



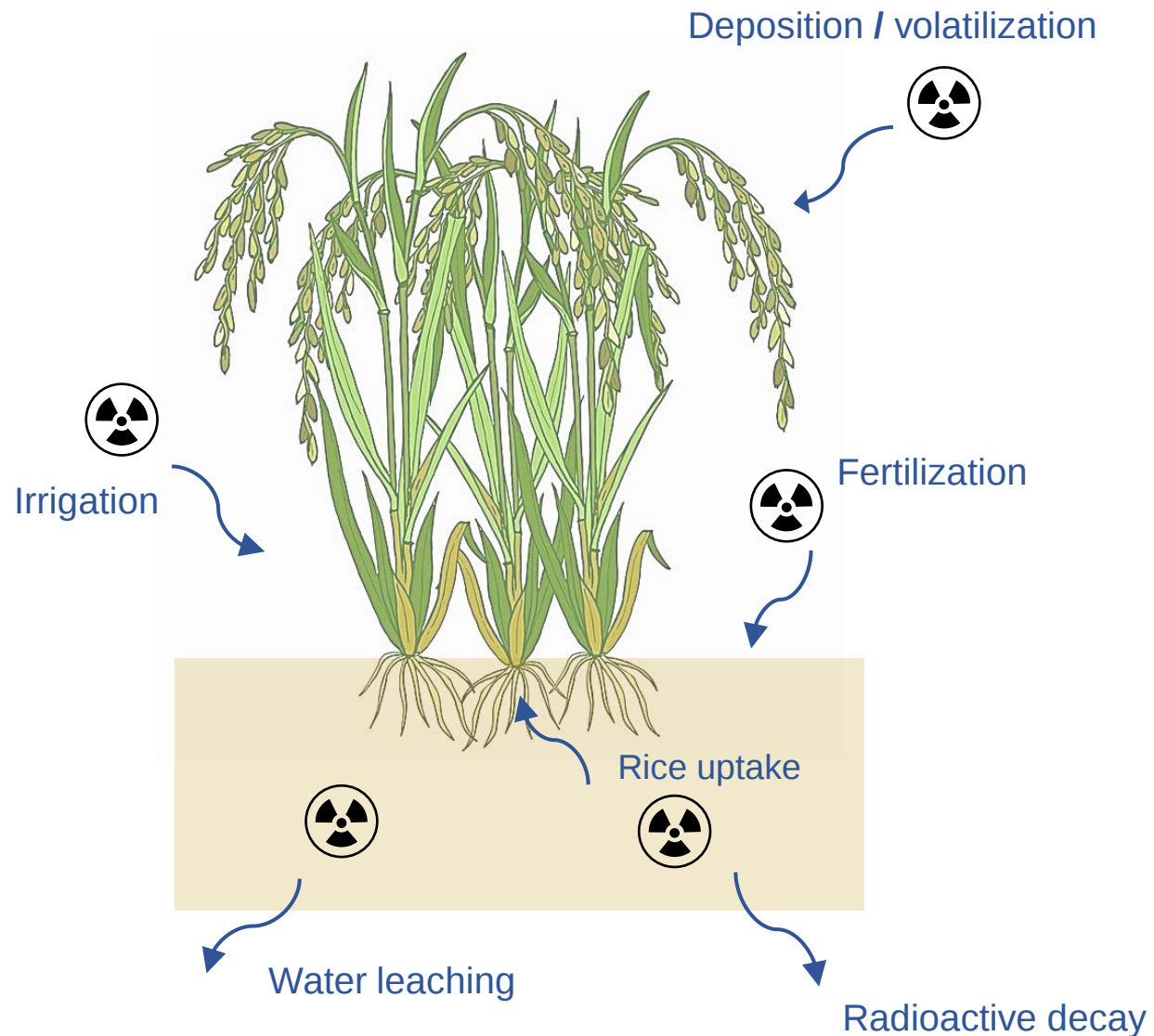
ASSOCIATION OF YOUNG SCIENTISTS AND SPECIALIST ALUSHTA CONFERENCE 2025

Natural Radionuclides in Rice Soils in the Mekong Delta Region, Vietnam: Health Risk, Transfer to Rice, and Long-Term Accumulation in Topsoil

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>> INTRODUCTION



NORM: naturally occurring radioactive materials.

