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**MAJALAH ILMIAH PENGAJIAN INDUSTRI**  
***JOURNAL OF INDUSTRIAL TECHNOLOGY ASSESSMENTS***

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**Volume 15 No. 2: August 2021**

**Published by:**  
**Deputy for Design and Engineering Industrial Technology**  
**Agency for the Assessment and Application of Technology**  
**Jakarta**

<b>MIPI</b>	<b>Vol. 15</b>	<b>No. 2</b>	<b>Page: 70-135</b>	<b>Jakarta, August 2021</b>	<b>P-ISSN 1410-3680</b> <b>E-ISSN 2541-1233</b>
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## ACKNOWLEDGEMENT

We would like to thank to the reviewers that have reviewed the published articles on the Journal of Industrial Technology Assessments (*Majalah Ilmiah Pengkajian Industri*) Volume 15, No. 2, (Agustus 2021). The participants:

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## Preface

Even though the COVID-19 pandemic has not abated yet, this edition of Industrial Analysis Journal volume 15 no 2 Agustus 2021 is still managed to publish. Thanks to continuous submission from contributors and hardwork of editor teams. This volume presents various fields of transportation and material sciences. Transportation engineering nowadays is among the priority programs in Indonesia, which emphasize in Infrastructures development. Material sciences are therefore very relevant in supporting this theme.

Research and assessment were conducted by various institutions researchers in those fields. In this edition, the journal publishes important and interesting papers related to transportation, such as . alysis Of Heat Release Rate In Engine Room Fires Of 300 Gt Ferry Ro-Ro Passenger By Using Water Mist System And CO<sub>2</sub> System, Hydrodynamic And Boussinesq Wave Modeling For The N219 Amphibious Aircraft Seaplane Dock Development Plan In Panjang Island, and Developing Supply Chain Network With Piecewise Linear Transportation Cost For A Small-And-Medium Enterprise In Cilegon.

In this editions are published also paper on materials engineering :. Relationship Between Safety Culture And The Safety Climate, Safety Behavior, And Safety Management, Microstructure And Oxidation Behavior Of The Oxide Dispersion Strengthened Stainless Steel 316L With Zirconia Dispersion and Assay And Graphite Furnace- Atomic Absorbance Spectrometry Accuracy For Palladium Content Analysis. The other paper are environment researchers : Demographic Characteristics Of Site Vicinity Area For Preparation In West Kalimantan NPP Site and The Effect Of Dimethyl Ether (DME) as LPG Substitution On Household Stove: Mixture Stability, Stove Efficiency, Fuel Consumption, and Materials Testing.

The editors always do their best to improve the quality of the Journal; especially now that we are heading towards an english language journal in order to increase the impact and citations. The next publication is scheduled on December 2021. As closing remarks, the editors always call for critics and suggestions to further improve this Journal.

The Editors

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(Journal of Industrial Technology Assessments)

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## **ANALYSIS OF HEAT RELEASE RATE IN ENGINE ROOM FIRES OF 300 GT FERRY RO-RO PASSENGER BY USING WATER MIST SYSTEM AND CO<sub>2</sub> SYSTEM**

**Wira Setiawan, Distyan Kotanjungan**

### **Abstract**

Based on statistical data in recent years, there are still quite several ship accidents due to fires, including on passenger ships. The water mist system is a fire suppression system that allows it to be used in the engine room with the advantage that it can keep the heat production rate low during the extinguishing process and can be operated earlier than the CO<sub>2</sub> system. The research is conducted by using a fire dynamic simulator in the engine room of a 300 GT ferry ro-ro passenger to compare the heat release rate of fire without an extinguishing system, an existing CO<sub>2</sub> system, and a water mist system. The result shows that the CO<sub>2</sub> fire suppression system reduces the heat release rate more rapidly to the decay phase at 375 seconds while the water mist takes more than 900 seconds. However, the fully developed phase of the water mist suppression system occurs more quickly than CO<sub>2</sub> because the sprinklers are activated shortly after a fire occurs. Unlike water mist, the CO<sub>2</sub> system is activated at 60 seconds so that the pre-combustion, growth, flashover, and fully developed phases are at the same HRR and time as the natural one.

