



## CONTENTS

	Page
1 INTRODUCTION	1
1.1 Scope of review	1
1.2 Extremely low frequency electric and magnetic fields	1
2 MECHANISMS OF INTERACTION	2
2.1 Electric fields	2
2.2 Magnetic fields	3
2.3 Biological interaction mechanisms	4
3 HUMAN STUDIES	6
3.1 Experimental studies	6
4 ANIMAL STUDIES	17
4.1 Body weight	17
4.2 Haematology and immunology	18
4.3 Endocrine system	22
4.4 Cardiovascular system	24
4.5 Nervous system	25
4.6 Circadian rhythms	30
4.7 Behaviour	32
4.8 Reproduction and development	37
4.9 Genetic effects	44
4.10 Cancer-related studies	45
5 <i>IN VITRO</i> STUDIES	47
5.1 Immune response	47
5.2 Chromosomal and mutagenic effects	49
5.3 Cancer-related studies	51
5.4 Bone metabolism studies	55
5.5 Ion exchange in nervous tissue	56
6 SUMMARY AND CONCLUSIONS	58
6.1 Summary	58
6.2 Conclusions	66
7 ACKNOWLEDGEMENTS	68
8 REFERENCES	68
 <b>TABLES</b>	
1 Comparison of averaged axial current densities in grounded primates, swine and rodents exposed to a 50 Hz, 10 kV m <sup>-1</sup> electric field	91
2 Comparison of averaged electric field acting on the surface of grounded primates, swine and rodents exposed to a 50 Hz, 10 kV m <sup>-1</sup> electric field	92

3	Scaling factors for primates, swine and rodents exposed to 50 Hz magnetic fields	93
4	Effects of currents passing through the human body	94
5	Approximate current density ranges for biological effects	95

#### FIGURES

1	Electromagnetic spectrum	96
2	Vertical current densities along the centre of the body, and along the middle of the arm and leg produced by a 60 Hz, 1 kV m <sup>-1</sup> applied electric field	97
3	Changes in calcium-dependent mobility of diatoms exposed to a range of ELF magnetic fields	98
4	Threshold values of the magnetic flux density required to elicit magnetic phosphenes plotted as a function of field frequency	99
5	Neural structure of the retina	100
6	Perceptual thresholds for auditory and visual sensations generated by electric currents (applied via electrodes attached to head)	101