In an **agro-ecosystem**, NORM can present in the **topsoil**, and inputted by **agricultural activities**, which leads to the **increased** radioactivity in both soil and rice.

Enhanced levels of NORM in rice may pose potential **long-term risks** to public health.

Rice is one of the **main food sources** in Vietnam and the world.

There had **not** been **any surveys** on rice and soil in this specific area.

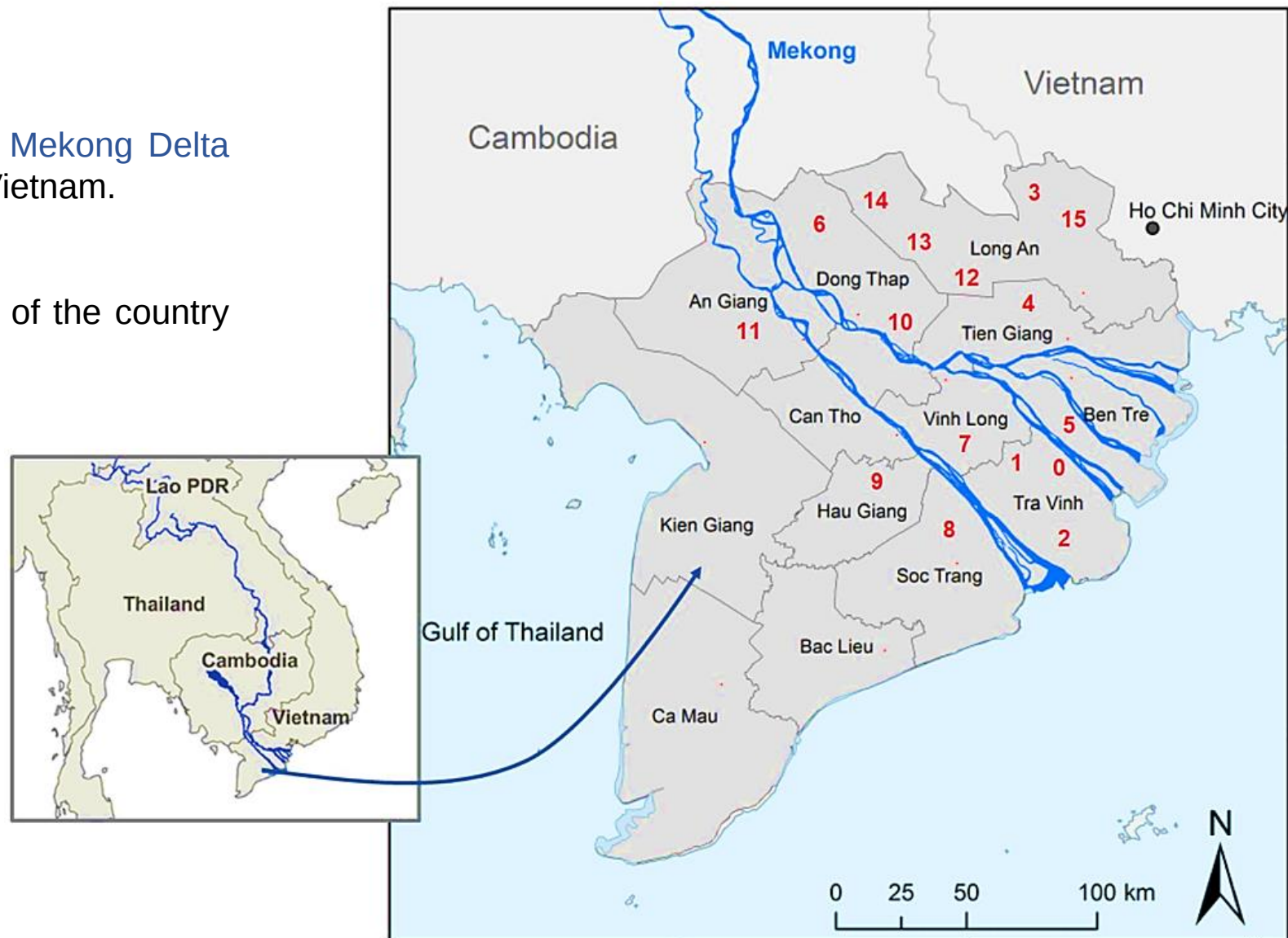
➤➤ RESEARCH SITE

The present study was performed in **Mekong Delta** which is the west-southern region of Vietnam.

