Assessment context

The following tables present an overview of the assessment context as discussed in the BIOMASS project (BIOMASS Theme 1 Working Document: BIOMASS/T1/WD02), and comparison in relevant aspects to the guidance provided by ICRP (in Publication 81 on "Radiation Protection Principles as Applied to the Disposal of Long-lived Solid Radioactive Waste), EPA (40 CFR Part 197 Environmental Radiation Protection for Yucca Mountain, Nevada; Proposed Rule), NRC (10 CFR Part 19 et al. Disposal of High-Level Wastes in a Proposed Geological Repository at Yucca Mountain, Nevada; Proposed Rule), to the Biosphere PMR developed by DoE, and to the Swedish Radiation Protection Authority's Regulations on Protection of Human Health and the Environment in connection with the Final Management og Spent Nuclear Fuel and Nuclear Waste, SSI FS 1998:1.

Note that these tables provide examples and not a complete anaysis. The intention is to show how the BIOMASS approach to the assessment context can be used for a systematic discussion of regulatory guidance as well as of the assessments made by the proponent.

Table 1. Assessment purpose

BIOMASS guidance	**ICRP guidance in Publication 81**	**Regulatory context (EPA and NRC proposed rules)**	**Purpose as described by DoE**	**SSI FS 1998:1**
Alternative purposes identified by BIOMASS include • Demonstration of compliance • Public confidence • Confidence of policy makers and scientific community • Guidance to research priorities • Guidance to site selection • Proof of concept • System optimisation	Publication 81 focuses on compliance with radiological criteria. A compliance assessment should be supported by a comprehensive safety case including site-specific information. A stepwise approach can be used which involves progressive assessments at the various stages of repository development. Due to uncertainties, the acceptability of a disposal system should be based on reasonable assurance rather that on an absolute demonstration of compliance.	The biosphere PMR forms part of a viability assessment and supports upcoming EIS and licensing applications.	The PMR summarises the biosphere model and presents biosphere-specific dose conversion factors (BCDF). Development of the biosphere PMR is a component of a process to • Evaluate post-closure safety and • Demonstrate compliance to regulatory standards The PMR also addresses issues raised by the peer review of the TSPA-VA	Risk shall be calculated on the basis of relevant scenarios (grouped, e.g., as normal scenarios, less likely scenarios and residual scenarios) and resulting probabilities of radiation detriment. The risk thus quantified shall not exceed 10^{-6} per year to individuals represenative of the most exposed population. Scenarios resulting in doses >1 mSv per year should be treated separately. Environmental consequences shall be assessed as well as the protective capability after intrusion (SSI FS 1998:1). A safety assessment shall be presented supporting the EIS.

Table 2. Endpoints

BIOMASS guidance	ICRP guidance in Publication 81	Regulatory context (EPA and NRC proposed rules)	Endpoints as described by DoE	SSI FS 1998:1
Alternatives identified by BIOMASS include • Individual dose/risk • Collective dose/risk • Doses to biota • Changed radiation environment • Fluxes and, as a special case, • Uncertainties/confidence	The ICRP system is developed for health protection. A constraint of 0.3 mSv per year is proposed for the optimisation of protection. A BAT-NEC approach is potentially beneficial for environmental protection.	The proposed rules consider health protection. The NRC rule specifies a 0,25 mSv per year constraint for the critical group, whereas EPA proposes a standard of 0.15 mSv per year to the Reasonably Most Exposed Individual (RMEI). NRC regulations indicate that dose calculations must incorporate the probability of the event leading to the dose.	The PMR addresses doses to humans, representative of a farming community, based on a survey in Amargosa Valley performed in 1997.	Health protection to the level of 10^{-6} annual risk for individuals representative of the most exposed population, a factor of 100 as as a reasonable distribution around the mean, and a maximal level of 10^{-5} annual rsk for a reasonably maximally exposed individual, such as a subsistence farmer. Hypothetical definitions of exposed groups/individuals. Environmental protection considers • Biological diversity • Biological resources

