

Exposure analysis of benzene in workplace control room A and

B P T X

by Fina Binazir Maziya

Submission date: 18-Apr-2022 02:58PM (UTC+0700)

Submission ID: 1813350986

File name: 7.Fina-Elsevier-Exposure_Benzene.pdf (760.96K)

Word count: 7941

Character count: 43369



ScienceDirect

Gaceta Sanitaria

Open access

7.4
CiteScore

2.139
Impact Factor

[Submit your article](#)

[Guide for authors](#)

[Menu](#)



[Search in this journal](#)

About the journal

[Aims and scope](#) [Editorial board](#) [Abstracting and indexing](#)

Director / Editor-in-Chief

Carlos Álvarez-Dardet Díaz, PhD

Universidad de Alicante, Grupo de Investigación en Salud Pública, Alicante, Spain

Associate Director / Directores asociados

Clara Bermudez Tamayo, PhD

Área de Gestión de Servicios y profesionales de la Salud. [Escuela Andaluza de Salud Pública. Ciber de Epidemiología y salud pública \(CIBERESP\)](#), Granada, Spain

Miguel Angel Negrin, PhD

Facultad de Economía. Universidad de Las Palmas de Gran Canaria, Las Palmas de Gran Canaria, Spain

Associate Editors / Editores y editoras asociados/as

Juan Alguacil, PhD

Área de Medicina Preventiva y Salud Pública. Departamento de Sociología, Trabajo Social y Salud Pública. Universidad de Huelva. Grupo de Investigación sobre Epidemiología Ambiental y Neurociencias., Huelva, Spain

David Cantarero Prieto, PhD

Universidad de Cantabria, Departamento de Economía, Santander, Spain

Manuel Franco, PhD

Medicina Preventiva y Salud Pública. Universidad de Alcalá, Alcalá De Henares, Spain

Javier García Amez, PhD

Departamento de Ciencias Jurídicas Básicas. Universidad de Oviedo, Oviedo, Spain

[María del Mar García Calvente, PhD](#)

[Escuela Andaluza de Salud Pública, Instituto de Investigación Biosanitaria IBS. Área de Salud Pública, Granada, Spain](#)

[Lorge Marcos Marcos, PhD](#)

[Departamento de Psicología de la Salud. Universidad de Alicante, Alicante, Spain](#)

Azucena Santillán, PhD

[FEEDBACK](#)

Hospital Universitario de Burgos, Burgos, Spain

Invited Editors / Editores Invitados

Gonzalo Casino Rubio, PhD

Departamento de Comunicación. Universidad Pompeu Fabra, Barcelona, Spain
(comunicación)

David M. Epstein, MSc, PhD

Departamento de Economía Aplicada. Universidad de Granada, Granada, Spain
(evaluación de tecnologías sanitarias)

Mariano Hernan, PhD, MPH, MSc

Escuela Andaluza de Salud Pública, Área de Salud Pública, Granada, Spain
(e-learning)

Joan Carles March Cerdà, PhD

Escuela Andaluza de Salud Pública. Ciber de Epidemiología y salud pública (CIBERESP), Granada, Spain

Maria Teresa Ruiz Cantero, PhD

Grupo de Investigación de Salud Pública. Universidad de Alicante. Ciber de Epidemiología y salud pública (CIBERESP), Alicante, Spain
(estrategia de género)

Andreu Segura, MD PhD

Plan Interdepartamental de Salud Pública. Projecte COMSalut. Departamento de Ciencias Experimentales y de la Salud de la Universidad Pompeu Fabra, Barcelona, Spain
(salud comunitaria)

Latin American editors/Editores y editoras en Latinoamérica

Mercedes Elcira Carrasco Portiño

Departamento de Obstetricia y Puericultura. Facultad de Medicina. Universidad de Concepción, Santiago de Chile, Chile

Leila Posenato García

Instituto de Pesquisa Econômica Aplicada – Ipea, Brasília, Brazil

Lucero Juárez

Universidad del Valle de México (UVM), Campus Hermosillo, Ciudad de México, México

Zulma Milena Cucunubá Pérez

Departamento de Epidemiología Clínica y Bioestadística. Facultad de Medicina. Pontificia Universidad Javeriana, Bogotá, Colombia

Jaime Miranda

CRONICAS Centro de Excelencia en Enfermedades Crónicas. Universidad Peruana Cayetano Heredia. Lima. Perú Facultad de Medicina.
Universidad Peruana Cayetano Heredia, Lima, Peru

All members of the Editorial Board have identified their affiliated institutions or organizations, along with the corresponding country or geographic region. Elsevier remains neutral with regard to any jurisdictional claims.

ISSN: 0213-9111

Copyright © 2022 Sociedad Española de Salud Pública y Administración Sanitaria. All rights reserved



Copyright © 2022 Elsevier B.V. or its licensors or contributors.

FEEDBACK



ScienceDirect® is a registered trademark of Elsevier B.V.



ScienceDirect

Gaceta Sanitaria

Open access

2.4
7
CiteScore

2.139
Impact Factor

[Submit your article](#)

[Guide for authors](#)

Menu



Search in this journal

The 3rd International Nursing and Health Sciences Students and Health Care Professionals Conference (INHSP)

Volume 35, Supplement 2,

Pages S103-S618 (2021)

[← Previous vol/issue](#)

[Next vol/issue >](#)

Receive an update when the latest issues in this journal are published

[Sign in to set up alerts](#)

Research article [Open access](#)

Factors affecting COVID-19 cases before epidemic peaks

Andika, P. Wulandari, Halmar Halide

Pages S103-S106

[Download PDF](#) [Article preview](#)

Research article [Open access](#)

A linkage of personal, food, and environmental hygiene to presence of *E. coli* in Warmindo Food Stall

Azham Umar Abidin, Adelia Anju Asmara, Anja Asmarany, Luthfia Isna Ardhayanti, ... Reynaldi Demoane Iskandar

Pages S107-S111

[Download PDF](#) [Article preview](#)

Research article [Open access](#)

Media communication and youth reproductive health, North Toraja District

Jeanny Maria Fatimah, Arianto, Tuti Bahfiarti

Pages S112-S115

[Download PDF](#) [Article preview](#)

Research article [Open access](#)

The relationship between service quality perceptions and the level of hospital accreditation

Syahrir A. Pasingringi, Fridawaty Rivai, Nur Arifah, Siti Fatmala Rezeki

FEEDBACK

Pages S116-S119

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Continuing medical education for general practitioners in Indonesia: Moving toward accountability

Yusring Sanusi Baso, Amir Syafruddin, Abraham Andi Padlan, Muhammad Akbar

Pages S120-S122

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Risk factors of anemia among pregnant women in community health center (Puskesmas) Singgani and Puskesmas Tipo Palu

Arum Diah Pusporini, Andi Ummu Salmah, Atjo Wahyu, Arifin Seweng, ... Mahfudz

Pages S123-S126

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Effect of education through video and packaging modifications of iron tablets on female adolescent behavior in the iron supplementation intake in SMPN 2 and SMPN 1 Parigi