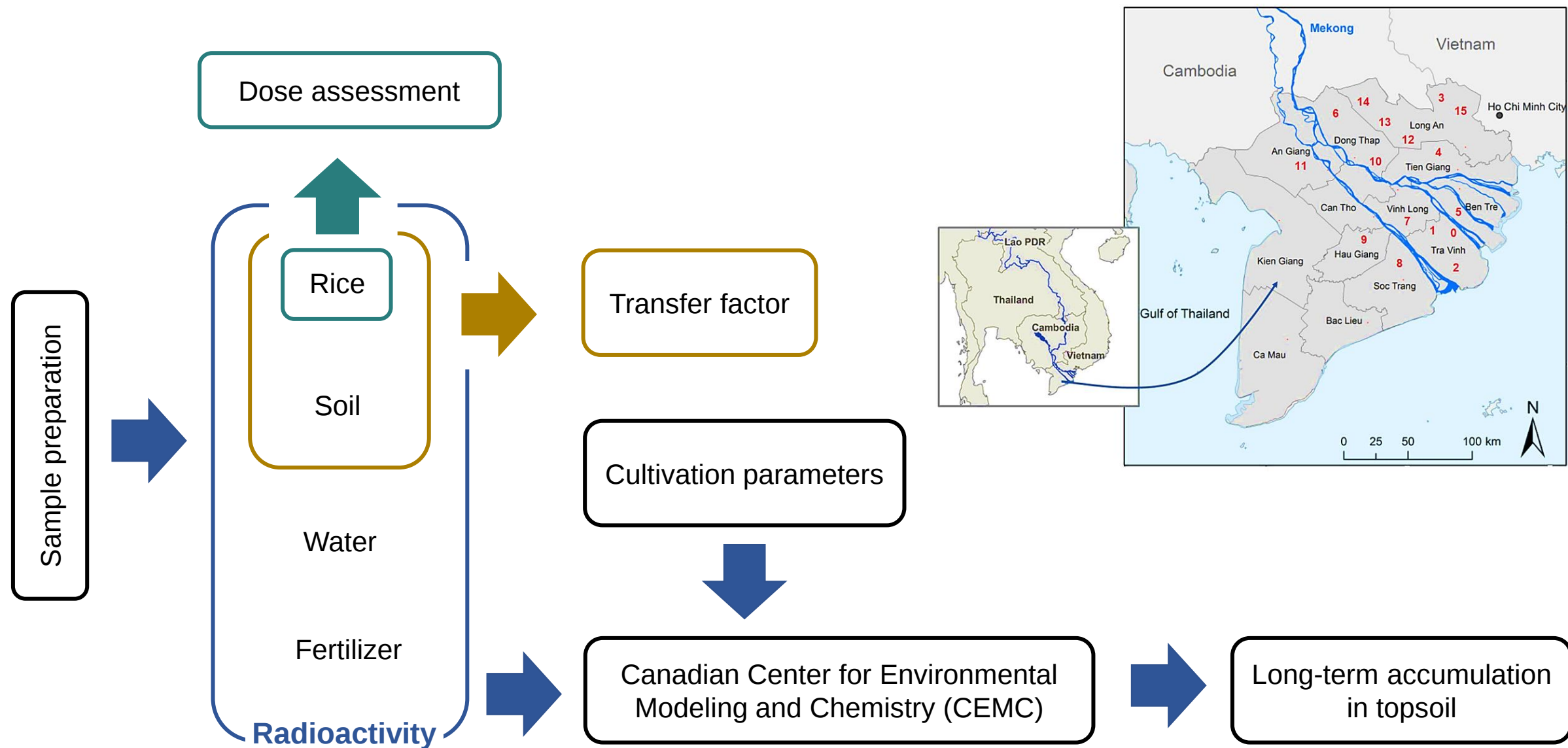
This is the **biggest agricultural region** of the country with most of the area of the Mekong Delta is used for **rice cultivation**.

