

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: KAKOVOST ZRAKA IN VPLIV NA ZDRAVJE
Course title: AIR QUALITY AND HEALTH EFFECT

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Varstvo okolja in ekotehnologije, 2. stopnja	/	2.	/
Environmental Protection and Eco-technologies, 2 nd level	/	2 nd	/

Vrsta predmeta / Course type

Izbirni predmet / Optional course

Univerzitetna koda predmeta / University course code:

KZVZ

Predavanja Lectures	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
20	15	/	5	80	4

Nosilec predmeta / Lecturer:

dr. An Galičič / An Galičič, PhD

Jeziki /

Predavanja / Lectures: Slovenščina / Slovenian

Languages:

Vaje / Tutorial: Slovenščina / Slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Pogojev ni.

Prerequisites:

No formal prerequisites.

Vsebina:

V okviru predmeta Kakovost zraka in vpliv na zdravje bodo študenti/ke spoznali kakovost zraka kot element človekovega okolja ter s tem povezane vplive na zdravje, tako zunanega kot notranjega zraka. Študenti/ke bodo spoznali tudi raziskovalne pristope na področju kakovosti zraka in s tem povezanimi vplivi na zdravje.

Poglavitne teme:

- Zrak kot element okolja
- Zrak kot determinanta zdravja
- Kakovost zunanega zraka in vplivi na zdravje
- Kakovost notranjega zraka in vplivi na zdravje
- Raziskovanje na področju kakovosti zraka in vplivov na zdravje

Content (Syllabus outline):

In the course Air Quality and Health effects, students will become familiar with air quality as an element of the human environment and its related health effects, considering both outdoor and indoor air. Students will also learn about research approaches in the field of air quality and the related health effects.

Main topics:

- Air as an element of the environment
- Air as a determinant of health
- Outdoor air quality and health effects
- Indoor air quality and health effects
- Research in the field of air quality and health effects

Temeljna literatura in viri / Textbooks:

Obvezna / Required:

1. Nacionalni inštitut za javno zdravje. Slovar strokovnih izrazov s področja zraka. Ljubljana: Nacionalni inštitut za javno zdravje, 2024. Dostopno na: <https://nijz.si/wp-content/uploads/2024/09/Slovar-ZRAK-verzija-1-1.pdf>
2. Kakovost zunanjega zraka: interdisciplinarni pristop k oceni stanja in oblikovanju ter izvajanju ukrepov: zbornik recenziranih znanstvenih prispevkov. Ljubljana: Nacionalni inštitut za javno zdravje, 2016. Dostopno na: https://nijz.si/wp-content/uploads/2022/07/kakovost_zunanjega_zraka.pdf
3. Kakovost zraka v notranjih prostorih: zbornik recenziranih znanstvenih povzetkov. Ljubljana: Nacionalni inštitut za javno zdravje, 2017. Dostopno na: https://www.nijz.si/sites/www.nijz.si/files/publikacije-datoteke/inairq_zbornik_2017_kakovost_zraka_v_notranjih_prostorih_koncna.pdf
4. Kakovost notranjega zraka v šolskih prostorih: Gradivo za izobraževanja v okviru projekta InAirQ: Zbornik recenziranih znanstvenih prispevkov. Ljubljana: Nacionalni inštitut za javno zdravje, 2019. Dostopno na: https://nijz.si/wp-content/uploads/2022/12/zbornik_e-verzija-compressed.pdf

Priporočena / Recommended:

1. Agencija Republike Slovenije. Kakovost zraka v Sloveniji v letu 2024. Ljubljana: Agencija Republike Slovenije za okolje, 2024. Dostopno na: https://www.arso.si/zrak/kakovost%20zraka/poro%c4%8dila%20in%20publikacije/Letno_porocilo_2024_za_splet.pdf
2. Rožanec J, Galičič A, Kukec A. The impact of outdoor environmental factors on indoor air quality in education settings: a systematic review. Atmosphere, 2024;15(11):1-17. Dostopno na: <https://www.mdpi.com/2073-4433/15/12/1403>
3. Kukec A, Božnar M, Mlakar P, Grašič B, Herakovič A, Zadnik V, Zaletel-Kragelj L, Farkaš-Lainščak J, Eržen I. Methodological approach in determination of small spatial units in a highly complex terrain in atmospheric pollution research : the case of Zasavje region in Slovenia. Geospatial Health, 2014; 8(2):527-35.

Cilji in kompetence:

Predmetno specifični cilji in kompetence:

- Razumevanje zraka kot elementa okolja.
- Razumevanje zraka kot determinante zdravja.
- Razumevanje kakovosti zunanjega zraka in vplivov na zdravje.
- Razumevanje kakovosti notranjega zraka in vplivov na zdravje.
- Poznavanje raziskovalnih pristopov na področju kakovosti zraka in vplivov na zdravje.

