ANALISIS RISIKO KESELAMATAN DAN KESEHATAN KERJA (K3) MENGGUNAKAN METODE FAILURE METODE AND EFFECT ANALYSIS (FMEA) DAN FAULT TREE ANALYSIS (FTA)

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Abstrak

Menurut data dari BPJS, kecelakaan kerja yang terjadi di Indonesia pada bulan Januari hingga November 2022 sebanyak 265.334 kasus. Jumlah ini meningkat 13,26 persen dibandingkan 234.270 kasus pada tahun 2021. Data tersebut menjadi peringatan keras bahwa penerapan K3 harus semakin di prioritaskan. UD Cantenan menggunakan beberapa mesin, bahan-bahan kimia dan suhu yang tinggi, dan hampir seluruh proses dilakukan masih secara manual tanpa alat bantu dan dioperasikan langsung. Berdasarkan obeservasi yang dilakukan terdapat 34 risiko kecelakaan kerja yang terdapat pada bagian proses produksi dan tercatat ada 14 kasus kecelakaan kerja yang terdapat pada bagian produksi di Ud Cantenan, data tersebut diambil dari bulan Febrari tahun 2020 hingga bulan Juli tahun 2023. Metode *JSA* digunakan untuk menentukan pekerjaan yang dianalisis serta mengidentifikasi risiko pada masing-masing pekerjaan, lalu *FMEA* digunakan untuk mengidentifikasi tingkat risiko kecelakaan kerja yang mengukur dari aspek dampak, peluang kejadian dan pencegahaannya dilakukan, sedangkan *FTA* digunakan untuk mengidentifikasi potensi penyebab kecelakaan. Dari hasil analisis data diketahui bahwa 5 failure mode dengan nilai *RPN* terbesar yaitu, terkena tumpahan logam cair,, tergulung putaran chuck mesin turning, tersengat listrik, tergulung putaran mata pahat milling dan mata terkena sekrap logam sisa produksi, ke lima failure mode dengan nilai *RPN* tertinggi yaitu fm 14, fm 27, fm 31 dengan nilai *RPN* 75 dan fm 22, fm 28 dengan nilai *RPN* 64. Nilai *RPN* tertinggi nantinya akan di analisis menggunakan metode *FTA* untuk mengetahui akar penyebab masalah dan diberikan rekomendasi untuk perbaikan, untuk *FM* 14, 21, dan 38 memiliki tiga akar masalah, sedangkan *fm* 27 dan 28 memiliki 4 akar masalah.

***Kata kunci**: keselamatan dan kesehatan kerja, Job safety analysis, Failure mode and Effect analysis, fault tree analysis*

OCCUPATIONAL SAFETY AND HEALTH (K3) RISK ANALYSIS USING FAILURE METHOD AND EFFECT ANALYSIS (FMEA) AND FAULT TREE ANALYSIS (FTA) METHODS

ABSTRACT

According to the data provided by BPJS, there were a total of 265,334 work accidents in Indonesia between January and November 2022. This figure represents a 13.26 percent increase compared to the 234,270 cases recorded in 2021. These statistics serve as a strong warning that the prioritization of K3 implementation is crucial. At UD Cantenan, various machines, chemicals, and high temperatures are utilized, and the majority of processes are carried out manually without the aid of tools. Upon conducting observations, it was discovered that there are 34 potential risks of work accidents in the production process section. Additionally, there have been 14 recorded cases of work accidents in the production section at Ud Cantenan between February 2020 and July 2023. This data was obtained through the utilization of the JSA method, which involves analyzing jobs and identifying associated risks. Furthermore, the FMEA method was employed to assess the level of work accident risk by considering impact, chance of occurrence, and prevention. Lastly, the FTA method was utilized to identify potential causes of accidents. The data analysis revealed that there are five failure modes with the highest RPN values. These failure modes include being hit by a liquid metal spill, being rolled by the turning machine chuck, being electrocuted, being rolled by the milling tool bit, and being hit by metal scrap from production. The failure modes FM 14, FM 27, and FM 31 have an RPN value of 75, while FM 22 and FM 28 have an RPN value of 64. The highest RPN values will later be analyzed using the FTA method to find out the root cause of the problem, and recommendations for improvement will be given for FM 14, 21, and 38, which have three root problems, while FM 27 and 28 have four root problems.