There are 16 rice fields in **9 provinces**, marked from 0 to 15 on the map.

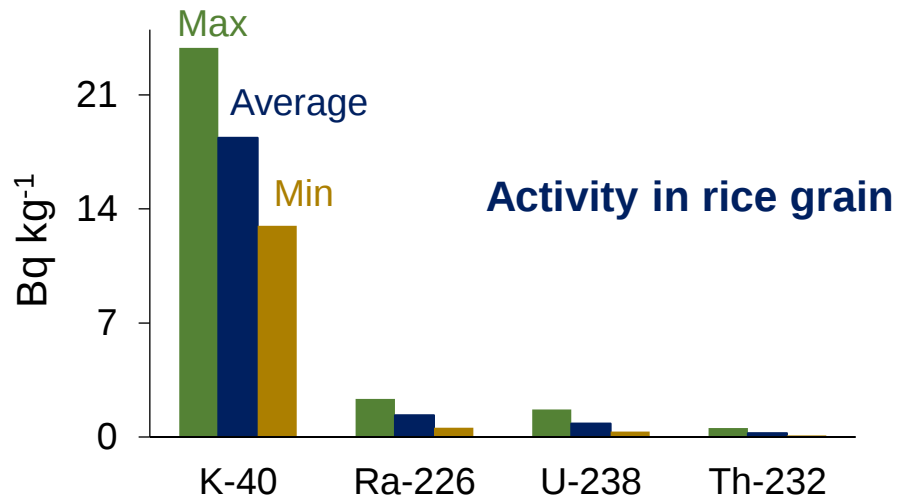
Location 0 was used to estimate the long-term NORM accumulation.



