CONTENTS

1. INTRODUCTION 1

1.1. Background 1
1.2. Objective 3
1.3. Scope 3
1.4. Structure 3

2. NEAR SURFACE DISPOSAL CONCEPTS 4

2.1. Multiple barrier concept 4
2.2. Disposal systems 5
2.2.1. Basic disposal system concepts 5
2.2.2. Repository design components 7
2.3. Types of radioactive waste 9
2.4. Developing a repository 10
2.4.1. Pre-operational phase 11
2.4.2. Operational phase 12
2.4.3. Post-closure phase 13
2.5. Developing a safety case 14
2.6. Monitoring and surveillance 17

3. NEARFIELD 20

3.1. Near field environment 20
3.1.1. Host geological environment 20
3.1.2. Hydrogeological conditions 21
3.1.3. Chemical conditions 22
3.2. Waste packages 24
3.2.1. Waste form performance 24
3.2.2. Container performance 26
3.3. Engineered barriers 27
3.3.1. Functions and materials 27
3.3.2. Degradation processes 29
3.4. Gas generation 31
3.5. Transport of radionuclides 32

4. FAR FIELD 33

4.1. Geology 33
4.2. Hydrogeology 35
4.2.1. Saturated zone 35
4.2.2.Vadose zone 36
4.3. Geochemistry 37
4.4. Migration of radionuclides 39
4.5. Potential impacts of climate change on the far field 41

5. BIOSPHERE 42

5.1. Reference biosphere concept 43
5.2. Migration and accumulation of radionuclides 45

6. CONFIDENCE IN REPOSITORY PERFORMANCE AND SAFETY . . 46

6.1. Confidence in waste isolation 46
6.1.1. Suitability of the site 47
6.1.2. Robustness of the design 48
6.1.3. Robustness of the **assessment** **48**
6.2. Building confidence in the safety case 48
6.2.1. Structuring the safety assessment 49
6.2.2. Uncertainty management 50
6.2.3. Testing models 51
6.2.4. Natural and archaeological analogues 51
6.2.5. Documentation and maintenance of records 52

7. SUMMARY AND CONCLUSIONS 53

REFERENCES 57
CONTRIBUTORS TO DRAFTING AND REVIEW ..... 67 .

400282 61060