Ni Putu Osyani Madestria, Apik Indarty Moedjiono, Suriah, Muh. Tahir, ... Aminuddin Syam

Pages S127-S130

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Risk factors for asphyxia neonatorum in public health centres of nosarara and pantoloan, Palu City

Yuli Fitriana, Apik Indarty M, Anwar Mallongi, Masni Mappajanci, ... Aminuddin Syam

Pages S131-S134

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Sexual behavior influence against HIV/AIDS in homosexuals at Palu City in 2020

Jenefri Maharani, Arifin Seweng, Muhammad Sabir, Muhammad Tahir, ... Rosmala Nur

Pages S135-S139

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

The effect of balanced counseling strategy family planning against attitude, subjective norm, and intentions on the use of modern contraception behavior in the Singgani Public Health Center work area of Palu city

Rosalia Stefani Palinggi, Apik Indarty Moedjiono, Ketut Suarayasa, Masni, ... Aminuddin Syam

Pages S140-S144

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Effect of varash oil to decrease menstrual pain in primary dysmenorrhea of senior high school student at Palu City

Ni Wayan Wirayanti Putri Negara, Stang, Ansariad, A. Ummu Salamah, ... Aminuddin Syam

Pages S145-S147

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

FEEDBACK 

Postpartum hemorrhage in maternal mothers at Anutapura Public Hospital in Palu, 2017

Rosmala Nur, Hasra Sartika Sarina, Nurhaya S. Patui, Sitti Radhiah, ... Lusia Salmawati

Pages S148-S151

[Download PDF](#) Article preview 

Research article *Open access*

Mapping of high-risk detection of women pregnancy on antenatal care in Talise Health Center, Palu City, Indonesia

Muhammad Asep Dwitama, Masni, Rosmala Nur, Apik Indarty, ... Alam Ansyari

Pages S152-S158

[Download PDF](#) Article preview 

Research article *Open access*

The influence of fluoride in drinking water on the incidence of fluorosis and intelligence of elementary school students in Palu City

Sri Indah Yani, Arifin Seweng, Anwar Mallongi, Rosmala Nur, ... Alam Anshary

Pages S159-S163

[Download PDF](#) Article preview 

Research article *Open access*

The relationship between knowledge and personal hygiene and the occurrence of sexually transmitted diseases at the Community Health Center Talise, Palu

Andi Mariani, Arifin Seweng, Syamsiar S. Ruseng, Apik Indarty Moedjiono, ... Sabir

Pages S164-S167

[Download PDF](#) Article preview 

Research article *Open access*

The effect of oxytocin massage and breast care on the increased production of breast milk of breastfeeding mothers in the working area of the public health center of Lawanga of Poso District

Ade Triansyah, Stang, Indar, Apik Indarty, ... Muhammad Rusydi

Pages S168-S170

[Download PDF](#) Article preview 

Research article *Open access*

The relationship between socioeconomic status and nutritional status of pregnant women in temporary shelter, Talise, Palu

Irani Nur Ramadhani, Masni, Aminuddin Syam, Arifin Seweng, ... Rosmala Nur

Pages S171-S175

[Download PDF](#) Article preview 

Research article *Open access*

Factors related to the incidence of unmet need in couples of reproductive age in the working area of Marawola Health Center

Rosmala Nur, A.B. Subardin, Pash Panggabean, Esron Sirait, ... Ridwan Amiruddin

Pages S176-S179

[Download PDF](#) Article preview 

Research article *Open access*

Hospital laboratory management in dealing with disaster

Rosa Dwi Wahyuni, Syahrir A. Pasinringi, Sukri Palutturi, Muhammad Sabir, ... Abd. Farid Lewa

Pages S180-S182

FEEDBACK 

[Download PDF](#) Article preview 

Research article [Open access](#)

Stress management for breast cancer survivor in South Sulawesi Province Indonesia

Azriful, Fatmawaty Mallapiang, Nildawati, Syamsul Alam, ... Masyitha Muis

Pages S183-S185

[Download PDF](#) Article preview 

Research article [Open access](#)

Patient satisfaction: Public vs. private hospital in Central Sulawesi, Indonesia

Diah Mutiarasari, Indah Puspasari Kiay Demak, Elli Yane Bangkele, Rosmala Nur, Tri Setyawati

Pages S186-S190

[Download PDF](#) Article preview 

Research article [Open access](#)

Biscuits containing *Moringa oleifera* leaves flour improve conditions of anemia in pregnant women

Makrina Sedista Manggul, Healthy Hidayanty, Sharvianty Arifuddin, Mardiana Ahmad, ... Andi Nilawati Usman

Pages S191-S195

[Download PDF](#) Article preview 

Research article [Open access](#)

Effectiveness of turmeric (*Curcuma Longa* Linn) Gel Extract (GE) on wound healing: Pre-clinical test

Adeliana, Andi Nilawati Usman, Mardiana Ahmad, Sharvianty Arifuddin, ... Prihantono

Pages S196-S198

[Download PDF](#) Article preview 

Research article [Open access](#)

The effectiveness of 7% table salt concentration test to increase collagen in the healing process of wound

Sitti Samidah, Prihantono, Mardiana Ahmad, Jamaluddin Jompa, ... Andi Nilawati Usman

Pages S199-S201

[Download PDF](#) Article preview 

Research article [Open access](#)

Analysis of antioxidant activity on cocktail honey products as female pre-conception supplements

Riska Reviana, Andi Nilawati Usman, Indah Raya, Aliyah, ... Fendi Fendi

Pages S202-S205

[Download PDF](#) Article preview 

Research article [Open access](#)

Moringa oleifera leaf flour biscuits increase the index of erythrocytes in pregnant women with anemia

Monika Loa, Healthy Hidayanty, Sharvianty Arifuddin, Mardiana Ahmad, Veni Hadju

Pages S206-S210

[Download PDF](#) Article preview 

Research article [Open access](#)

Moringa oleifera capsule and diet in young women with dropout school

Suhartini, Veni Hadju, Samricard R, Alimuddin Unde, ... Burhanuddin Bahar

Pages S211-S215

[Download PDF](#) Article preview 

FEEDBACK 

Research article [Open access](#)

Care for perineal tears in vaginal delivery: An update for midwife

Asniah Hartinah, Andi Nilawati Usman, Sartini, Nurhaedar Jafar, ... Jumiaty Nurung

Pages S216-S220

 [Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Effectiveness of Augmented Reality (AR) based learning media on increasing the physical examination system of pregnant women urinary system

Sri Nurlaily Z, Mardiana Ahmad, Syafruddin Syarif, Budu, ... Stang

Pages S221-S223

 [Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Analysis of serum levels L-arginine and 25-hydroxyvitamin D as a predictor of survival of severe preeclampsia mothers

Dwi Wahyuningsih, Andi Nilawati Usman, Prihantono

Pages S224-S226

 [Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Risk factors analysis of non-compliance of Tuberculosis (TB) patients taking medicine in Puskesmas Polonia, Medan, 2021