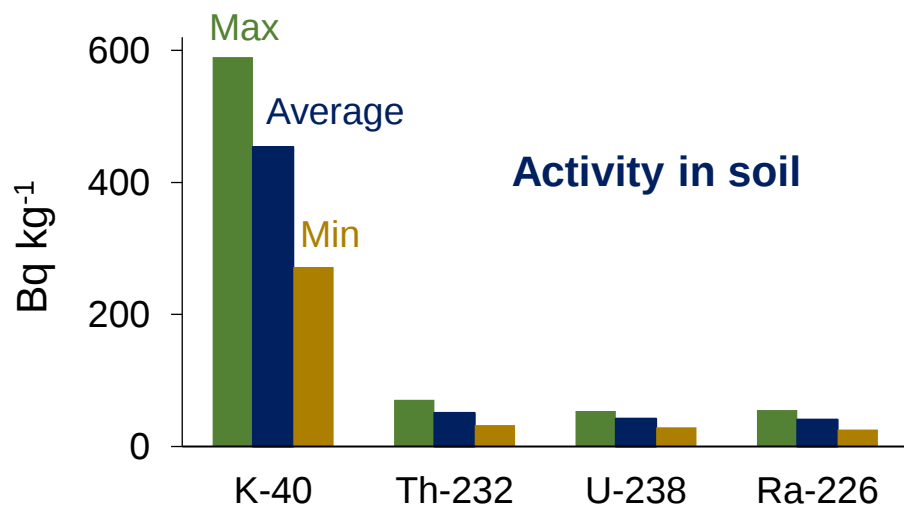
RESEARCH PROCEDURE



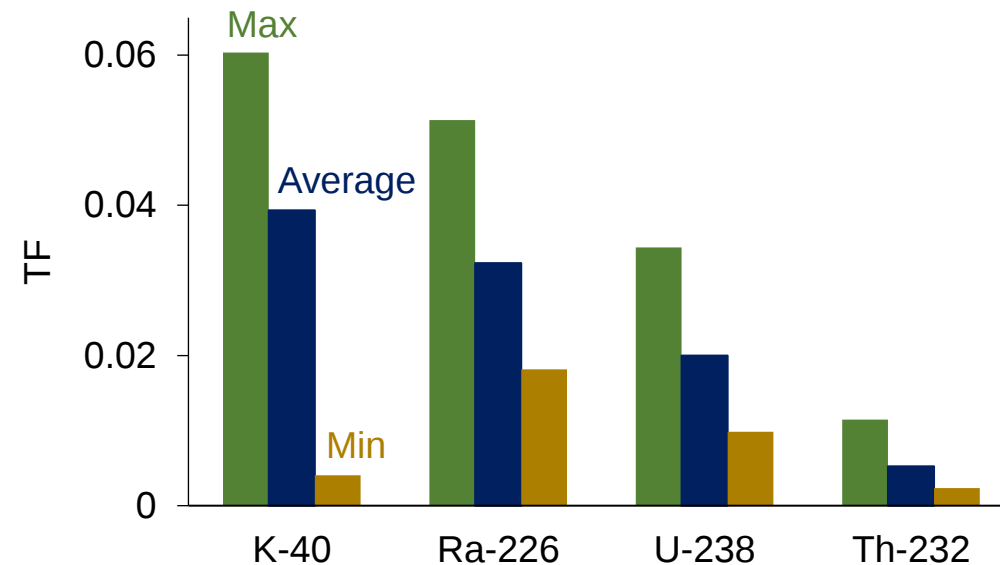
RADIOACTIVITY IN SAMPLES



TF =



Soil-to-rice transfer factors (TF)

