République algérienne démocratique et populaire
Ministère de l'enseignement supérieure et de la recherche scientifique
Ecole Nationale Polytechnique

Département de maîtrise des risques industriels et environnementaux

Thesis of final studies project

Application of Passive and Active Fire Protection Systems in the Oil and Gas Industry

BEN BOUTELDJA Mohamed Sabri

BOUDERBALA M'hammed

Under the direction of:

M.M. BOUSBAI	Associate professor B at ENP	
Ms.H. MERZOUGI	Safety Engineer	at CEI HALFAOUI
Ms.H. BENRABAH	Safety Engineer	at CEI HALFAOUI

Presented and defended publicly on 29 - 06 - 2024 in front of the jury composed of:

M YOUSFI Hamid	President	Professor at ENP
M.BOUBAKEUR Mohamed	Examiner	Associate Professor A at ENP
M.KERTOUS Aboubaker	Examiner	Associate Professor A at ENP

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Mémoire de fin d'études

Application des Systèmes de Protection Passive et Active contre les incendies dans l'Industrie du Oil & Gas

BEN BOUTELDJA Mohamed Sabri

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الملخص:
تتناول هذه الأطروحة موضوع حماية الحرائق لوحدة معالجة المحروقات. من أجل ذلك، قمنا بإجراء دراسة تقييم مخاطر الحرائق والانفجارات (FERA) باستخدام برنامج DNV Safeti 8.4 لمحاكاة سيناريوهات حقيقية للحرائق وتقدير النتائج المتوقعة.

هذه البيانات أدت إلى وضع خطة للحماية السلبية من الحرائق وفقًا لمعيار API RP 2218. تتيح هذه الخطة حماية المعدات المهمة لفترة مطولة أثناء حدوث حريق.

بالإضافة إلى ذلك، تم تقييم فعالية أنظمة الإطفاء النشطة لضمان مكافحتها بشكل مثلى للحرائق داخل بيئة وحدة المعالجة، ملتزمين بمعايير NFPA.

من خلال دمج هذه الاستراتيجيات، تقترح هذه الأطروحة خطة شاملة لحماية الحرائق لوحدة معالجة المحروقات، مع التركيز على سلامة الأفراد وتقليل الضرر المحتمل.

الكلمات الرئيسية: FERA، الحماية من الحرائق السلبية، الحماية من الحرائق، الحماية النشطة من الحرائق، النمذجة، المحاكاة، Safeti 8,4، معايير API RP ، معايير NFPA.

Résumé :
Cette thèse aborde la protection contre les incendies pour une unité de traitement des hydrocarbures. Pour ce faire, nous avons réalisé une étude d'évaluation des risques d'incendie et d'explosion (FERA) en utilisant le logiciel Safeti 8.4 pour simuler des scénarios d'incendie réels et estimer les conséquences.

Ces données ont guidé l'élaboration d'un plan de protection passive contre les incendies conforme à la norme API RP 2218. Ce plan permet de protéger les équipements critiques pendant une période prolongée en cas d'incendie.

De plus, l'efficacité des systèmes actifs de suppression des incendies a été évaluée afin de garantir qu'ils combattent de manière optimale les incendies dans l'environnement unique de l'unité de traitement, en respectant les normes NFPA.

En combinant ces stratégies, cette thèse propose un plan de protection incendie complet pour l'unité de traitement des hydrocarbures, en priorisant la sécurité du personnel et en minimisant les dommages potentiels.

Mots-clés : FERA, Protection passive contre les incendies, Ignifugation, Protection active contre les incendies, Modélisation, Simulation, Safeti 8.4, Normes API RP, Normes NFPA.

Abstract:
This thesis addresses fire protection for a hydrocarbon treatment unit. In order to do that, we realized a Fire and Explosion Risk Assessment (FERA) study using Safeti 8.4 software to simulate real fire scenarios and estimate the consequences.

This data guided the development of a passive fireproofing plan following the API RP 2218 standard. This plan allows to protect critical equipment for an extended period during a fire.

Additionally, the effectiveness of active fire suppression systems was evaluated to ensure they optimally combat fires within the unique environment of the treatment unit, adhering to NFPA standards.

By combining these strategies, this thesis proposes a comprehensive fire protection plan for the hydrocarbon treatment unit, prioritizing personnel safety and minimizing potential damage.

Keywords: FERA, Passive Fire Protection, Fire Proofing, Active Fire Protection, Modeling, Simulation, Safeti 8.4, API RP Standards, NFPA Standards.

Dedications

To my parents, Mom and Dad, who have done everything for me and to whom I shall be grateful all my life.

To my younger sister, whom I'm so grateful to have, even though I never said it.

To my grandmother and my aunts, who have always supported me.

To my friends and classmates, who made this journey sweet and with whom I shared the most beautiful memories.

To my project partner, M'hammed, whom I'm thankful for working with over the last few months.

To my two cats, who added considerable drama to my life.

– Sabri

To my loving family—Mom, Dad, and my brothers and little sister—your unwavering support and belief in me have been my greatest motivation. Thank you for always encouraging me to pursue my dreams.

To my mentors and supervisors, whose guidance and wisdom have shaped my journey. Your patience and insights have been invaluable in molding my understanding and skills.

To my teachers and professors, for sharing your knowledge and pushing me to explore new horizons. Your dedication to education has inspired me to strive for excellence.

To my classmates and friends, who have made this academic adventure unforgettable. Your camaraderie and shared experiences have made the challenges easier and the victories sweeter.

To my project partner, Sabri, thank you for being by my side throughout this journey. Your dedication, ideas, and collaboration have been instrumental in our success.

And finally, to everyone who has believed in me and supported me along the way—thank you. This achievement would not have been possible without each of you.

– M'hammed

Acknowledgments

We would like to express our sincere gratitude to Mrs. Hadjer BENRABAH and Mrs. Hind MERZOUGI for their invaluable guidance and support throughout the duration of this internship. Their expertise, patience, and encouragement have been instrumental in shaping our experience and guiding us through its various stages. We are truly fortunate to have had the opportunity to benefit from their wisdom and mentorship.

We would also like to extend our heartfelt thanks to our academic tutor, Mr. BOUSBAI M'hammed, for his unwavering support and valuable insights. His dedication to our professional growth and his willingness to share his knowledge have been invaluable resources throughout this journey.

Furthermore, we are deeply grateful to all the personnel of CEI Halfaoui for their unwavering support and professionalism. Their assistance and cooperation have greatly contributed to the successful completion of this internship.

Lastly, we would like to express our immense appreciation for the privilege of working on such a meaningful project with such exceptional mentors. Their guidance and mentorship have not only enriched our professional experience but have also inspired us to strive for excellence in all our endeavors.

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