Keywords: occupational safety and health, job safety analysis, failure mode and effect analysis, fault tree analysis

DAFTAR PUSTAKA

AS/NZS, A. S. /. N. Z. S., 1999. Risk Management Guidelines. Sidney: Australian Standard / New Zeland Standard

Bastuti, S., 2020. Analisis Risiko Kecelakaan Kerja Dengan Metode Failure Mode And Effect Analysis (FMEA) dan Fault Tree Analysis (FTA) untuk Menurunkan Tingkat Risiko Kecelakaan Kerja (PT. Berkah Mirza Insani). Teknologi: Jurnal Ilmiah dan Teknologi, 2(1), pp. 48-52.

Cahyaningrum, Dwi, Sari, H. T. M. & Iswandari, D., 2019. Faktor-faktor yang berhubungan dengan kejadian kecelakaan kerja di laboratorium pendidikan. Jurnal Pengelolaan Laboratorium Pendidikan, 1(2), pp. 41-47.

Choudhary, S., Solanki, P. & Gidwani, 2018. Job Safety Analysis (JSA) Applied In Job Safety Analysis (JSA) Applied In. IJSTE - International Journal of Science Technology & Engineering, 4(9), pp. 1-9.

Dahlan, A., 2019. IDENTIFIKASI DAN ANALISIS RISIKO OPERASIONAL PADA DIVISI PRODUKSI PERUSAHAAN VULKANISIR BAN MENGGUNAKAN METODE RISK MANAGEMENT DENGAN PENDEKATAN FMEA DAN FTA (Studi kasus: CV. Citra Buana Mandiri Surabaya). (Doctoral dissertation, Universitas Muhammadiyah Gresik).

Darwis, A. M. et al., 2020. Kejadian kecelakaan kerja di industri percetakan kota Makassar. Jurnal Kesehatan Masyarakat Maritim, 3(2), pp. 155-163.

Darwis, A. M. et al., 2020. Kejadian kecelakaan kerja di industri percetakan kota Makassar. Jurnal Kesehatan Masyarakat Maritim, 3(2), pp. 155-163.

Dewanti, D. F. & Pujotomo, D., 2018. Analisis Penyebab Cacat Produk Kain Dengan menggunakan Metode Failure and Effect Analysis (FMEA). Industrial Engineering Online Journal, 6(4)

Dizdar, Neşet, E. & Ünver, M., 2019. The assessment of occupational safety and health in Turkey by applying a decision-making method; MULTIMOORA. Human and Ecological Risk Assessment: An International Journal, 26(6), pp. 1693-1704.

Faishal, N., 2019. ANALISA PENYEBAB KETERLAMBATAN PROYEK PEMBANGUNAN HOTEL MASON PINE BANDUNG MENGGUNAKAN METODE FAULT TREE ANALYSIS (FTA). Doctoral dissertation Universitas Mercubuana.

Far, S. Y. et al., 2018. Assessment of Health, Safety and Environmental Risks of Zahedan City Gasoline Stations. Engineering, Technology & Applied Science Research, 8(2), pp. 2689-2692.

Fattahi, Reza & Khalilzadeh, M., 2018. Risk evaluation using a novel hybrid method based on FMEA, extended MULTIMOORA, and AHP methods under fuzzy environment. Safety science, Volume 102, pp. 290-300.

Fauziyah, A., Djaelani, H. A. K. & Slamet, A. R., 2018. Pengaruh Lingkungan Kerja, Kesehatan dan Keselamatan Kerja Terhadap Produktivitas Kerja Karyawan (Studi Pada Karyawan Bagian Produksi PT. Berlina Tbk). Jurnal Ilmiah Riset Manajemen, 7(2).