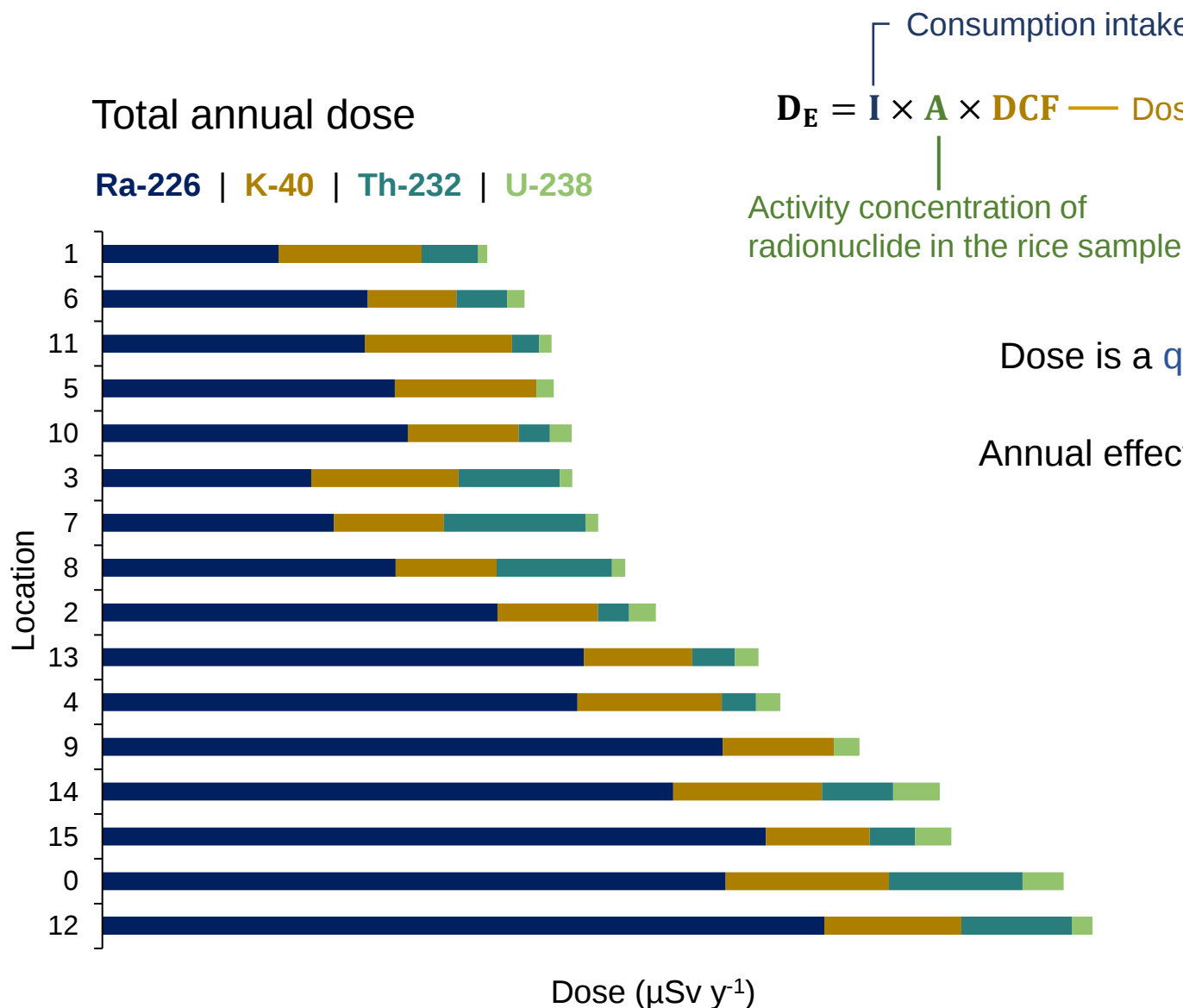


TF **predicts** the **radionuclide contamination** in the plant based on the activity concentrations of radionuclides in the soil and in the rice.

Values are **within the ranges** of TF in the world according to TRS-472 report (IAEA, 2010).

The **differences** between the TF values are due to some factors such as **environments** and **soil properties**.

➤➤ ANNUAL EFFECTIVE DOSE



Dose is a **quantity of radiation** to be taken at a particular time.

Annual effective dose trend: **Ra-226** > **K-40** > **Th-232** > **U-238**.

Ra-226 contributed a main fraction to the total dose due to the **highest DCF**.

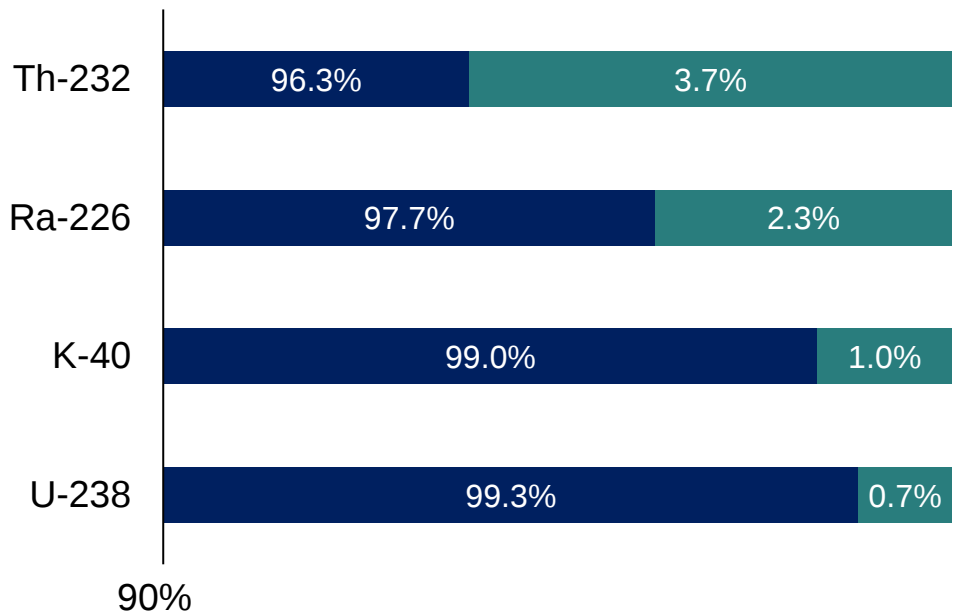
Highest estimated for rice **sample 12** < the exemption mean dose criterion of **0.3 mSv year⁻¹** (UNSCEAR* - 2000).

*The United Nations Scientific Committee on the Effects of Atomic Radiation (1955).