Asriwati, Erni Yeti, Niakurniawati, Andi Nilawati Usman

Pages S227-S230

 [Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Use of technology for monitoring the development of nutritional status 1000 hpk in stunting prevention in Indonesia

Hijrawati, Andi Nilawati Usman, Syafruddin Syarif, Veni Hadju, ... Yusring Sanusi Baso

Pages S231-S234

 [Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Overview of Anemia; risk factors and solution offering

Yan Deivita, Syarif Syafruddin, Usman Andi Nilawati, Aminuddin Aminuddin, ... Zainuddin Zahir

Pages S235-S241

 [Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Mean arterial pressure and the endothelin-1 levels in preeclampsia

Melicha Kristine Simanjuntak, Irfan Idris, Isharyah Sunarno, Sharvianty Arifuddin, Andi Wardihan Sinrang

Pages S242-S244

 [Download PDF](#) [Article preview](#) 

Research article [Open access](#)

The effectiveness of gentle prenatal yoga on the recovery of anxiety level in primigravid and multigravid pregnant women

Andi Sulastri, Saidah Syamsuddin, Irfan Idris, Eryln Limoa

Pages S245-S247

 [Download PDF](#) [Article preview](#) 

FEEDBACK 

Research article Open access

Web-based learning media the skills of suturing rupture perineum of midwifery students

Nurul Fitrahminarsih N, Syafruddin Syarif, Mardiana Ahmad, Budu, Yusring Sanusi B

Pages S248-S250

[Download PDF](#) Article preview 

Research article Open access

Ginger honey affects cortisol, estrogen and glutathione levels; preliminary study to target preconceptional women

Andi Nilawati Usman, Indah Raya, Riska Yasmin, Aliyah, ... Emmasitah

Pages S251-S253

[Download PDF](#) Article preview 

Research article Open access

The effect of breastfeeding on body temperature, body weight, and jaundice of 0–72 h old infants

Emi Yulita, Nasrudin A. Mappaware, Werna Nontji, Andi Nilawati Usman

Pages S254-S257

[Download PDF](#) Article preview 

Research article Open access

Prenatal yoga exercise improves sleep quality in the third trimester of pregnant women

Hajratul Azward, Sri Ramadhany, Nugraha Peluassy, Andi Nilawati Usman, Farida Tandi Bara

Pages S258-S262

[Download PDF](#) Article preview 

Research article Open access

Antenatal care parameters that are the risk factors in the event of preeclampsia in primigravida

S.T. Rahmawati Hamzah, Aminuddin, Irfan Idris, Muhammad Rachmat

Pages S263-S267

[Download PDF](#) Article preview 

Research article Open access

Influence of breast milk education media on increasing knowledge about breast milk: Literature review

Natasha Novianty, Syafruddin Syarif, Mardiana Ahmad

Pages S268-S270

[Download PDF](#) Article preview 

Research article Open access

Date palm (*Phoenix dactylifera*) consumption as a nutrition source for mild anemia

Resti Dona Saputri, Andi Nilawati Usman, Yuyun Widaningsih, Nurhaedar Jafar, ... Andi Dirpan

Pages S271-S274

[Download PDF](#) Article preview 

Research article Open access

Malnutrition in children associated with low insulin-like growth factor binding protein-3 (IGFBP-3) levels

Dwi Ayu Rahmawati, Aminuddin Aminuddin, Firdaus Hamid, Prihantono Prihantono, ... Veni Hadju

Pages S275-S277

[Download PDF](#) Article preview 

Research article Open access

FEEDBACK 

Leptin levels in children with malnutrition

Resky Devi Akib, Aminuddin Aminuddin, Firdaus Hamid, Prihantono Prihantono, ... Veni Hadju
Pages S278-S280

[Download PDF](#) Article preview 

Research article [Open access](#)

Effects of *Centella asiatica* (L.) Urban extract in TNF- α levels

Melliyana Nurdin, Risfah Yulianty, Syamsa Latief, Prihantono, ... Andi Nilawati Usman
Pages S281-S283

[Download PDF](#) Article preview 

Research article [Open access](#)

Enhance midwifery student skills about active management third stage labor via learning media

Andi Ramliany Hasyim, Syafruddin Syarif, Mardiana Ahmad, Muhammad Niswar, ... A.M. Nasrudin
Pages S284-S287

[Download PDF](#) Article preview 

Research article [Open access](#)

Effect of royal jelly to deal with stress oxidative in preconception women: A literature review

A. Mustika Fadillah Rizki, Andi Nilawati Usman, Indah Raya, Aliyah, ... Andi Sumidarti
Pages S288-S290

[Download PDF](#) Article preview 

Research article [Open access](#)

Analysis of cocktail honey content as a supplementary preparation in preconception women

A. Mustika Fadillah Rizki, Andi Nilawati Usman, Indah Raya, Andi Sumidarti, ... Fendi Fendi
Pages S291-S294

[Download PDF](#) Article preview 

Research article [Open access](#)

Anchovy fish biscuits improve adolescents nutritional status

Kiki Uniatry Thalib, Suryani As'ad, Healthy Hidayanti, Mardiana Ahmad, Andi Nilawati Usman
Pages S295-S297

[Download PDF](#) Article preview 

Research article [Open access](#)

The influence of macronutrient intake, stress and prostaglandin levels (pgF 2α) of urine with the incidence of dysmenorrhea in adolescents

Asriani Tahir, Andi Wardihan Sinrang, Elizabet Catherine Jusuf, Saidah Syamsuddin, ... Aryadi Arsyad
Pages S298-S301

[Download PDF](#) Article preview 

Research article [Open access](#)

Learning media based on augmented reality (AR) increased the skill of physical examination of the integumentary system of pregnant women in midwifery students

Hikmandayani, Mardiana Ahmad, Syafruddin Syarif, Budu, ... Stang
Pages S302-S305

[Download PDF](#) Article preview 

FEEDBACK 

Research article [Open access](#)

Comparison of nitric oxide levels, roll over test value, and body mass index in preeclampsia and normotension

Indri N. Marasing, Irfan Idris, Isharyah Sunarno, Sharvianty Arifuddin, ... Burhanuddin Bahar

Pages S306-S309

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

The effectiveness of gentle prenatal yoga on the recovery of depression level in pregnant women aged

Kiki Reski Rahmadani Bakri, Andi Nilawati Usman, Saidah Syamsuddin, Irfan Idris, Eryln Limoa

Pages S310-S313

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Preeclampsia and normotensive pregnancy with tribal differences in South Sulawesi: Comparison of serum interleukin-10 (IL-10) levels

Leasly Sanjoita Lamma, Muh Nasrum Massi, Sitti Wahyuni, Prihantono, Yuyun Widaningsih

Pages S314-S318

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Determinant of anemia in pregnancy at Polewali Mandar District, South Sulawesi, Indonesia

Sumiyati, Elizabet C. Jusuf, Aminuddin, Muhammad Rachmat

Pages S319-S321

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Potency of complemeter therapy to the healing process of perineal wound; turmeric (*Curcuma longa* Linn) Infusa

Wa Ode Nurul Mutia, Andi Nilawati Usman, Nur Jaqin, Prihantono, ... Mardiana Ahmad

