EI Research report

Aviation fuelling hazardous area classification

energy institute

EI RESEARCH REPORT

AVIATION FUELLING HAZARDOUS AREA CLASSIFICATION

July 2017

Published by
Energy Institute, London
The Energy Institute is a professional membership body incorporated by Royal Charter 2003
Registered charity number 1097899

The Energy Institute (EI) is the chartered professional membership body for the energy industry, supporting over 23 000 individuals working in or studying energy and 250 energy companies worldwide. The EI provides learning and networking opportunities to support professional development, as well as professional recognition and technical and scientific knowledge resources on energy in all its forms and applications.

The EI's purpose is to develop and disseminate knowledge, skills and good practice towards a safe, secure and sustainable energy system. In fulfilling this mission, the EI addresses the depth and breadth of the energy sector, from fuels and fuels distribution to health and safety, sustainability and the environment. It also informs policy by providing a platform for debate and scientifically-sound information on energy issues.

The EI is licensed by:
– the Engineering Council to award Chartered, Incorporated and Engineering Technician status;
– the Science Council to award Chartered Scientist status, and
– the Society for the Environment to award Chartered Environmentalist status.

It also offers its own Chartered Energy Engineer, Chartered Petroleum Engineer and Chartered Energy Manager titles.

A registered charity, the EI serves society with independence, professionalism and a wealth of expertise in all energy matters.

This publication has been produced as a result of work carried out within the Technical Team of the EI, funded by the EI's Technical Partners. The EI's Technical Work Programme provides industry with cost-effective, value-adding knowledge on key current and future issues affecting those operating in the energy sector, both in the UK and internationally.

For further information, please visit **http://www.energyinst.org**

The EI gratefully acknowledges the financial contributions towards the scientific and technical programme from the following companies

Apache North Sea
BP Exploration Operating Co Ltd
BP Oil UK Ltd
Centrica
Chevron North Sea Ltd
Chevron Products Company
CLH
ConocoPhillips Ltd
DCC Energy
DONG Energy
EDF Energy
ENGIE
ENI
E. ON UK
ExxonMobil International Ltd
Innogy
Kuwait Petroleum International Ltd
Maersk Oil North Sea UK Limited
Nexen CNOOC
Phillips 66
Qatar Petroleum
Repsol Sinopec
RWE npower
Saudi Aramco
Scottish Power
SGS
Shell UK Oil Products Limited
Shell U.K. Exploration and Production Ltd
SSE
Statkraft
Statoil
Tesoro
Taqa Bratani
Total E&P UK Limited
Total UK Limited
Tullow Oil
Uniper
Valero
Vattenfall
Vitol Energy
Woodside
World Fuel Services

However, it should be noted that the above organisations have not all been directly involved in the development of this publication, nor do they necessarily endorse its content.

ISBN 978 0 85293 844 7

Published by the Energy Institute

Hard copy and electronic access to EI and IP publications is available via our website, **https://publishing.energyinst.org**.
Documents can be purchased online as downloadable pdfs or on an annual subscription for single users and companies.
For more information, contact the EI Publications Team.
e: **pubs@energyinst.org**

CONTENTS

LIST OF FIGURES AND TABLES

Page

Figures

Tables

FOREWORD

This EI Research Report has been prepared by Andrew Garrison and Steve Sherwen of RPS Risk Management[1] under the direction of the Energy Institute's (EI) Aviation Committee.

This work was commissioned to provide an authoritative hazardous area classification for aviation fuelling with jet fuel and to propose internationally-acceptable direct examples. This was in recognition that there is a large degree of standardisation in aviation fuelling vehicle design (hydrant dispensers, refuellers and hydrant carts) and that of vehicle-mounted service equipment.

The intention of this work was to achieve consensus agreement on a subject that has been debated for many years, with a wide range of regional and national interpretation, due to the relatively high flashpoint of jet fuel (well above ambient in temperate zones) and lack of quantitative data on mist/spray formation.

This EI Research Report is intended to assist all those involved in the design, construction, inspection and maintenance of aviation fuelling vehicles and all companies involved in the fuelling of commercial aircraft with jet fuel.

The EI is not undertaking to meet the duties of employers to warn and equip their employees, and others exposed, concerning health and safety risks and precautions, nor undertaking their obligations under local and regional laws and regulations.

Nothing contained in any EI publication is to be construed as granting any right, by implication or otherwise, for the manufacture, sale, or use of any method, apparatus, or product covered by letters patent. Neither shall anything contained in the publication be construed as insuring anyone against liability for infringement of letters patent.

This report is intended to assist those involved in aviation fuel handling. Every effort has been made by the EI to ensure the accuracy and reliability of the data contained herein; however, the EI makes no representation, warranty, or guarantee in connection with this publication and hereby expressly disclaims any liability or responsibility for loss or damage resulting from its use or for the violation of any local or regional laws or regulations with which this publication may conflict.

1 RPS Risk Management, 105 Dalton Avenue, Birchwood Park, Warrington, Cheshire, WA3 6YF, UK. Tel: +44(0)1925 831 000, http://www.rpsgroup.com

ACKNOWLEDGEMENTS

This EI Research Report was prepared by Andrew Garrison and Steve Sherwen of RPS Risk Management who are thanked for their significant contributions on this topic.

Jan de Wit (formerly of Shell Aviation), Bernhard Mädler (Shell Aviation) and Arthur Mitchell (Air BP) formed a Working Group under the direction of the Aviation Committee and provided considerable technical input to the study.