>> CULTIVATION CHARACTERISTICS

Contribution to total **INPUT** rate

Irrigation | Fertilization

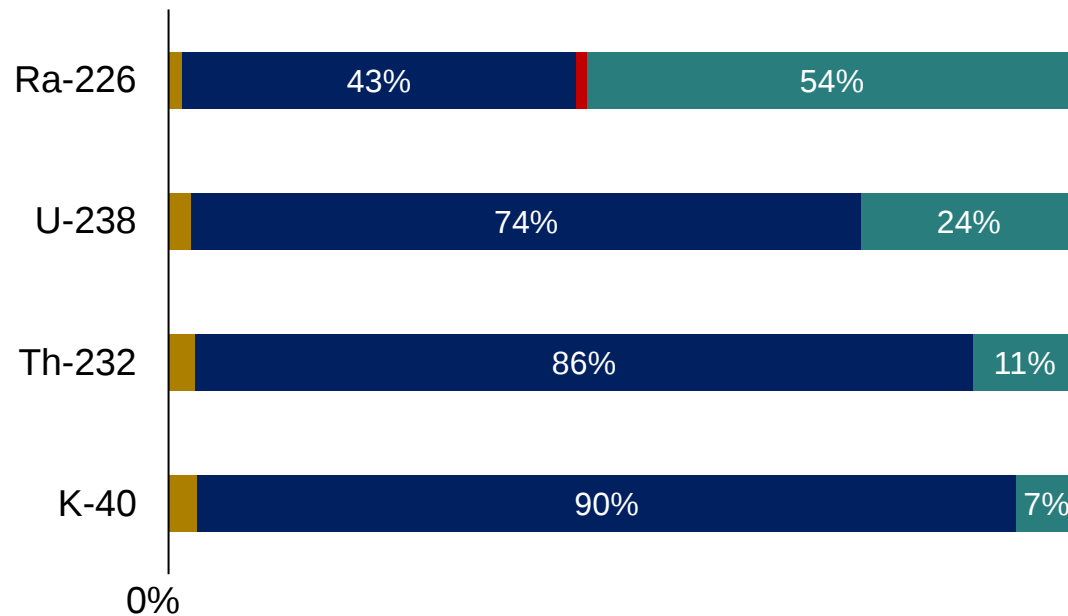


Fertilization : $^{232}\text{Th} > ^{226}\text{Ra} > ^{40}\text{K} > ^{238}\text{U}$

Irrigation: $^{238}\text{U} > ^{40}\text{K} > ^{226}\text{Ra} > ^{232}\text{Th}$

Contribution to total **OUTPUT** rate

Volatilization | Leaching | Decay | Rice uptake



Rice uptake: $^{226}\text{Ra} > ^{238}\text{U} > ^{232}\text{Th} > ^{40}\text{K}$