Pages S322-S326

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Malnutrition in children associated with low growth hormone (Gh) Levels

Yuli Oktavina Sari, Aminuddin Aminuddin, Firdaus Hamid, Prihantono Prihantono, ... Veni Hadju

Pages S327-S329

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Analysis of temperature and humidity on dengue hemorrhagic fever in Manado Municipality

Tyrsa C.N. Monintja, A.Arsunan Arsin, Ridwan Amiruddin, Muhammad Syafar

Pages S330-S333

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Analysis relationship of fatness in venerable people at Johan Pahlawan Health Center, West Aceh District

Susy Sriwahyuni, Darmawan, Danvil Nabela, Winda Ayu Lestari, Muhammad Reza Firdaus

Pages S334-S336

[Download PDF](#) [Article preview](#) 

FEEDBACK 

Research article *Open access*

Combination model in reducing HIV-related stigma: A systematic review

Sri Handayani, M. Alimin Maidin, Agus Bintara Birawida, Ansariadi, Rahayu Indriasari

Pages S337-S339

[Download PDF](#) Article preview 

Research article *Open access*

Exposure analysis of benzene in workplace control room A and B PT X

M. Lazuardi Faiz, Azham Umar Abidin, Fina Binazir Maziya

Pages S340-S344

[Download PDF](#) Article preview 

Research article *Open access*

The state responsibility on food availability on the pandemic

Maskun, A. Ilmar, Naswar, Ahmad, ... [Rian Nugraha](#)

Pages S345-S347

[Download PDF](#) Article preview 

Research article *Open access*

An analysis of pivotal factors in the implementation of occupational health and safety management systems in micro, small and medium enterprises (MSMEs): Literature review

Mila Tejamaya, Wishnu Puspoprodo, Heru Suseyo, Robiana Modjo

Pages S348-S359

[Download PDF](#) Article preview 

Research article *Open access*

Ergonomic assessment in metal-based small industries in Bogor Regency, Indonesia, 2019

Prima Andriani, Mila Tejamaya, Baiduri Widanarko, Amelia Anggarawati Putri

Pages S360-S363

[Download PDF](#) Article preview 

Research article *Open access*

PQRST wave detection on ECG signals

Putri Madona, Rahmat Ilias Basti, Muhammad Mahrus Zain

Pages S364-S369

[Download PDF](#) Article preview 

Research article *Open access*

Determinant factors of weight status among under two years children received the complementary feeding program

Eha Sumantri, Healthy Hidayanty, Deli Gustin, Sri Handayani

Pages S370-S373

[Download PDF](#) Article preview 

Research article *Open access*

A case study: Chemical health risk assessment in three footwear small industries in Bogor-Indonesia year 2019

Yenni Miranda Savira, Mila Tejamaya, Amelia Anggarawati Putri

Pages S374-S378

[Download PDF](#) Article preview 

FEEDBACK 

Research article [Open access](#)

Public perception toward local food and macronutrient: Content of Kaledo

Yusma Indah Jayadi, Nikmah Utami Dewi, Muhammad Nasir, Indriany, ... Munawir Amansyah

Pages S379-S381

[Download PDF](#) Article preview 

Research article [Open access](#)

Fermented soybean cake nugget (tempeh) as an alternative for increasing weight of little children aged 36–60 months

B. Suriani, Jumrah Sudirman, Sitti Mukarramah, Syamsyuriyana Sabar, Hasriani Saleng

Pages S382-S384

[Download PDF](#) Article preview 

Research article [Open access](#)

Safety risk assessment in construction projects at Hasanuddin University

A. Muflihah Darwis, M. Furqaan Nai'em, Yahya Thamrin, Noviponiharwani, ... Fauziah Amin

Pages S385-S387

[Download PDF](#) Article preview 

Research article [Open access](#)

An overview of the implementation of the continuity of care model in maternal health services: A literature review

Adriana Palimbo, Andi Ummu Salmah, Ridwan Amiruddin, Aminuddin Syam

Pages S388-S392

[Download PDF](#) Article preview 

Research article [Open access](#)

Home sanitation facilities and prevalence of diarrhea for children in Oelnasi Village, Kupang Tengah Sub-district

Agustina, Olga Mariana Dukabain, Siprianus Singga, Wanti Wanti, ... Fransiskus Geroda Mado

Pages S393-S395

[Download PDF](#) Article preview 

Research article [Open access](#)

Chemical composition of *Moringa oleifera* and Honey from three different Areas in South Sulawesi, Indonesia

Veni Hadju, Muhammad Dassir, Aliyah Putranto, Andi Sadapotto

Pages S396-S399

[Download PDF](#) Article preview 

Research article [Open access](#)

Prevent postpartum blues with the implementation of breastfeeding father education model to increase the frequency of breastfeeding in mothers: A systematic review

Gusti Ayu Martha Winingsih, Ummu Salmah, Masni, Rahayu Indriasari, ... Agus Bintara Birawida

Pages S400-S403

[Download PDF](#) Article preview 

Research article [Open access](#)

The relationship among working period, work shift, and workload to work fatigue in air traffic controllers at Sultan Hasanuddin Airport

Syamsiar S. Russeng, Lalu Muhammad Saleh, Anwar Mallongi, Chin Hoy

Pages S404-S407

[Download PDF](#) Article preview 

FEEDBACK 

Research article [Open access](#)

Climate factors and dengue fever occurrence in Makassar during period of 2011–2017

Andi Susilawaty, Ranti Ekasari, Lilis Widiastuty, Dian Rezki Wijaya, ... Syahrul Basri

Pages S408-S412

[Download PDF](#) Article preview 

Research article [Open access](#)

Personal hygiene and bowls sanitation of meatball cart traders

Hasnawati Amqam, Syamsuar Manyullei, Andi Wahyuni, Nasrah, ... Ismi Yunita Sari

Pages S413-S416

[Download PDF](#) Article preview 

Research article [Open access](#)

Musculoskeletal disorders problems and its relation to age, working periods, and smoking habit among fishermen

Yahya Thamrin, Syahrir Pasinringi, A. Muflihah Darwis, Irawan S. Putra

Pages S417-S420

[Download PDF](#) Article preview 

Research article [Open access](#)

The effect of convergent action on reducing stunting prevalence in under-five children in Banggai District, Central Sulawesi, Indonesia

Aspar Abdul Gani, Veni Hadju, Akmal Novrian Syahrudin, Anang S. Otuluwa, ... Abdul Razak Thaha

Pages S421-S424

[Download PDF](#) Article preview 

Research article [Open access](#)

The application of FGD to support concept of National Policy on health and safety work procedures on ATC employees in Indonesia

Lalu Muhammad Saleh, Syamsiar S. Russeng, Istiana Tadjuddin, Nurul Mawaddah Syafitri, ... Mahfuddin Yusbud

Pages S425-S427

[Download PDF](#) Article preview 

Research article [Open access](#)