Table 3. Assessment philosophy

BIOMASS guidance	ICRP guidance in Publication 81	Regulatory context (EPA and NRC proposed rules)	Assessment philosophy as described by DoE	SSI FS 1998:1
Distingusihes between “cautious” and “equitable” approaches, although these should no be considered as opposites.	The critical group concept is inherently cautious. The use of otimisation (or BAT) would prevent over-conservatism. It is recommended that the critical group is hypothetical and that consideration is given to biosphere changes.	The proposed rules are specific with regard to location of the exposed population and (current) habits. The critical group/RMEI shall be selected in a cautious but reasonable manner. Events with a lower probability than 10^{-8} (10^{-4} in 10 000 years) do not need to be considered.	The BDCFs are “reasonably conservative”.	The choice of a 10^{-6} risk standard is “cautious” in the sense that it gives reasonable allowance also for future practices or activities causing discharges from several sources, separated in both space and time. Requirements on optimisation and BAT call for a realistic approach.

Table 4. Site context

BIOMASS guidance	ICRP guidance in Publication 81	Regulatory context (EPA and NRC proposed rules)	Site context as described by DoE	SSI FS 1998:1
The site context needs to be known in order to establish what reference (or assessment) biosphere that would be appropriate. Defines the spatial domain to be included within the biosphere system description.	"A critical group cannot be defined independently of the assumed biosphere" (par. 45). See also Table 3 above.	The proposed rules are specific for the Yucca Mountain site. Biosphere FEPs should be consistent with arid or semi-arid conditions	The Yucca Mountain site is characterized in terms of geography, geology, physiography, climate, ground water, human activities and water use.	The biosphere at the time of application and its known evolution forms one case, other shall be defined as necessary. Affected ecosystems shall be described in order to assess environmental effects outside health protection. No limit given for collective dose. Collective dose may be used by proponent to distinguish between alternatives. Transmutation might imply a high collective dose, for example, which must be reported. .

Table 5. Source-term and geosphere-biosphere interface (GBI)

BIOMASS guidance	ICRP guidance in Publication 81	Regulatory context (EPA and NRC proposed rules)	Source-term and GBI as described by DoE	SSI FS 1998:1t
Limited to groundwater release scenarios. Important to consider the GBI in relation to time-dependent changes, e.g. if climatic evolution will affect the receiving medium.	No specific recommendation, but see Tables 3 and 4 above.	Exposure through of contaminated ground water and through intrusion should be considered.	The proponent considers groundwater contamination and volcanism. Further analysis will be made regarding climate change. FEPs relevant for the Yucca Mountain area.	Consideration of both the environment and public health effectively rules out limitation to only a well scenario for temperate climates. Changes caused by known climate and ecosystem evolution shall always be included in one, basal scenario.

Table 6. Time frame

BIOMASS guidance	ICRP guidance in Publication 81	Regulatory context (EPA and NRC proposed rules)	Time frames as described by DoE	SSI FS 1998:1
Time frames will have to be selected on the basis of • Institutional control period • Surface environment evolution • Engineered barrier degradation • Geological evolution • PA results • Radionuclide decay	Quantitative estimates of dose or risk can be performed for times up to between 1 000 and 10 000 years after closure. Qualitative analysis including stylised approaches can be used when considering longer time frames.	A compliance period of 10 000 years. Events with a probability of $>10^{-4}$ during this time should be included. Longer time frames shall be included if the peak dose will occur after 10 000 years.	BDCFs are calculated for 10 000 years. Additional calculation has been performed for 1 million years.	Radiation protection standards in principle not limited in time. Quantitative estimates have to be provided for the first 1000 years, whereas qualitative judgements become more prominent for longer time periods. Draft safety regulations (SKI) specify thet the assessment has to cover 10 000 years and need not be performed for longer times than 1 000 000 years.