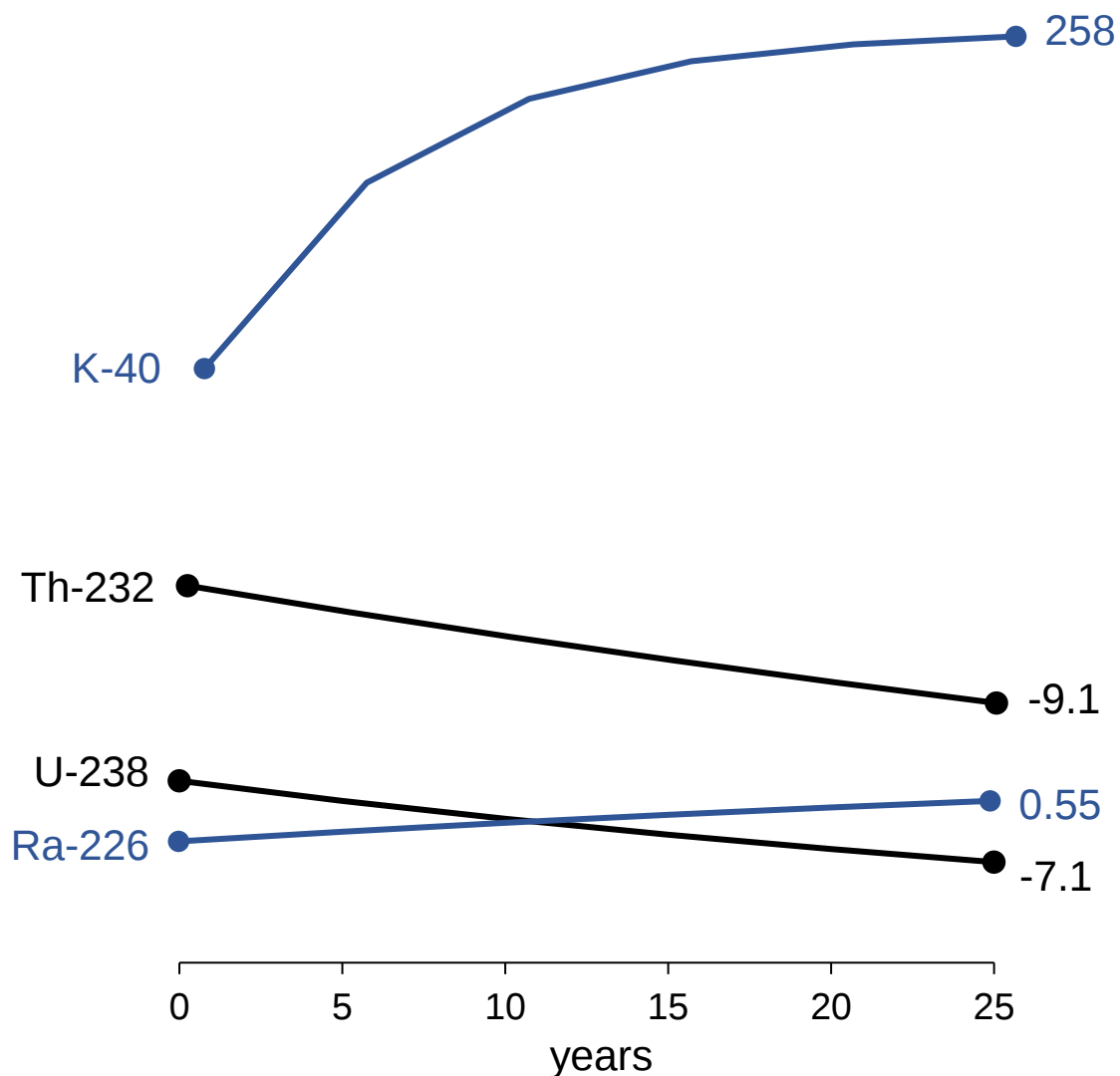
Decay: $^{226}\text{Ra} > ^{40}\text{K} > ^{232}\text{Th} > ^{238}\text{U}$

Leaching: $^{40}\text{K} > ^{238}\text{U} > ^{232}\text{Th} > ^{226}\text{Ra}$

Volatilizing : $^{40}\text{K} > ^{238}\text{U} > ^{232}\text{Th} > ^{226}\text{Ra}$

ESTIMATE ACCUMULATION IN TOPSOIL

Isotope accumulation through years (Bq kg^{-1})



After 25 years of rice cultivation,

Agricultural practices cause a significant increase of K-40 in the topsoil (0–20 cm).

Ra-226 has an insignificant increasing amount.

Activity concentrations of Th-232 and U-238 decrease but with low rates.

Rate values in our study are lower than the rates found by other studies in the world.

CONCLUSION

1. NORM and the radiological health risks were assessed for rice and paddy soil samples collected in the Mekong Delta.
2. Activity concentrations of K-40 and Ra-226 in the paddy soil increased due to the long-term rice cultivation in the study area.
3. Irrigation system is the main factor that potentially increases the accumulation rate of radionuclides in the soil.
4. The accumulation rates of radionuclides therefore can be controlled by changing the irrigation conditions such as water source or irrigation rate.

NEXT STEPS

1. Mitigate the radioactivity absorption of rice plants.
2. Immobilize radionuclides in soil medium.

Thank You

For Your Attention