**Keywords:** Heat Release Rate; Water mist System; CO<sub>2</sub> System; Fire on Ship; Fire Dynamics

## **THE EFFECT OF DIMETHYL ETHER (DME) AS LPG SUBSTITUTION ON HOUSEHOLD STOVE: MIXTURE STABILITY, STOVE EFFICIENCY, FUEL CONSUMPTION, AND MATERIALS TESTING**

**Galuh Wirama Murti, Unggul Priyanto, Imron Masfuri, Nesha Adelia**

### **Abstract**

DME has characteristics similar to LPG so that the storage and handling are not different from LPG. DME could be used as a solvent that can extract typical types of rubber/polymer material. The aims and objectives of this study are to determine the effect of blending DME/LPG ratios (100/0, 80/20, 50/50, 30/70, 20/80) on the stability of the DME/LPG mixture, the efficiency of the stove, and the fuel consumption. The highest efficiency of the stove with blending DME/LPG was 71.29% and was achieved by the LPG-DME stove with 50/50 DME/LPG. This result shows the stove design has an enormous effect on efficiency. The increasing DME ratio in the blending fuel can raise fuel consumption. The study also observes the effect of the blending on several stove accessories rubber materials. The study reveals that the usage of a DME/LPG with blend ratios between 20/80 - 30/70 does not require a replacement of any substitute materials but only requires minor modifications to the stove. However, at a higher DME composition, the use of the fuel needs to replace the seal that is resistant to DME.

**Keywords :** Dimethyl ether; LPG; stability; stove; the rubber material Received: 2021-05-03; Revised: 2021-07-19; Accepted: 2021-07-19

## **HYDRODYNAMIC AND BOUSSINESQ WAVE MODELING FOR THE N219 AMPHIBIOUS AIRCRAFT SEAPLANE DOCK DEVELOPMENT PLAN IN PANJANG ISLAND**

**Hanah Khoirunnisa, Mardi Wibowo, Wahyu Hendriyono, Khusnul Setia Wardani**

### **Abstract**

The flight test of N219 Amphibious aircraft will be targeted in 2023/2024 and it needs a seaplane dock. One of the potential locations for the seaplane dock is Panjang Island at Seribu Islands. This study aims to know the characteristic of hydrodynamic and wave conditions and to determine whether Panjang Island is suitable for the seaplane dock. This study uses a modelling method with MIKE 21 Flexible mesh (FM) Hydrodynamic-Spectral wave (HD-SW) module and MIKE 21 Boussinesq Wave (BW) module. The needed data are the bathymetry data were obtained from the Indonesian Navy Hydrographic and Oceanographic Center (Pushidrosal), tidal data, wave and wind data. The validation result between hydrodynamic modelling and Tidal model driver (TMD) is 92%. Current velocity has a range of 0.018-0.199 m/s during the west monsoon and 0.02-0.193 m/s during the east monsoon. The 50-year return period modelling resulted the maximum wave height between 1.139 to 1.474 m. Furthermore, the significant wave height has the range of 0.679 to 0.741 with the period of 13.45 seconds. In general, the current and wave conditions in Panjang Island is suitable for the construction of the seaplane dock, except that the dominant wave heights are still above the requirements.

**Keywords** : boussinesq wave; hydrodynamic modelling; spectral wave; N219A; seaplane dock

## **DEVELOPING SUPPLY CHAIN NETWORK WITH PIECEWISE LINEAR TRANSPORTATION COST FOR A SMALL-AND-MEDIUM ENTERPRISE IN CILEGON**

**Bobby Kurniawan, Ade Irman, Akbar Gunawan, Ani Umyati, Evi Febianti, Nuraida Wahyuni,  
Putro Ferro Ferdinand, Ratna Ekawati, Fellek Getu Tadesse**

### **Abstract**

This study proposed a supply chain network for determining suppliers' location in which the transportation costs are a piecewise linear function. The supply chain network consists of a production facility, suppliers, and customers. These types of costs are found in the fields of transportation, logistics, and purchasing discount. First, the supply chain network is formulated as the mixed-integer non-linear programming (MINLP) because piecewise linear transportation cost makes the model non-linear. Then, the model is transformed into a mixed-integer programming (MIP) model using the convex-combination method to overcome this nonlinearity. The model was used for solving the problem faced by a small and medium enterprise (SME) in Cilegon. The MIP was solved using the CPLEX software. Sensitivity analysis was carried to provide the SME with several alternatives in handling the suppliers' location problem.

**Keywords** : Supply chain network; piecewise linear function; convex-combination method; small and medium enterprise

## **RELATIONSHIP BETWEEN SAFETY CULTURE AND THE SAFETY CLIMATE, SAFETY BEHAVIOR, AND SAFETY MANAGEMENT**

**Dian Palupi Restuputri, M. Syahban Giralddi, Shanty Kusuma Dewi, Ilyas Masudin, Uci Yuliaty**

### **Abstract**

This article aims to measure the application of occupational safety and health using Cooper's Reciprocal Safety Culture Model and Confirmatory Factor Analysis method. The objective function of this article is to find out the aspects of safety culture that have been implemented by companies. A questionnaire was circulated to staff on the company's production floor as part of this study. The results of the questionnaire recapitulation were then analyzed using the confirmatory factor analysis method. Based on the score calculation results and the category determination build on the questionnaire scores on each dimension of the safety culture applied to the Steel Company, the safety climate value of 55.58 is obtained, which is on a 'quite good' scale. The safety behavior value of 44, 89 is included on a 'quite good' scale, the safety management system value of 22.04 is on a 'poor' scale, and the safety culture value of 40.83 is on the 'quite good' scale. With these results, it is essential to make improvements to the safety culture in the company, especially in the dimensions of the safety management system, which is on the 'quite good' scale.