Fithri, P., Nofriyanti, Hasan, A. & Kurnia, I., 2020. Risk Analysis for Occupational Safety and Health In Manufacturing Company Using FMEA And FTA Methods: A Case Study. IOP Conference Series: Materials Science and Engineering, Volume 1003, p. 012073.

Gumelar, I. & Hendri, T., 2019. Analisa Perbaikan Produk NG Pada Proses Mixing dengan Metode Fault Tree Analysis (FTA) dan Failure Mode and Effect Analysis (FMEA). Jurnal Rekayasa Teknologi dan Sains Terapan, 2(1), pp. 2- 19.

Hidayat, A. A., Kholil, M., Hendri & Suhaeri, 2018. The Implementation of FTA (Fault Tree Analysis) and FMEA (Failure Mode And Effect Analysis) Methods to Improve the Quality of Jumbo Roll Products. IOP Conference Series: Materials

Jaafara, M. H., Arifinb, K., Aiyubb, K. & Razmanc, M. R., 2018. Occupational safety and health management in the construction industry: a review. International Journal of Occupational Safety and Ergonomics (JOSE), 24(4), p. 493–506

Li, W., Cao, Q. & Min He, Y. S., 2018. industrial non-routine operation process risk assessment using job safety analysis (JSA) and a revised Petri net. Process Safety and Environmental Protection 117, Volume 117, pp. 533-538.

Luo, Z. & Cheng, H.-Y., 2021. Failure Analysis of Asphalt Foaming Device Based on FMEA and FTA. IOP Conference Series: Materials Science and Engineering.

McCann, P. & Vorley, T., 2020. Productivity Perspectives. Cheltenham: Edward Elgar Publishing.

Mete, S., 2019. Assessing occupational risks in pipeline construction using FMEA-based AHP-MOORA integrated approach under Pythagorean fuzzy environment. Human and Ecological Risk Assessment: An International, Volume 25, pp. 1645-1660.

Micheli, G., Cagno, E. & Calabrese, A., 2018. The transition from occupational safety and health (OSH) interventions to OSH outcomes: An empirical analysis of mechanisms and contextual factors within small and medium-sized enterprises. International journal of environmental research and public health, 15(8), p. 162

Munirwansyah, et al., 2018. Geotechnical Approach for Occupational Safety Risk Analysis of Critical Slope in Open Pit Mining for Earthquake Hazard. IOP Conf, Series: Material Science and Engineering, 352(1), p. 012035.

Mutlu, Gülüm, N. & Altuntas, S., 2019. Risk analysis for occupational safety and health in the textile industry: Integration of FMEA, FTA, and BIFPET methods. International Journal of Industrial Ergonomics, Volume 72, pp. 222-240.

Mutlu, N. G. & Altuntaş, S., 2019. Hazard and Risk Analysis for Ring Spinning Yarn Production Process by Integrated FTA-FMEA Approach. Textile and Apparel, 29(3), pp. 208-218

Mutlu, N. G. & Altuntaş, S., 2019. Hazard and Risk Analysis for Ring Spinning Yarn Production Process by Integrated FTA-FMEA Approach. Textile and Apparel, 29(3), pp. 208-218.

Nicolaidou, O. et al., 2021. The use of weak signals in 1occupational safety and health: An investigation. Safety Science, Volume 139, p. 105253.

Nurdiansyah, A., 2018. Analisa Risiko dan Pengendalian K3 Pada Area Warehouse PT. X Tahun 2018. Doctoral dissertation: Institute of Health Science BINAWAN.

Ouyang, L., Zhu, Y., Zheng, W. & Yan, L., 2021. An information fusion FMEA method to assess the risk of healthcare waste. Journal of Management Science and Engineering, pp. 111-124.

Pasaribu, Haryanto P, Harijanto S. Wulfram I. E., 2017 Metode Failure Mode and Effect Analysis (FMEA) dan Fault Tree Analysis (FTA) Untuk Mengidentifikasi Potensi dan Penyebab Kecelakaan Kerja Pada Proyek Gedung. Universitas Atma Jaya. Yogyakarta.

