Guidelines on detecting, controlling and mitigating microbial growth in oils and fuels used at power generation facilities

energy institute

GUIDELINES ON DETECTING, CONTROLLING, AND MITIGATING MICROBIAL GROWTH IN OILS AND FUELS USED AT POWER GENERATION FACILITIES

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FOREWORD

Microbes can infect power generation fuel and turbine oil systems, causing damage to both products and systems. The most common types of microbial damage (biodeterioration) to diesel fuel include reduced oxidative stability, increased haze due to water dispersion, increased particulate contamination, and increased corrosivity. The most common types of microbial damage to turbine oil include decreased oxidative stability, viscosity, and water demulsibility, and increased acid number, particulate load, and corrosivity. Microbiologically influenced corrosion (MIC) and flow restriction (filter plugging and biomass accumulations decreasing line diameters) are the most common system deterioration symptoms. There are billions of different types of bacteria and fungi, many of which can use the chemicals found in fuels and lubricants as food. Moreover, microbes can thrive under nearly all environmental conditions found on earth. Section 4 of this guidance document offers a primer on microbiology; sufficient to allow the non-technical reader to understand the material presented herein.

This guidance document focuses on addressing operational problems from microbial growth in turbine, lubricating, transformer and other oils and diesel fuels at power stations. The consequences of microbial growth in oils include additive depletion, tank and pipe sludging, filter plugging, gauging problems, corrosion, increased acidity, attack on paint surfaces, viscosity changes and smell and discolouration. The costs of treating a system once microbial fouling has taken place are considerable and the associated costs of unscheduled downtime and equipment repairs may run to several million pounds. Additionally, diesel stored in power stations for use in back-up generators can be particularly prone to microbial growth. As a consequence, over time diesel fuel may become unfit for use, compromising station operability. There is also a risk of MIC with consequent loss of tank integrity.

A climate survey (Section 2) was carried out at the start of this project. Nearly 200 United Kingdom (UK) and North American (United States of America and Canada) power generation facility fuel and turbine oil system operators were invited to respond to surveys designed to assess issue recognition and current procedures for microbial contamination control. There were no complete responses from turbine oil operators. This supported speculation that although microbial contamination affects turbine oils and systems, operators rarely make the connection between symptoms and their cause. This document provides case studies (Section 3) to illustrate biodeterioration problems, effective root cause analysis (RCA), remediation, and prevention.

Guidance is provided for product and system condition monitoring (Section 6) and for controlling microbial contamination when it is detected (Section 7). A complete list of consensus standards used to collect samples, analyse products, and diagnose problems is provided in Annex C. This section also lists non-consensus references. Annex B provides a glossary of microbiological terms used in this guidance document.

This guidance document provides sufficient background information to the power generation industry stakeholders who are unfamiliar with microbiology as a tool to empower them to recognise and effectively control microbial contamination in fuel and turbine oil systems. It offers information about both turbine oil and fuel product and system biodeterioration. Much of the fuel-related material derives from Energy Institute (EI) *Guidelines for the Investigation of the Microbial Content of Liquid Fuels and for the Implementation of Avoidance and Remedial Strategies* (EI Fuel Guidelines).