Splošne kompetence:

- Študent/ka bo osvojil znanja, ki mu bodo omogočala opolnomočeno delo in soodločanje na področju vplivov zraka na zdravje ljudi.
- Študent/ka bo razumel specifične metode dela pri odkrivanju in obvladovanju škodljivih vplivov zraka na zdravje ljudi.

Objectives and competences:

Subject-specific objectives and competences:

- Understanding of air as an element of the environment
- Understanding of air as a determinant of health
- Understanding of outdoor air quality and its health effects
- Understanding of indoor air quality and its health effects
- Understanding of research approaches in the field of air quality and health effects

General competences:

- Students will acquire knowledge that will enable them to work independently and participate in decision-making in the field of effects of air on human health.
- Students will understand specific methods of work in detecting and controlling harmful effects of air on human health.

Predvideni študijski rezultati:**Znanje in razumevanje:**

Študent/ka bo ob zaključku predmeta sposoben:

- Sodelovati v multidisciplinarnem timu na področju vplivov zraka na zdravje ljudi.

Prenosljive/ključne spretnosti in drugi atributi:

- Študent/a bo sposoben obravnavati problematiko vpliva zraka na zdravje ljudi v širšem konceptu vpliva okolja na zdravje ljudi.

Intended learning outcomes:**Knowledge and understanding:**

At the end of the subject, student will be able:

- Participate in a multidisciplinary team in the field of effects of air on human health.

Transferable/key skills and other attributes:

- The student will be able to address issues related to effects of air on human health within the broader context of environmental effects on human health.

Metode poučevanja in učenja:**Oblike dela:**

- Individulano delo
- Delo v dvojicah ali manjših skupinah

Metode dela:

- Predavanje
- Metoda razpravljanja
- Metoda reševanja konkretnih primerov

Learning and teaching methods:**Forms of teaching:**

- Individual work
- Work in pairs or small groups

Teaching methods:

- Lectures
- Discussion method
- Case-based problem-solving method

Načini ocenjevanja:

Delež (v %) /

Weight (in %)

Assessment:**Pogoji za pristop k izpitu:**

- 100 % prisotnost na predavanjih, seminarjih in vajah,
- Pripravljena seminarska naloga.

Končno oceno pri predmetu predstavljata:

- ocena seminarske naloge: 30 %,
- ocena pisnega izpita: 70 %.

Ocenjevalna lestvica:

- zadostno 6: 60–67 %
- dobro 7: 68–75 %
- prav dobro 8: 76–83 %
- prav dobro 9: 84–90 %
- odlično 10: 91–100 %

A prerequisite for access to the exam:

- 100 % attendance at lectures, seminars and practicals.
- Completed seminar paper.

Final evaluation consists of:

- Seminar paper grade: 30 %,
- Written exam grade: 70 %.

Grading scale:

- Sufficient D (6): 60–67%
- Good C (7): 68–75%
- Very good B (8): 76–83%
- Very good B+ (9): 84–90%
- Excellent A (10): 91–100%

Materialni pogoji za izvedbo predmeta :

- Predavalnica z videoprezentacijsko opremo, urejenim dostopom do interneta in možnostjo dela v manjših skupinah.

Material conditions for subject realization:

- A lecture room equipped with video presentation equipment, reliable internet access, and the possibility of working in smaller groups.

Obveznosti študentov:**Student's commitments:**

- 100 % prisotnost na predavanjih, seminarjih in vajah.
- Pripravljena seminarska naloga.
- Pisni izpit.

- 100 % attendance at lectures, seminars and practicals.
- Completed seminar paper.
- Written exam.

Reference nosilca predmeta:

Pedagoško delo:

- nosilec predmeta Človek in vplivi okolja na zdravje na Fakulteti za varstvo okolja
- nosilec predmeta Kakovost zraka in vpliv na zdravje na Fakulteti za varstvo okolja
- izvajalec vaj pri predmetu Epidemiologija na Zdravstveni fakulteti Univerze v Ljubljani

Znanstveno-raziskovalno delo:

- bibliografija:
<https://cris.cobiss.net/ecris/si/sl/researcher/45052>
- sodelovanje pri nacionalnih projektih:
 - Razvoj modela za napovedovanje izpostavljenosti onesnaževalom v notranjem zraku v šolah in priprava z dokazi podprtih ukrepov za načrtovanje učinkovitega naravnega prezračevanja učilnic
 - Pilotno epidemiološko spremljanje na karbapeneme odpornih bakterij v odpadnih vodah v Sloveniji
- sodelovanje pri mednarodnih projektih:
 - Mediterranean Health Interview Surveys Studies: Long Term Exposure to Air Pollution and Health Surveillance (MED-HISS)
 - Transnational Adaption Actions for Integrated Indoor Air Quality Mngement (InAirQ)
 - Wastewater Integrated Surveillance for Public Health (EU-WISH)