**Keywords:** Occupational Safety and Health; Safety Culture; Safety Climate; Safety Behavior

## **MICROSTRUCTURE AND OXIDATION BEHAVIOR OF THE OXIDE DISPERSION STRENGTHENED STAINLESS STEEL 316L WITH ZIRCONIA DISPERSION**

**Syahfandi Ahda, Rohmad Salam, Agus Sujatno, Diene Hairani, Nanda Shabrina, Sulistioso Giat, Bandriyana**

### **Abstract**

Synthesis of the oxide dispersion sODS steels was performed by dispersing 0.5 wt % zirconia to the stainless steel SS 316L by the powder metallurgy method. The ball milling process was carried out for pre-alloying the elements continued with the consolidation performed by the compaction and sintering process using the APS (Arc Plasma Sintering). Analysis of microstructure was performed by observing the morphology, identify the phase and evaluate the oxide distribution. An oxidation test was carried out at 700°C for 8 hours using the MSB (Magnetic Suspension Balanced) apparatus to evaluate the primary oxidation curve. Relatively the same grain fineness consists of 2 dominant phases, so the presence of an austenitic phase and a ferritic phase has been analyzed from the X-Ray Diffraction pattern. The homogeneous distribution of zirconia was observed, followed by improvements in mechanical properties, which could be identified by hardness testing. The parabolic phenomenon oxidation curve was explained by the excellent high-temperature oxidation behavior of the ODS steel, followed by the formation of ZrO<sub>2</sub> oxide protective thin layer.

**Keywords:** ODS steel; zirconia; microstructure; oxidation; powder metallurgy



## **ASSAY AND GRAPHITE FURNACE- ATOMIC ABSORBANCE SPECTROMETRY ACCURACY FOR PALLADIUM CONTENT ANALYSIS**

**Ronaldo Irzon, Kurnia**

### **Abstract**

Palladium is a member of the expensive Platinum Group Metals as it is indispensable for various applications of modern technology. Due to the very small number of these elements in nature, high-sensitivity analytical methods and devices are required for accurate PGM measurement. The current study aims to determine the accuracy level of the Graphite Furnace-Atomic Absorbance Spectrometry device for palladium analysis after pre-concentration through the assaying process. The studied samples were two in-house standard reference samples with stream sediment and ultramafic rock matrices. Due to the lack of certified reference material containing certain palladium compositions, the degree of accuracy was tested by the spiking method. The detection limit for Pd in this study was 11.79 ppb. Pd content in the stream sediment (17 ppb) is much lower than of the ultramafic sample (290 ppb), implying PGM association to ultramafic rock naturally. Almost all measurements have good accuracy according to spike recovery between 80-120%. Inaccurate addition process and inappropriate calibration range most probably lead to inaccuracy.

**Keywords:** palladium; GF-AAS; assay; spiking

## **DEMOGRAPHIC CHARACTERISTICS OF SITE VICINITY AREA FOR PREPARATION IN WEST KALIMANTAN NPP SITE**

**Siti Alimah, Euis Etty Alhakim, Sunarko, Kurnia Anzhar, Mudjiono**

### **Abstract**

The potential risk of radioactive release to the environment and surrounding population can occur when there is a nuclear emergency, and nuclear preparedness planning is required for disaster mitigation. In preparedness planning, data is needed, one of which demographic characteristics. Demographic information in site preparation can produce appropriate and efficient policy formulations because the number and density of the population, as well as the susceptible population, are known. The method used is secondary data collection, data verification, data processing, mapping, and analysis. This study aims to determine the demographic characteristics of the site vicinity. The study results show that the population density in 5 km radius area is 177 people/km<sup>2</sup>. In 2018, the total population was 5,199 people, the percentage of the male population was 50.3%, and the female population was 49.7%. The population aged ≥20 years was 63.4%, 5-19 years old was 29.7%, and aged 0-4 was 6.9%. The projected population in 2047 is 6,523 people. The assumption is that in the event of a nuclear emergency, the emergency response considers the susceptible population. Evacuation of residents related to the emergency response can be carried out through 2 routes, namely through the South Singkawang District to the West Singkawang area, which is about 30 km from the site or through the Sungai Raya District to the Sungai Kunyit area, which is of about 26 km from the site.

**Keywords :** Demographic; Site Vicinity; Nuclear Emergency; Evacuation