The determinant of work stress on bank employees in Makassar, Indonesia

Masyitha Muis, Atjo Wahyu, Fatmawaty Mallapiang, A. Muflihah Darwis, ... Nurul Rezkiyah

Pages S428-S431

[Download PDF](#) Article preview 

Research article [Open access](#)

Leadership style based on the study of multifactor leadership questionnaire in Palu Anutapura hospital

Fajrillah Kolomboy, Sukri Palutturi, Fridawaty Rifai, Lalu Muhammad Saleh, ... Ridwan Amiruddin

Pages S432-S434

[Download PDF](#) Article preview 

Research article [Open access](#)

Biomarkers of pneumonia disease in under five children in “grill culture”

Sintha Lisa Purimahua, A. Arsunan Arsin, Anwar Daud, Ridwan M. Thaha, ... Agus Bintara Birawida

Pages S435-S437

[Download PDF](#) Article preview 

FEEDBACK 

Research article [Open access](#)

Behavioral risk factors and periodontal disease in Malang, Indonesia

Rara Warih Gayatri, Tika Dwi Tama, Lucky Radhita Alma, Low Wah Yun, ... Asmi Kuroidah
Pages S438-S440

[Download PDF](#) Article preview 

Research article [Open access](#)

How to detect healthcare fraud? "A systematic review"

Andi Yaumul Bay R. Thaifur, M. Alimin Maidin, Andi Indahwati Sidin, Amran Razak
Pages S441-S449

[Download PDF](#) Article preview 

Research article [Open access](#)

Exposure analysis of lead (Pb) and chromium (Cr) in workplace workshop PT. X

Ari Widyantoro, Fina Binazir Maziya, Azham Umar Abidin
Pages S450-S454

[Download PDF](#) Article preview 

Research article [Open access](#)

Determining significant factors associated with daily COVID-19 cases within three social distancing regimes

Putri Wulandari, Andika, Halmar Halide
Pages S455-S458

[Download PDF](#) Article preview 

Research article [Open access](#)

Essential oil as a new tool for larvicidal *Aedes aegypti*: A systematic review

Budiman, Hasanuddin Ishak, Stang, Erniwati Ibrahim, ... Ridwan Amiruddin
Pages S459-S462

[Download PDF](#) Article preview 

Research article [Open access](#)

Compliance of the COVID-19 prevention protocols on daily activities among adolescents in the period of early adapting new habits, South Sulawesi Province, Indonesia

Bs. Titi Haerana, Dian Ihwana Ansyar, Rimawati Aulia Insani Sadarang, Tri Addya Karini, ... Zilfadhilah Arranury
Pages S463-S467

[Download PDF](#) Article preview 

Research article [Open access](#)

Evaluation of the completeness and accuracy of 42 safety data sheets (SDSs) of chemical substances, 2019

Dana Hidayat, Charen Andella, Mila Tejamaya
Pages S468-S471

[Download PDF](#) Article preview 

Research article [Open access](#)

Mother's behavior in breastfeeding in Gowa Regency, South Sulawesi (study on mothers with insufficient breastmilk production)

Fairus Prihatin Idris, Bau Kanang, Fitri Adriani, Andi Asrina
Pages S472-S474

[Download PDF](#) Article preview 

FEEDBACK 

Research article [Open access](#)

The relation of estradiol conditions and usage length to sexual dysfunction in progesterone acetate medroxepeo acceptories at Bara-Baraya public health center of Makassar

Zelna Yuni Andryani, Anieq Mumthi'ah Alkautzar, Nurfaizah Alza, Ferawati Taherong, ... Sharvianty Arifuddin
Pages S475-S478

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Family planning (KB) practices and the impact on Papuan women reproductive health

Usman Idris, Simon Abdi K. Frank, Reni F. Hindom, Jumiatiy Nurung
Pages S479-S482

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Dietary diversity, dietary patterns and dietary intake are associated with stunted children in Jeneponto District, Indonesia

Hasan Basri, Veni Hadju, Andi Zulkifli, Aminuddin Syam, ... Siti Helmiyanti
Pages S483-S486

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Does the presence of praziquantel-related adverse events affect the health community's perception toward the mass chemopreventive program in the highest prevalence area of Schistosomiasis in Indonesia? Study in Dodolo village, Napu Valley, Central Sulawesi

Ayu Sekarani Damana Putri, T. Vera Diana, Rahma Daris, Fitri Afriana, Serli Hatul Hidayat
Pages S487-S490

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Family resilience in caring for drug addiction

Ira Kusumawaty, Yunike, Jawiah, Rehana
Pages S491-S494

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

A case study of document readiness in the Administration and Management Working Group on accreditation results at Lalolae Health Center

Sartini Risky, Lodes hadju, Sri Mulyani, Azlimin, Muhammad Rachmat
Pages S495-S497

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Factors associated with and mode of delivery in prelabour rupture of membrane at secondary health care

Isharyah Sunarno, Deviana Soraya Riu, Nasrudin Andi Mappaware
Pages S498-S500

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Eating habits and history of hyperemesis gravidarum as a risk factor of preeclampsia

Nurmiaty, Melania Asi, Sitti Aisa, Halijah, ... Andi Nilawati Usman

FEEDBACK 

Pages S501-S505

[Download PDF](#) [Article preview](#) 





Research article [Open access](#)

Medical nutrition therapy in hemodynamically unstable patients due to cardiogenic shock with infected bronchiectasis and severe protein-energy malnutrition

Caroline Prisilia Marsella, Nurpudji Astuti Taslim, Nurbaya Syam, Andi Yasmin Syauki

Pages S506-S509

[Download PDF](#) [Article preview](#) 

  page 1 of 2  

[< Previous vol/issue](#)

[Next vol/issue >](#)

ISSN: 0213-9111

Copyright © 2022 Sociedad Española de Salud Pública y Administración Sanitaria. All rights reserved



Copyright © 2022 Elsevier B.V. or its licensors or contributors.
ScienceDirect® is a registered trademark of Elsevier B.V.

FEEDBACK 

Exposure analysis of benzene in workplace control room A and B PT X

M. Lazuardi Faiz, Azham Umar Abidin*, Fina Binazir Maziya

Department of Environmental Engineering, Faculty of Civil Engineering and Planning, Universitas Islam Indonesia, Indonesia



ARTICLE INFO

Article history:

Received 28 June 2021
Accepted 30 July 2021

Keywords:

Benzene
Environmental health
Health risk
Industrial hygiene
Risk analysis

ABSTRACT

Objective: The control room A and B employees are a high risk of benzene exposure, because they work close to the waste pit which is a source of benzene. This study is to analyze the magnitude of the health risk of benzene exposure to all employees.

Methods: The data of this study were obtained from interviews and the results of environmental quality of PT X. Data were analyzed using Environmental Health Risk Analysis (EHRA) method which compared with RfC for non-carcinogenic effects and CSF for carcinogenic effects.

Results: The results of individual calculations for the non-carcinogenic and carcinogenic effect of benzene are at a dangerous level in both real time and lifetime exposure.

Conclusions: In the calculation of carcinogenic and non-carcinogenic risk exposure in real time, half the populations are at risk of being affected and in lifetime the entire populations are at risk of being exposed to these effects.

