ni-59 (65.8) |
| 2BMA | 1.08 | 28,500 | 157_1 | DM | Ca-41 (56.6) |
| Silo | 3.64 | 7,150 | 157_2 | DM | Mo-93 (49,3) |
| Total SFR | 7.76 | 6,550 | 157_2 | DM | Mo-93 (58.0) |

Figure 2-1shows the doses over time from 1BMA, 2BMA, Silo and the entire extended SFR in the corrected case. The total dose from the reference case is shown for comparison, and the results are not significantly different at any time point. Note that Figure 2-1 uses a linear dose scale.

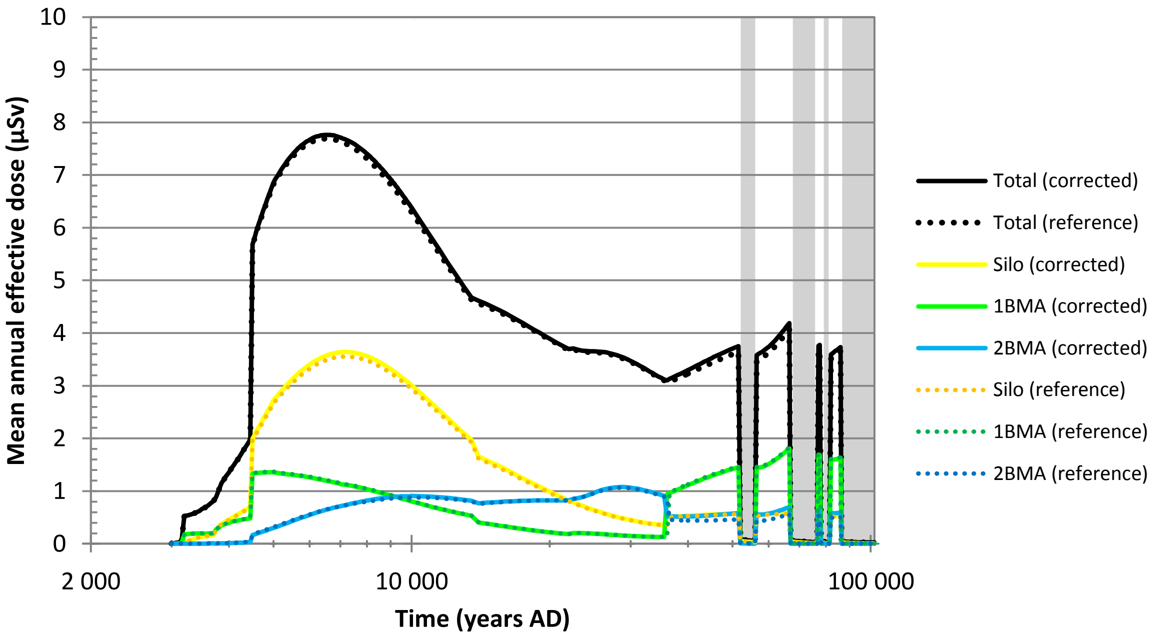


***Figure 2-1.*** *Arithmetic mean of the annual effective dose to the most exposed group, for releases from the entire extended repository and contributions from 1BMA, 2BMA and Silo waste vaults, in the global warming calculation case. The unshaded areas correspond to temperate climatic conditions and the grey shaded areas to periglacial conditions with continuous permafrost. The dotted lines show the result as calculated in the reference case.*

# 3 Conclusions

Some of the waste package volumes used in the calculations supporting SR-PSU are incorrect. Although this affects the relative amounts of different cement-based materials (e.g. grout, waste form and waste packaging) inside the concrete structures, the total volume of cement-based materials is not affected. The error therefore has a negligible effect on the radionuclide releases and doses. This correction does not affect the results of the assessment (SKB 2015a) in any significant way.

# References

**SKB, 2014.** Initial state report for the safety assessment SR-PSU. SKB TR-14-02, Svensk Kärnbränslehantering AB.

**SKB, 2015a.** Safety analysis for SFR. Long-term safety. Main report for the safety assessment SR-PSU. Revised edition. SKB TR-14-01, Svensk Kärnbränslehantering AB.

**SKB, 2015b.** Radionuclide transport and dose calculations for the safety assessment SR-PSU. Revised edition. SKB TR-14-09, Svensk Kärnbränslehantering AB.

**Åstrand P-G, Lindgren M, Ekström P-A, 2017.** Corrected implementation of fracture model used for 1BMA and 2BMA in SR-PSU. SKBdoc 1585173 ver 1.0, Svensk Kärnbränslehantering AB.