Ponda, H. & Fatma, N. F., 2019. Identifikasi Bahaya, Penilaian dan Pengendalian Risiko Keselamatan dan Kesehatan Kerja (K3) pada Departemen Foundry PT. Sicamindo. Heuristic, 16(2).

Pratiwi, F. S., 2023. RI Alami 265.334 Kasus Kecelakaan Kerja hingga November 2022 Artikel ini telah tayang di Dataindonesia.id dengan judul "RI Alami 265.334 Kasus Kecelakaan Kerja hingga November 2022"., https://dataindonesia.id/tenaga-kerja/detail/ri-alami-265334-kasus-kecelakaan-kerja-hingga-november-2022

R, A. & Qurtubi, 2019. Hazard Identification, Risk Assessment, and Risk Controlling Using Hazard Identification and Risk Assessment Method. IOP Conference Series: Materials Science and Engineering, 598(1), p. 012123.

Rajmohan, P. & Srinivasan, P., 2017. Safety Analysis of different industries using Fuzzy AHP. Journal of Advances in Chemistry, 12(26), pp. 5967-5990.

Sari, D. P. et al., 2018. ANALISIS PENYEBAB CACAT MENGGUNAKAN METODE FMEA DAN FTA PADA DEPARTEMEN FINAL SANDING PT EBAKO NUSANTARA. Prosiding SNST Fakultas Teknik, 1(1), p. 125–130.

Schulte, P., Delclos, G., Felknor, S. A. & Chosewood, L. C., 2019. Toward an expanded focus for occupational safety and health: a commentary. International journal of environmental research and public health, 16(24), p. 4946.

Sharma, K. D. & Srivastava, S., 2018. Failure Mode and Effect Analysis (FMEA) Implementation: A Literature Review. Journal of Advance Research in Aeronautics and Space Science, Volume 5, pp. 1-17.

Stefanova, M. G., 2019. Determination Of HAZARDS And Assessment of Risks And. Maritime Scientific Conference, pp. 46-50.

Sugarindra, M., Suryoputro, M. R. & Novitasari, A. T., 2017. Hazard Identification and Risk Assessment of Health and Safety Approach JSA (Job Safety Analysis) in Plantation Company. IOP Conf. Series: Materials Science and Engineering, 215(1), p. 012029.

Suharianto, F. & Muliatna, I. M., 2017. Study Tentang Job Safety Analysis dalam Identifikasi Potensi Bahaya sebagai Upaya Pencegahan Kecelakaan Kerja pada Pekerjaan Reparasi Kapal Kri Nala 363 di PT. Dok dan Perkapalan Surabaya (Persero. Jurnal Pendidikan Teknik Mesin, 6(2), pp. 104-107..

Suryoputro, M. R. et al., 2020. Occupational Health and Safety Effects on Productivity in a Garment Factory Using Structural Equation Modeling. IOP Conf. Series: Materials Science and Engineering, Volume 722, p. 012061.

Syafrial, H. & Ardiansyah, A., 2020. Prosedur Keselamatan Dan Kesehatan Kerja (K3) Pada PT. Satunol Mikrosistem Jakarta. JURNAL ABIWARA, 1(2), pp. 60-70

Syahtaria, I., Mashudi, A. & Suharjo, B., 2018. FAILURE RISK ANALYSIS GLASS BOWL PRODUCTION PROCESS USING FAILURE MODE EFFECT ANALYSIS AND FAULT TREE ANALYSIS METHODS (A CASE STUDY). International Journal of ASRO, 9(2), pp. 1-10.

Syahtaria, I., Mashudi, A. & Suharjo, B., 2018. FAILURE RISK ANALYSIS GLASS BOWL PRODUCTION PROCESS USING FAILURE MODE EFFECT ANALYSIS AND FAULT TREE ANALYSIS METHODS (A CASE STUDY). International Journal of ASRO, 9(2), pp. 1-10.

Wang, W., Liu, X., Qin, Y. & Fu, Y., 2018. A risk evaluation and prioritization method for FMEA with prospect theory and Choquet integral. Safety science, Volume 110, pp. 152-163.