© 2021 SESPAS. Published by Elsevier España, S.L.U. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Naturally, benzene comes from crude oil. For example benzene, found at concentrations up to 4 g/L in petroleum content, is also found in seawater with concentrations up to 0.8 ppb in the vicinity of natural gas and petroleum storage.¹ Measurement of benzene exposure for a population is quite difficult to quantify because the lifestyle of each individual varies widely, environmental weather conditions can also affect, and the environment in which they live varies.²

Workers in industries that make or use benzene such as petrochemicals, petroleum refining, coal mining, tire manufacturing, benzene storage and distribution, fuel storage and distribution can be exposed to high levels. Other occupations that have the potential to be exposed to benzene are workers working in coal furnaces in the steel industry, printing, shoe factories, laboratory technicians, firefighters, and gas station operators.³

The effects of acute exposure to high levels of benzene (to nerves, skin, respiration, and digestion) can occur immediately after exposure. Neurological effects due to the anesthetic nature of benzene which directly attacks the central nervous system/preceded by feelings of drift, depression, and if exposure to high levels of benzene continues, it can cause death. The effects of moderate concentrations of benzene exposure can cause headaches, dizziness, nausea, dizziness, and eye burning. The effects of continued exposure can cause tremors, shortness of breath, confusion, loss of consciousness, coma, and death.⁴

In Indonesia, standards have been established for the determination of the threshold value (NAV) for physical and chemical

6 factors in the workplace. In the Regulation of the Minister of Manpower of the Republic of Indonesia No. 5 of 2018 concerning Work Safety in the Work Environment stipulates that benzene is included in group A1 or a chemical substance that is proven to have a carcinogenic health effect for humans with a threshold value (TLV) of 0.5 ppm for 8 h of exposure. Meanwhile, for a short exposure for 15 min of 2.5 ppm.⁵

Methods

Study design

The study design will use a risk analysis method which is taken from the following 3 steps: first is a risk analysis consisting of hazard identification, exposure analysis, dose–response analysis, and risk characteristics, second is risk management, and the last is risk communication which is carried out to assess and predict what will happen due to exposure to hazardous substances that can harm workers, in this case, benzene.¹

Data collection

This type of research is a descriptive study using quantitative analysis methods. This research begins by collecting secondary data related to the work process which includes chemicals in the work area, material safety data sheets (MSDS) for these materials, and the number of workers involved in this work. Then the authors collected primary data related to body weight and then what symptoms were felt during work and what PPE was used during work, frequency of exposure, time of exposure, duration of employee exposure to benzene with the help of questionnaires and interviews with several workers. As well as assistance from the 2018 industrial hygiene report as secondary data to determine the concentration of benzene in control room A and B.

² Peer-review under responsibility of the scientific committee of the 3rd International Nursing, Health Science Students & Health Care Professionals Conference. Full-text and the content of it is under responsibility of authors of the article.

* Corresponding author.

E-mail addresses: azham.abidin@uii.ac.id, pmc@agri.unhas.ac.id (A.U. Abidin).

Data analysis

The data processing that will be carried out is by comparing the research results (intake values) that have been obtained from workers with a reference concentration value (RfC) which is safe for exposure to non-carcinogenic effects and cancer slope factor (CSF) for carcinogenic effects. However, this data processing comes from two sources, namely primary data and secondary data. Thus, data processing can provide significant results. Then perform engineering to reduce exposure and concentration benzene.⁴

States that an adverse health impact on an organism, system, or (sub) population caused by exposure to an agent in the amount and with a certain pathway of exposure is called risk. There is another argument that states that OSH risk is a combination and the possibility of a hazardous event or exposure occurring with the severity of the injury or health problems caused by the event or exposure. Meanwhile, risk management is a business process to manage/control the risks that exist in every work activity.³

In making risk management, what must be done is to make a risk analysis. Risk analysis is a process for controlling situations where the object of research may be exposed to danger. There are 3 components in risk analysis, namely first is risk assessment, second is risk management, and last is risk communication.⁶

Exposure assessment is an evaluation of the exposure of an organism, system, or sub (population) to an agent. In this analysis, identification of the dose or amount of risk agent received by a person (intake) is carried out through inhalation (respiratory tract). Intake (intake) is the amount of intake received by an individual per body weight per day. This intake data can use this equation as follows⁷:

$$I = \frac{C \times R \times t_E \times f_E \times D_t}{W_b \times t_{avg}} \quad (1)$$

With:

I: intake/intake (mg/kg/day)

C: concentration of risk agent, mg/m³ for air medium, mg/l for drinking water, mg/kg for food or food

R: rate (rate) of intake (m³/day)
t_E: time of exposure/work in a day (h/day)
f_E: frequency of annual exposure (days/years)

D_t: duration of exposure, years (real-time or protection, 30 years for residential default values)

W_b: weight (kg)

Table 1

Secondary data of benzene results in the air control room A and B in the 2018 Industrial Hygiene report.

Location	Name of substance	Physical form	Measurement results (mg/m ³)	Threshold value 8 h (ppm)**	Threshold value 12 h (ppm)
Control room A	Benzene (C ₆ H ₆)	Gas	0.1913	0.5	0.3
Control room B	Benzene (C ₆ H ₆)	Gas	0.1594	0.5	0.3

* Data source: Work Environment Quality Monitoring Report (Industrial Hygiene) PT. X (Secondary Data).

** Threshold values reference: Regulation of the Minister of Manpower of the Republic of Indonesia Number 5 of 2018 concerning Occupational Safety and Health in the Work Environment.

Table 2

Distribution of benzene exposure pattern in air control room A.

Participants	Time exposure/t _E (h/day)	Frequency exposure/f _E (day/year)	Duration time/D _t (year)	Age (year)	Body weight/W _b (kg)
A1	12	243	26	50	90
A2	12	243	23	43	75
A3	12	243	13	45	61
A4	12	243	24	43	68
A5	12	243	24	46	53
A6	12	243	18	41	87
A7	12	243	25	49	75
A8	12	243	0.42	44	70
A9	12	243	12	36	84
A10	12	243	11	36	75
A11	12	243	28	52	73
A12	12	243	6	42	71

t_{avg}: average time period, (D_t × 365 days/year for non-carcinogens, 70 years × 365 days/year for carcinogens).

Result

The source of benzene in the control room comes from the waste pit which is an open oil pool, so that with the help of sunlight, evaporation will occur and produce a strong benzene smell that can be carried by wind.

The working hours of the control room workers consist of 3 shifts were 1-morning shift, 1-night shift, and 1-holiday shift which changes every 3 days continuously. 1 shift has 12 h of working hours, holidays do not affect them because the machines and tools on-site must always be maintained for 24 h because if there is any damage, they can be immediately resolved and do not interfere with oil production.

Concentration of benzene in the air

See Table 1.

Duration of exposure

See Tables 2 and 3.

