UNIVERSIDADE FEDERAL DE SANTA CATARINA - UFSC
NÚCLEO RESSACADA DE PESQUISAS EM MEIO AMBIENTE - REMA

SCHOLARSHIP SELECTION TEST FOR UNDERGRADUATE STUDENTS

3D SOFTWARE PROJECTS – PROGRAMMING

1. GENERAL OBJECTIVE

Develop a small application responsible for assessing the non-carcinogenic health risk to humans. The risk calculation is performed in two steps. First, the intake value is estimated, representing the amount of a given contaminant absorbed by a human (Eq. 1).

$$I = C \cdot \frac{IR \cdot EF \cdot ED}{BW \cdot AT}. \quad (1)$$

Where:

- I: intake [mg/(kg.day)];
- C: contaminant concentration in the medium [mg/L or mg/kg];
- IR: intake rate or contact rate with the medium [L/day or kg/day];
- EF: exposure frequency [day/year];
- ED: exposure duration [year];
- BW: body weight [kg];
- AT: averaging time [day].

The non-carcinogenic risk is then calculated using the intake value and the Reference Dose (RfD), which defines the maximum exposure level without adverse health effects (Eq. 2). For practical purposes, if QR > 1, there is a potential health risk.

$$QR = \frac{I}{RfD}. \quad (2)$$

Where:

- QR: risk quotient for the contaminant [unitless];
- I: intake for the contaminant [mg/(kg·day)];
- RfD: reference dose of the contaminant [mg/(kg·day)].

The Reference Dose (RfD) value is specific to each contaminant (see Figure 1) and should be obtained from the provided .xls file (attached via email) or from the website. All other parameters are user inputs.

Figure 1: RSLs - Summary Table (Toxicological values)

Regional Screening Levels (RSLs) - Generic Tables

Tables as of: November 2024

Screening Levels	(TR=1E-06 THQ=1.0)	(TR=1E-06 THQ=1.0)	(TR=1E-06 THQ=0.1)	(TR=1E-06 THQ=0.1)
Summary Table	PDF	XLS	PDF	XLS

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; T = ATSDR DRAFT; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; R = ORD; N where nc SL < 10X ca SL; SSL values are based on DAF=1; m = ceiling limit e

Toxicity and Chemical-specific Information												Contaminant	
SFO (mg/kg-day)$^{-1}$	key	IUR (µg/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	mutagen	GIABS	ABS_{GI}	C_{sat} (mg/kg)	Analyte	CAS No.
				3.00E-04	O				1	0.1		Acephate	30560-19-1
		2.20E-06	I			9.00E-03	I	V	1		1.07E+05	Acetaldehyde	75-07-0
				2.00E-02	I				1	0.1		Acetochlor	34256-82-1
				9.00E-01	I			V	1		1.14E+05	Acetone	67-64-1
						2.00E-03	X		1	0.1		Acetone Cyanohydrin	75-86-5
						6.00E-02	I	V	1		1.28E+05	Acetonitrile	75-05-8
				1.00E-01	I			V	1		2.52E+03	Acetophenone	98-86-2
3.80E+00	C	1.30E-03	C						1	0.1		Acetylaminofluorene, 2-	53-96-3
				5.00E-04	I	2.00E-05	I	V	1		2.27E+04	Acrolein	107-02-8
5.00E-01	I	1.00E-04	I	2.00E-03	I	6.00E-03	I	M	1	0.1		Acrylamide	79-06-1
				5.00E-01	I	2.00E-04	P	V	1		1.09E+05	Acrylic Acid	79-10-7
5.40E-01	I	6.80E-05	I	9.00E-05	T	2.00E-03	I	V	1		1.13E+04	Acrylonitrile	107-13-1
						6.00E-03	P		1	0.1		Adiponitrile	111-69-3
5.60E-02	C			1.00E-02	I				1	0.1		Alachlor	15972-60-8
				1.00E-03	I				1	0.1		Aldicarb	116-06-3

Source: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

2. SPECIFIC OBJECTIVES

- The application must be developed in JavaScript or, preferably, TypeScript. If needed, you may transpile TypeScript into JavaScript, but be sure to include the original TypeScript files as well;
- You must build either a CLI (Command-Line Interface) or, preferably, a simple GUI (Graphical User Interface) using plain HTML/CSS or any framework you are comfortable with (e.g., React, Vite, Next, Vue…). The choice of tools will not affect your evaluation;
- Your application must integrate with the toxicological values table in some way. You can read the .xls file directly using JavaScript/TypeScript, convert it to another format, or even use Python as an intermediate step to facilitate reading;
- The application should allow the user to select a contaminant, input the required parameters, and then display the calculated non-carcinogenic risk for that contaminant.

3. NOTES

- Feel free to research online or use AI tools;
- You are allowed to use third-party libraries to simplify development.
- Evaluation will be based on adherence to good programming practices and the overall functionality of the application.

4. SUBMISSION GUIDELINES

- Include a text file explaining how to run your application;
- Compress all necessary files into a .zip or .7z archive. Do not include unnecessary files or folders (e.g., cache folders);
- Send your submission to: projeto.3d.rema@gmail.com