Bernhard Mädler, Nic Mason (Kuwait Petroleum International Aviation Company) and the staff at ASIG, Manchester, are thanked for their assistance in arranging a site visit.

A draft version of this report was made available for review by representatives of the following EI Aviation Committee and EI Area Classification Working Group member companies and organisations, who are thanked for their participation and contributions to the preparation of this publication:

Air BP Limited
Air TOTAL
Airlines for America
Bechtel
Chevron
Civil Aviation Administration of China
Compañía Logística de Hidrocarburos (CLH)
ExxonMobil
F.E.S. (EX) Ltd
Haztech Consultants
Health and Safety Executive
Health and Safety Laboratory
International Air Transport Association
Joint Inspection Group
Kuwait Petroleum International Aviation Company Ltd.
Phillips 66
Shell Aviation Ltd.
Shell Global Solutions
Tesoro
US Air Force Petroleum Office
Valero
Vitol Aviation
World Fuel Services

The EI is grateful to the following organisations for granting permission to reproduce certain figures in this report:

API (Figure 6)
Health and Safety Laboratory (Figure 5)
IATA (Figure 17)
Standards Australia/Standards New Zealand (Figure ZA.25)

Project coordination and editing was undertaken by Martin Hunnybun (EI).

1 INTRODUCTION

The EI Aviation Committee has identified a need to standardise the classification of potentially hazardous zones around commercial jet aircraft fuelling across the world.

RPS was given the task of providing technical assistance to support the preparation of Hazardous Area Classification (HAC) guidance on the potentially flammable zones that may exist around jet aircraft fuelling operations.

The following sections follow the review of existing technical information on the HAC of aircraft refuelling and then provide guidance for the size and nature of zones, using the format of the direct examples given in EI 15 4th Edition. The zones and their hazardous extents are taken from the literature reviewed and applied pragmatically to reflect the nature and working environment of the aircraft fuelling equipment.

This publication has been created with Jet A-1/Jet A as the process fluid. If an aircraft's fuel tanks are filled with lower flash point fuels (e.g. TS-1 or AVGAS) then spills and vent vapours will have a higher risk of ignition and a specific study must be carried out to determine the extent of any hazardous zone.

2 METHODOLOGY

RPS had an initial meeting on 24 March 2016 with the EI Aviation Committee where information was gathered on aircraft refuelling operations and vehicles. RPS was shown dispenser and refueller equipment located at the ASIG facility and then witnessed an aircraft being refuelled by a dispenser at Manchester Airport to aid in their understanding of the process and the potential sources of release.

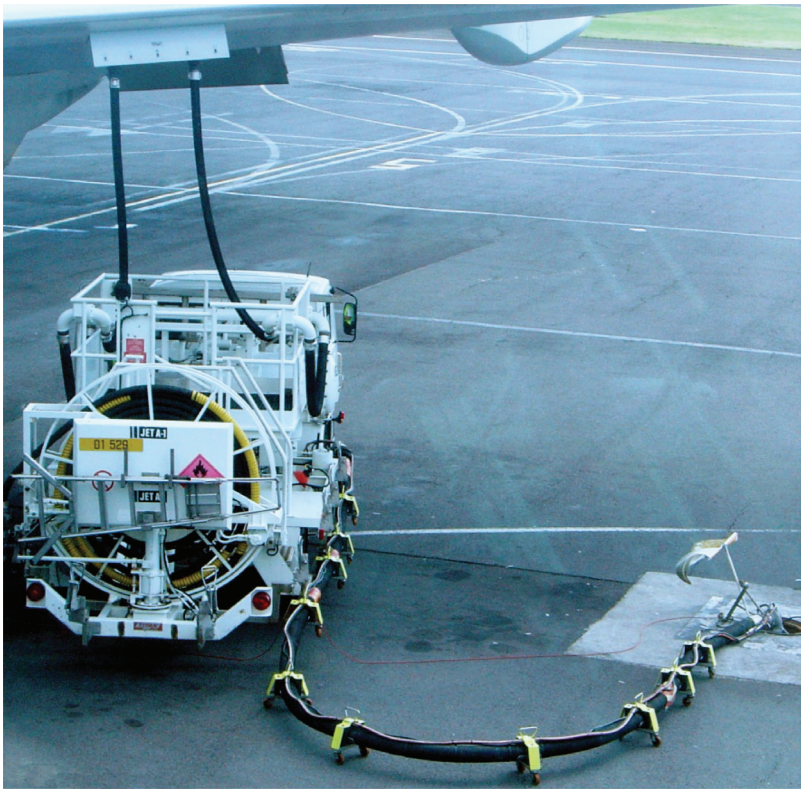

Figure 1: A fuel dispenser fuelling an aircraft

RPS then conducted a technical review of available literature and documentation which was supplied by the EI Aviation Committee. The following operations were considered in the development of the HAC:

– in position ready to perform the fuelling operation;
– performing the fuelling operation, and
– in standby with no connections made to a hydrant or aircraft.

Following this technical review RPS presented its findings to the Aviation Committee at a meeting of the working group in Prague on 19 May 2016. Here RPS proposed the options for direct examples for the operations listed here. During the meeting the opinion was taken to construct a set of worldwide direct examples which could be applied to any aircraft refuelling operations, independent of the ambient temperature. Acceptance was gained and technical feedback given.