Calculation of cancer and non-cancer intakes

The calculation of the intake of non-cancer exposure is carried out to take into account the non-cancer effects that can occur on workers in 2 different times of exposure, namely real time and lifetime. In real time, real time figures are used, namely the length of time they have worked in that place, while the non-cancerous lifetime exposure is 40 years, which is obtained from workers starting to work until they retire (Tables 4 and 5).

$$I = \frac{C \times R \times t_E \times f_E \times D_t}{W_b \times t_{avg}}$$

Table 3
Distribution of benzene exposure pattern in air control room B.

Participants	Time exposure/ t_E (h/day)	Frequency exposure/ f_E (day/year)	Duration time/ D_t (year)	Age (year)	Body weight/ W_b (kg)
B1	12	243	30	52	60
B2	12	243	3	44	72
B3	12	243	29	53	67
B4	12	243	26	52	61
B5	12	243	26	52	62
B6	12	243	9	47	74
B7	12	243	23	48	68
B8	12	243	3	41	66
B9	12	243	7	28	63
B10	12	243	24	50	74

Table 4
The value of intake (intake) of non-carcinogenic and carcinogenic effects in control room A employees.

Participants	Non-carcinogenic		Carcinogenic	
	Real time	Lifetime	Real time	Lifetime
A1	0.0104	0.0160	0.0045	0.0069
A2	0.0104	0.0181	0.0045	0.0078
A3	0.0067	0.0207	0.0029	0.0089
A4	0.0116	0.0193	0.0050	0.0083
A5	0.0136	0.0227	0.0058	0.0097
A6	0.0074	0.0164	0.0032	0.0070
A7	0.0113	0.0181	0.0049	0.0078
A8	0.0002	0.0190	0.0001	0.0081
A9	0.0050	0.0168	0.0022	0.0072
A10	0.0050	0.0181	0.0021	0.0078
A11	0.0129	0.0184	0.0055	0.0079
A12	0.0028	0.0188	0.0012	0.0081

Table 5
The value of intake (intake) of non-carcinogenic and carcinogenic effects in control room B employees.

Participants	Non-carcinogenic		Carcinogenic	
	Real time	Lifetime	Real time	Lifetime
B1	0.0131	0.0175	0.0056	0.0075
B2	0.0012	0.0155	0.0005	0.0066
B3	0.0118	0.0163	0.0051	0.0070
B4	0.0112	0.0173	0.0048	0.0074
B5	0.0111	0.0171	0.0048	0.0073
B6	0.0034	0.0152	0.0015	0.0065
B7	0.0093	0.0161	0.0040	0.0069
B8	0.0012	0.0164	0.0005	0.0070
B9	0.0030	0.0169	0.0013	0.0073
B10	0.0091	0.0152	0.0039	0.0065

Risk characterization

The risk characteristics are used to distinguish the health effects of non-cancer and cancer from the parameters tested, namely benzene. The risk characteristics for non-carcinogenic effects can be determined using the following formula:

$$RQ = \frac{InC}{Rfd \text{ or } Rfc}$$

After getting the RQ value, it can be assumed as follows:

- If $RQ < 1$, then the hazard concentration is not at risk of causing non-carcinogenic health effects.
- If $RQ > 1$, then the hazard concentration is already at risk of causing non-carcinogenic health effects.

The characteristics for the cancer effect can be determined by multiplying the carcinogenic intake value by the CSF value (Tables 6–9).

$$ECR = IC \times CSF$$

After getting the ECR value, the following assumptions are used:

- If the $ECR < 10^{-4}$, then the hazard concentration has not caused a carcinogenic health effect.
- If the $ECR > 10^{-4}$, then the hazard concentration values have already caused carcinogenic health effects.

Risk management

Risk management is an effort to protect the object of research, in this case, workers from the influence of benzene, which can cause non-carcinogenic and carcinogenic health effects. The first way to do after a risk analysis is to reduce the concentration of benzene exposure and reduce the contact time of workers with benzene (Table 10).⁸

Reduces concentration during life time exposure

$$C = \frac{(0.0001/CSF) \times W_b \times t_{avg}}{R \times t_E \times f_E \times D_t}$$

Table 6
Distribution of risk quotient (RQ) values in control room A.

Participants	Real time	Risk level	Life time	Risk level
A1	1.210	B	1.861	B
A2	1.211	B	2.106	B
A3	0.784	TB	2.412	B
A4	1.349	B	2.248	B
A5	1.583	B	2.638	B
A6	0.857	TB	1.905	B
A7	1.316	B	2.106	B
A8	0.023	TB	2.205	B
A9	0.585	TB	1.951	B
A10	0.579	TB	2.106	B
A11	1.501	B	2.145	B
A12	0.328	TB	2.185	B
Average	0.944	TB	2.156	B

Table 7
Distribution of risk quotient (RQ) values in control room B.

Participants	Real time	Risk level	Life time	Risk level
B1	1.524	B	2.032	B
B2	0.135	TB	1.804	B
B3	1.371	B	1.891	B
B4	1.307	B	2.010	B
B5	1.293	B	1.989	B
B6	0.399	TB	1.771	B
B7	1.077	B	1.873	B
B8	0.143	TB	1.910	B
B9	0.345	TB	1.969	B
B10	1.063	B	1.771	B
Average	0.866	TB	1.902	B

Table 8
Distribution of excess cancer risk (ECR) values in control room A.

Participants	Real time	Risk level	Life time	Risk level
A1	0.00012	B	0.00019	B
A2	0.00012	B	0.00021	B
A3	0.00008	TB	0.00024	B
A4	0.00014	B	0.00023	B
A5	0.00016	B	0.00027	B
A6	0.00009	TB	0.00019	B
A7	0.00013	B	0.00021	B
A8	0.00000	TB	0.00022	B
A9	0.00006	TB	0.00020	B
A10	0.00006	TB	0.00021	B
A11	0.00015	B	0.00022	B
A12	0.00003	TB	0.00022	B
Average	0.00009	TB	0.00022	B

Table 9
Distribution of excess cancer risk (ECR) values in control room B.

Participants	Real time	Risk level	Life time	Risk level
A1	0.00015	B	0.00020	B
A2	0.00001	TB	0.00018	B
A3	0.00014	B	0.00019	B
A4	0.00013	B	0.00020	B
A5	0.00013	B	0.00020	B
A6	0.00004	TB	0.00018	B
A7	0.00011	B	0.00019	B
A8	0.00001	TB	0.00019	B
A9	0.00003	TB	0.00020	B
A10	0.00011	B	0.00018	B
Average	0.00009	TB	0.00019	B

Notes: B: risk of carcinogenic health effects; TB: no risk of carcinogenic effects.

Table 10
Data from the calculation of risk control options for the effects of cancer on safe benzene exposure in the employee population of control room A and B.