Strokovno delo in izbrane strokovne publikacije:

- Zdravstvena ekologija (vplivi okolja na zdravje ljudi):
 - Bitenc K in sod. Navodila za izdelavo ocene tveganja za zdravje ljudi zaradi izpostavljenosti kemijskim in mikrobiološkim dejavnikom iz okolja z izbranimi poglavji in praktičnimi primeri : I. del. Ljubljana: Nacionalni inštitut za javno zdravje, 2017.
 - Uršič S, Galičič A. 10 let preventivnega programa Varo s soncem: izvedba programa Varo s soncem v šolskem letu 2016/17 in kratak pregled izvajanja preventivnega programa v desetletnem obdobju: zaključno poročilo. Ljubljana: Nacionalni inštitut za javno zdravje, 2017. III, 36 str.
 - Blaznik U in sod. Poročilo o aktivnostih NIJZ v zvezi s požarom v obratu KEMIS d.o.o. na Vrhniki: poročilo 354-131/17-1/127. Ljubljana: Nacionalni inštitut za javno zdravje, 2017. 26 str.
- Nalezljive bolezni (spremljanje, pripravljenost in odzivanje):

Lecturer's references:

Pedagogic activities:

- Course leader for Human and Environmental Effects on Health at the Faculty of Environmental Protection
- Course leader for Air Quality and Health Effects at the Faculty of Environmental Protection
- Practical lecturer for Epidemiology at the Faculty of Health Sciences, University of Ljubljana

Scientific and research work:

- Bibliography:
<https://cris.cobiss.net/ecris/si/sl/researcher/45052>
- Participation in national projects:
 - Development of the prognostic model of exposure to indoor air pollutants in schools and preparation of evidence based measures for planning of efficient natural ventilation of the classrooms
 - Pilot epidemiological wastewater surveillance of carbapenem-resistant bacteria in Slovenia
- Participation in international projects:
 - Mediterranean Health Interview Surveys Studies: Long Term Exposure to Air Pollution and Health Surveillance (MED-HISS)
 - Transnational Adaption Actions for Integrated Indoor Air Quality Mngement (InAirQ)
 - Wastewater Integrated Surveillance for Public Health (EU-WISH)

Professional work and selected professional publications:

- Environmental health (environmental effects on human health):
 - Bitenc K et al. Guidelines for conducting a human health risk assessment due to exposure to chemical and microbiological environmental factors, with selected chapters and practical examples: Part I. Ljubljana: National Institute of Public Health, 2017.
 - Uršič S, Galičič A. 10 years of the preventive programme Safe in the Sun: implementation of the programme Safe in the Sun in the 2016/17 school year and a brief overview of the prevention program over a ten-year period: final report. Ljubljana: National Institute of Public Health, 2017. III, 36 pp.
 - Blaznik U et al. Report on NIJZ activities related to the fire at KEMIS d.o.o. in Vrhnika: report 354-131/17-1/127. Ljubljana: National Institute of Public Health, 2017. 26 pp.
- Infectious diseases (surveillance, preparedness and response):
 - Fafangel et al. Proposals and guidance for medium- and long-term sustainable preparedness and response to SARS-

