

TABLE OF CONTENTS

Acknowledgments.....	iii
Abstract and Benefits.....	iv
List of Tables	vii
List of Figures	viii
List of Acronyms	x
Executive Summary	ES-1
1.0 Introduction.....	1-1
1.1 Microbial Fuel Cell Basics.....	1-2
1.2 Microbial Fuel Cell Components.....	1-2
1.2.1 Anode.....	1-2
1.2.2 Proton Exchange Membrane and Catalyst Layer.....	1-3
1.2.3 Gas Diffusion Layer.....	1-4
1.3 Research Objectives.....	1-4
2.0 Literature Review	2-1
2.1 Early History	2-1
2.2 Biological Electron Transfer and MiFC Basics	2-1
2.3 MIFC Configurations.....	2-2
2.3.1 Two-Chamber MiFCs.....	2-3
2.3.2 Tubular and Upflow MiFCs	2-3
2.3.3 Single-Chamber MiFCs.....	2-4
2.4 Single-Chamber MIFCs.....	2-5
2.4.1 Single-Chamber MiFCs: Substrates.....	2-5
2.4.2 Single-Chamber MiFCs: Membranes and Cathodes	2-6
2.4.3 Single-Chamber MiFCs: Anodes.....	2-7
3.0 Experimental Procedures.....	3-1
3.1 Microbial Techniques	3-1
3.1.1 Laboratory Sludge.....	3-1
3.1.2 Iron-Rich Sludge	3-1
3.1.3 Low-Iron, 3% Sludge.....	3-1
3.1.4 Iron-Rich, 3% Sludge.....	3-2
3.2 Microbial Fuel Cell Assembly.....	3-3
3.2.1 End Plates/Chamber.....	3-4
3.2.2 Membrane-Electrode Assembly (MEA).....	3-4
3.2.3 Anode	3-4
3.3 Impedance Testing.....	3-5
3.4 Abiotic MEA Testing.....	3-7
3.5 Batch Anaerobic Sludge Fuel Cell testing.....	3-8
3.5.1 Pseudo-Sterile Testing Preparation	3-9
3.5.2 Laboratory Sludge Testing Preparation	3-9
3.5.3 Sodium Azide Testing Preparation to Affirm Role of Microbial Activity.....	3-9

3.5.4	Iron-Rich vs. Low-Iron Media Testing Preparation to Evaluate Role of Iron.....	3-10
3.5.5	Low-Iron 3% Sludge Testing Preparation to Evaluate CNS-Enhanced Anodes	3-10
3.5.6	Glucose Monitoring	3-10
4.0	Results	4-1
4.1	Impedance Testing Results	4-1
4.2	Pseudo-Sterile MiFC Testing Results.....	4-2
4.3	Laboratory Sludge MIFC Testing Results	4-6
4.4	Sodium Azide MIFC Testing Results.....	4-11
4.5	Iron-rich vs. Control Media MiFC Testing Results.....	4-13
4.6	Low-iron, 3% Sludge MiFC Testing Results.....	4-14
4.7	Nitrifying MiFC Results	4-16
4.7.1	Results from Initial Screening Experiments with <i>N. europaea</i>	4-16
4.7.2	Results for MiFCs Using Enriched Nitrifying Culture	4-17
5.0	Conclusions	5-1
	References.....	R-1