Component	Preliminary data	Safe variable
Concentration (C)	0.191 mg/m ³	0.1 mg/m ³
Time exposure (t _E)	12h/day	6 h/day
Frequency exposure (f _E)	243 day/year	115 day/year

Reduces the length of exposure (t_E) during lifetime exposure

$$t_E = \frac{(0.0001/CSF) \times W_b \times t_{avg}}{C \times R \times f_E \times D_t}$$

Reduces frequency of exposure (f_E) during lifetime exposure

$$f_E = \frac{(0.0001/CSF) \times W_b \times t_{avg}}{C \times R \times t_E \times D_t}$$

Discussion

The results of individual calculations for the non-carcinogenic effect of benzene, the results obtained for control room A on real time exposure, 6 people who had an RQ value ≤ 1 and 6 people had an RQ value > 1 , at lifetime exposure there were no people who had an RQ value ≤ 1 would but there are 12 people who have an RQ value > 1 . In control room B on real time exposure, 4 people who have an RQ value ≤ 1 and 6 people have an RQ value > 1 , on lifetime exposure there are no people who have an RQ value ≤ 1 but there are 10 people who have an RQ value > 1 .

The results of individual calculations for the carcinogenic effect of benzene, the results obtained for control room A on real time exposure, 6 people had ECR values $\leq 10^{-4}$, and 6 people had ECR values $> 10^{-4}$, at lifetime exposure there were no people who had ECR values $\leq 10^{-4}$ but 12 people who have ECR values $> 10^{-4}$. In control room B, on real time exposure, 4 people have an ECR value $\leq 10^{-4}$ and 6 people have an ECR value $> 10^{-4}$, at lifetime exposure there are no people who have an ECR value $\leq 10^{-4}$ but there are 10 people who have a value ECR $> 10^{-4}$.

The toxic effects of benzene exposure can be felt by the body in the short and long term. In the short term, benzene exposure will have an effect on throat problems and eye irritation. However, if the exposure is short term but the concentration is high enough the benzene exposure will cause narcosis: dizziness, headache, drowsiness, confusion, tremor, unconsciousness. In long-term exposure, the health effects due to benzene toxicity are on the bone marrow which is responsible for making blood cells so that it can cause leucopenia, anemia, and thrombocytopenia and prolonged exposure to benzene can cause leukemia.⁹

Provides more specific risk control guidelines for OHS hazards using approaches such as elimination, substitution, engineering control (technical approach), administrative control, and use of personal protective equipment (PPE). Since the benzene exposure in control rooms A and B came from a fixed source that could not be eliminated because it was used for the benefit of each company, the elimination and substitution approach could not be applied.¹⁰

The concentration of benzene exposure to control room A and B employees depends on the benzene content in crude oil (crude oil). Meanwhile, the time variable relates to the work rules/regulations that have been agreed upon between the employees and the management of control rooms A and B, which submit to labor

regulations. The results of the calculation of risk management measures for concentration, duration, and frequency are for control room A and B 0.1 mg/m³, 6 h/day, 115 days/year.

Therefore, risk control that can be done is by using engineering control (technical approach), administrative control (administrative control), and use of personal protective equipment (PPE). The first engineering control (technical approach) is to isolate the waste pit by adding a cover like a greenhouse with a gas channel and air suction so that the benzene content can be sucked up and disposed of in areas with less population.¹¹

Conclusion

The risk control that can be done is to carry out administrative control by adding an existing shift that previously had 3 shifts to 4 or 8 shifts so that workers can work with the ON-OFF-ON system because by adding this shift it can reduce exposure time to 6 h/day and exposure frequency to 122 days/year. The second is engineering control, it is recommended that PT X build a cover in each waste pit like a greenhouse so that the benzene content in the air does not pollute the environment, the use and supervision of PPE must be carried out to discipline workers to always use complete PPE while working to protect the health of workers.

2

Conflicts of interest

The authors declare no conflict of interest.

References

1. Indrawan D, Oginawati K. Pertamina Ru Iv Cilacap Btx Exposure Analysis Against Workers in Pt. Pertamina Ru Iv Cilacap. *J Tek Lingkungan*. 2014;20:132-41.
2. Sipayung LP, Suryanto D, Megawati ER. Korelasi Paparan Benzene Dengan Gambaran Complete Blood Count Karyawan Spbu X Dan Y. *Media Kesehatan Masyarakat*. 2016;12:81-90.
3. Nikmah W, Darundiati Y, Budiyo B. Hubungan Antara Paparan Benzene Dengan Profil Darah Pada Pekerja Di Industri Percetakan X Kota Semarang. *J Kesehatan Masyarakat*. 2016;4:213-9.
4. Wispriyono B, Handoyo E. Risiko Kesehatan Pajanan Benzene, Toluena Dan Xylene Petugas Pintu Tol. *J Kesehatan Masyarakat*. 2016;11:188.
5. Bourdieu P. An ecological and bacterial study of the waters of the Tigris and Diyala rivers, south of Baghdad. In Arabic. *Director*. 2018;15:2017-9.
6. Yudison A. Analisis kandungan BTEX pada emisi gas buang sepeda motor. *Proceeding B Semin Nas Teknol Lingkungan XII*. 2015:457-64 [September 2016].
7. Febriana A. Hubungan Paparan Benzene di Udara Ambien Industri Percetakan Terhadap Kadar Trans-Trans Muconic Acid Urin pada Pekerja Industri Percetakan di Kota Medan Tahun 2018; 2018.
8. Panggabean AS, Widyastuti T, Hindryawati N. Validasi Metode Penentuan Benzene, Toluena dan Xilena pada Sampel Udara dan Tanah Menggunakan Kromatografi Gas. *ALCHEMY J Penelit Kim*. 2019;15:177.
9. Resdwivani DM. Kadar Benzene Di Udara, Kadar Asam Trans. Trans- Muconic Dalam Urine Dan Gangguan Kesehatan Pekerja SPBU X Di Jakarta Selatan. *J Kesehatan Lingkungan*. 2018;10:159-64.
10. Hayat I. Analisis Besaran Risiko Kesehatan Paparan Benzene Pada Petugas Operator Spbu Di Wilayah Ciputat Tahun 2012. *Skripsi*; 2013.
11. Ramon A. Analisis Paparan Benzene terhadap Profil Darah pada Pekerja Industri Pengolahan Minyak Bumi. *Univ Diponegoro*; 2007.

Exposure analysis of benzene in workplace control room A and B PT X

ORIGINALITY REPORT

6%

SIMILARITY INDEX

7%

INTERNET SOURCES

3%

PUBLICATIONS

1%

STUDENT PAPERS

PRIMARY SOURCES

1	www.semanticscholar.org Internet Source	1%
2	Dwi Wahyuningsih, Andi Nilawati Usman, Prihantono. "Analysis of serum levels L-arginine and 25-hydroxyvitamin D as a predictor of survival of severe preeclampsia mothers", Gaceta Sanitaria, 2021 Publication	1%
3	eds.ieee.org Internet Source	1%
4	daten-quadrat.de Internet Source	1%
5	jtphillips.com Internet Source	1%
6	trijurnal.lemlit.trisakti.ac.id Internet Source	1%
7	Submitted to East Carolina University Student Paper	1%

8

buscador.una.edu.ni

Internet Source

1 %

9

"Veterinary Pharmacovigilance", Wiley, 2009

Publication

1 %

Exclude quotes On

Exclude matches < 1%

Exclude bibliography On