<ul style="list-style-type: none"> Fafangel in sod. Predlogi in usmeritve za srednje in dolgoročno vzdržno pripravljenost in odzivanje na okužbe z virusom SARS-CoV-2 v Sloveniji. Ljubljana: Nacionalni inštitut za javno zdravje, 2023. Fafangel M, Galičič A, Vuzem S, Učakar V. Strokovna izhodišča za prilagoditev sistema obravnave oseb, ki so bile v visoko tveganem stiku z osebo, okuženo z virusom SARS-CoV-2, vezano na virusno različico B.1.1.529 (omikron). Ljubljana: Nacionalni inštitut za javno zdravje, 2022. 17 str. Fafangel M, Vuzem S, Galičič A, Žohar Čretnik T. Epidemiološka in mikrobiološka strokovna izhodišča glede ponavljajočega prostovoljnega samo-testiranja prebivalstva z neinvazivnimi metodami hitrega testiranja na domu. Ljubljana: Nacionalni inštitut za javno zdravje, 2021. 22 str. <ul style="list-style-type: none"> Spremljanje javnozdravstvenih parametrov v odpadni vodi: <ul style="list-style-type: none"> Galičič A in sod. Načrt epidemiološkega spremljanja poliovirusov v odpadnih vodah v Sloveniji. 1. elektronska izd. Ljubljana: Nacionalni inštitut za javno zdravje, 2025. Galičič A, Rožanec J, Steyer A, Jurša T. Načrt izrednega epidemiološkega spremljanja povzročiteljev nalezljivih bolezni v odpadni vodi na Letališču Jožeta Pučnika Ljubljana. Ljubljana: Nacionalni inštitut za javno zdravje, 2024. 21 str. Galičič A in sod. Načrt epidemiološkega spremljanja SARS-CoV-2 v odpadnih vodah v Sloveniji. 1. elektronska izd. Ljubljana: Nacionalni inštitut za javno zdravje, 2023. <p>Priznanja in nagrade:</p> <ul style="list-style-type: none"> Prešernova nagrada Zdravstvene fakultete Univerze v Ljubljani za magistrsko nalogo 	<p>CoV-2 infections in Slovenia. Ljubljana: National Institute of Public Health, 2023.</p> <ul style="list-style-type: none"> Fafangel M, Galičič A, Vuzem S, Učakar V. Professional basis for adapting the system for managing persons who were in high-risk contact with a person infected with SARS-CoV-2, related to the viral variant B.1.1.529 (Omicron). Ljubljana: National Institute of Public Health, 2022. 17 pp. Fafangel M, Vuzem S, Galičič A, Žohar Čretnik T. Epidemiological and microbiological professional basis for repeated voluntary population self-testing using non-invasive rapid home testing methods. Ljubljana: National Institute of Public Health, 2021. 22 pp. <p>• <u>Wastewater-based public health surveillance:</u></p> <ul style="list-style-type: none"> Galičič A et al. Plan for epidemiological surveillance of polioviruses in wastewater in Slovenia. 1st electronic edition. Ljubljana: National Institute of Public Health, 2025. Galičič A, Rožanec J, Steyer A, Jurša T. Emergency epidemiological surveillance plan for communicable disease agents in wastewater at Jože Pučnik Airport Ljubljana. Ljubljana: National Institute of Public Health, 2024. 21 pp. Galičič A et al. Plan for epidemiological surveillance of SARS-CoV-2 in wastewater in Slovenia. 1st electronic edition. Ljubljana: National Institute of Public Health, 2023. <p>Awards:</p> <ul style="list-style-type: none"> Prešeren Award of the Faculty of Health Sciences, University of Ljubljana, for the master's thesis
<p>Izbrani znanstveni članki / Selected scientific papers:</p> <ol style="list-style-type: none"> GALIČIČ, An, ROŽANEC, Jan, KUKEC, Andreja, MEDVED, Sašo, ERŽEN, Ivan. Assessment of perceived indoor air quality in the classrooms of Slovenian primary schools and its association with indoor air quality factors, for the design of public health interventions. Atmosphere 2024;15(8):1-11. DOI: 10.3390/atmos15080995. ROŽANEC, Jan, GALIČIČ, An, KUKEC, Andreja. The impact of outdoor environmental factors on indoor air quality in education settings: a systematic review. Atmosphere. 2024;15(11):1-17. DOI: 10.3390/atmos15121403. GALIČIČ, An, ROŽANEC, Jan, KUKEC, Andreja, CARLI, Tanja, MEDVED, Sašo, ERŽEN, Ivan. Identification of indoor air quality factors in Slovenian schools: national cross-sectional study. Processes. 2023;11(13): 1-16. DOI: 10.3390/pr11030841. KUKEC, Andreja, GALIČIČ, An, JOVIŠIČ, Rok, POHAR, Majda, GOLJA, Viviana. Emisije hlapnih in polhlapnih organskih spojin iz gradbenih proizvodov in ocena njihovega vpliva na zdravje = Emission of volatile and semivolatile organic compounds of building materials and health impact assessment. Javno zdravje. 2021;4:1-9. DOI: 10.26318/JZ-21-3. GALIČIČ, An, ERŽEN, Ivan, OTOREPEC, Peter, KUKEC, Andreja. Prostorska povezanost med delci v zunanjem zraku in umrljivostjo zaradi bolezni dihal v Sloveniji = Spatial association between particle matters in ambient air and respiratory disease mortality in Slovenia. Javno zdravje. 2020;10:1-9. Dostopno na: https://www.nijz.si/sites/www.nijz.si/files/uploaded/galicic_et_al_iz_2020_10.pdf. KRANJEC, Natalija, GALIČIČ, An, ERŽEN, Ivan, KUKEC, Andreja. The impact of ultrafine particles on daily counts of deaths from respiratory diseases in the municipality of Ljubljana: a temporal variability study. Sanitarne inženirstvo. 2016;10(1):35-47. Dostopno na: http://journal.institut-isi.si/wp-content/uploads/2017/01/SI-110-2016-Kranjec-Galicic-Erzen-Kucec-1.pdf. 	