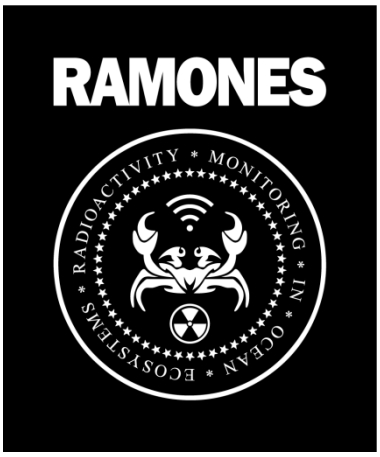

RAMONES
Radioactivity Monitoring in Ocean Ecosystems

Deliverable

Document ID: D5.3 Repository, Information System and Risk no3

9/2023

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Disclaimer

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RAMONES project's main objective is to close the current marine radioactivity gap in sampling and foster new interdisciplinary research in ocean ecosystems. RAMONES will invest a significant effort to provide tools to enable long-term data acquisition missions, rapid deployments, low cost per information byte, and propose new AI and Robotics-driven and supported methodologies, being ambitious to eventually offer scaled-up solutions to researchers, policy makers and communities. These goals will be achieved by combining state-of-the-art (SoA) methodologies and equipment from various disciplines in a well-balanced synergy. It will also design new and effective methodologies targeting the marine environment, which will provide efficient response to existing natural and man-made hazards, and shape future policies for the global population. RAMONES will additionally contribute to shaping a blueprint on Environmental Intelligence in the EU and worldwide.

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List of acronyms

Acronym	Description
AI	Artificial Intelligence
DB	Database
EIC	European Innovation Council
EU	European Union
F2SS	Forecasting & Foresight Support System
GIS	Geographical Information System
Maastricht	Treaty on the European Union
POIS2ON	**P**rototype RAM**O**NES **I**nformation **S**ystem for **S**ocioec**ON**omic stakeholders
SoA	State of the Art
WP	Work Package

Table of Contents

Tables of Figures

Abstract

RAMONES is an ambitious, high-risk FET H2020 project which aims to achieve high-resolution temporal and spatial underwater AI-driven radioactivity measurements, in situ and in near-real-time, forming a game changer in deep-water environmental monitoring. RAMONES proposes a new generation of submarine radiation-sensing instruments, assisted by State of the Art robotic and artificial intelligence solutions towards understanding radiation related risks near and far from coastal areas, while providing data for the international community towards shaping new policies and governance guidelines for environmental sustainability, economic growth, and human health.

One of the main goals also of RAMONES is to introduce novel monitoring and response channels to **inform key socio-political and socio-economic stakeholders** at regular intervals at medium (hourly, daily, weekly) to low (monthly to inter-annually) frequencies. To that end, the deliverable **5.3. of Work Package 5 provides the Design** for the **Database** of the prototype information system, **POIS2ON** (Prototype RAMONES Information System for SocioecONomic stakeholders). The Database will offer the option to store reliably in one place all information measured from RAMONES that can be communicated to socioeconomic stakeholders.

Keywords

RAMONES; POIS2ON; Database; Radioactivity; Deep Water; Information System.

1. Introduction

1.1 Context

This document belongs to Work Package 5 (WP5, *Citizen Awareness, Communication and Dissemination Activities*), and in particular to Task T5.1 *Forecasting and risk management* led by UDUR that is aiming to transliterate the in-situ, high frequency (e.g. hourly, multiple times per day) measurements of radioactivity in deep ocean waters to actual time series that can be forecasted, estimating when general acceptable daily/weekly/monthly/annually limits are reached/exceeded, and as such quantify the risk and potential impact to the environment and human populations.

POIS2ON (Prototype RAMONES Information System for SocioecONomic stakeholders), a forecasting & foresight support system (F2SS) system is developed [Me22], which will now include an option of a centralized Repository and Database for recorded measurements and time series (D5.3) in order to offer in its final form (D5.4) forecasted cumulative radionuclide concentrations as well other dangerous elements concentrations at medium frequencies (hourly, daily & weekly) and the associated impact to relevant stakeholders: policy makers, regulatory agencies, governments, etc.

1.2 Structure of the document

From this point, the current document is organized according to the following structure and contents:

Section 2. The Database of POIS2ON

Section 3. Conclusion and the Future

1.3 Objectives and approach

The objectives of the RAMONES D5.3 deliverable is to set the option for and the respective design for a centralized **Database** (and a parallel repository) for the prototype information system **POIS2ON.**

2 The Database of POIS2ON

2.1 The Repository of POIS2ON

For the repository we do use the stable **ELOG** system, hosted on this address:

http://radium.phys.uoa.gr:8080/ramones

Secure *usernames* and *passwords* have been provided to the project partners in order to upload the data collected during the project in a secure and concise way.
To ensure integrity of the data we have limited the size of the files uploaded to the server to 100 MB (max), however, possible enlargement is feasible, if requested. We recommend that in each upload a description of the metadata, a name, a type and category, are dully provided. To that end, a metadata table/facility will be constructed within the repository to provide details on the contents of every file in the repository (implementation in D5.4).

The **ELOG** server is the standard system used by various large-scale infrastructures around the world (CERN, GSI, DESY etc), serving a very large community for longer time than cloud systems being available today. A **Zenodo** space is also under way to have open data approved by the consortium published at a later stage in line with our GA obligations, according to the Consortium DMP.

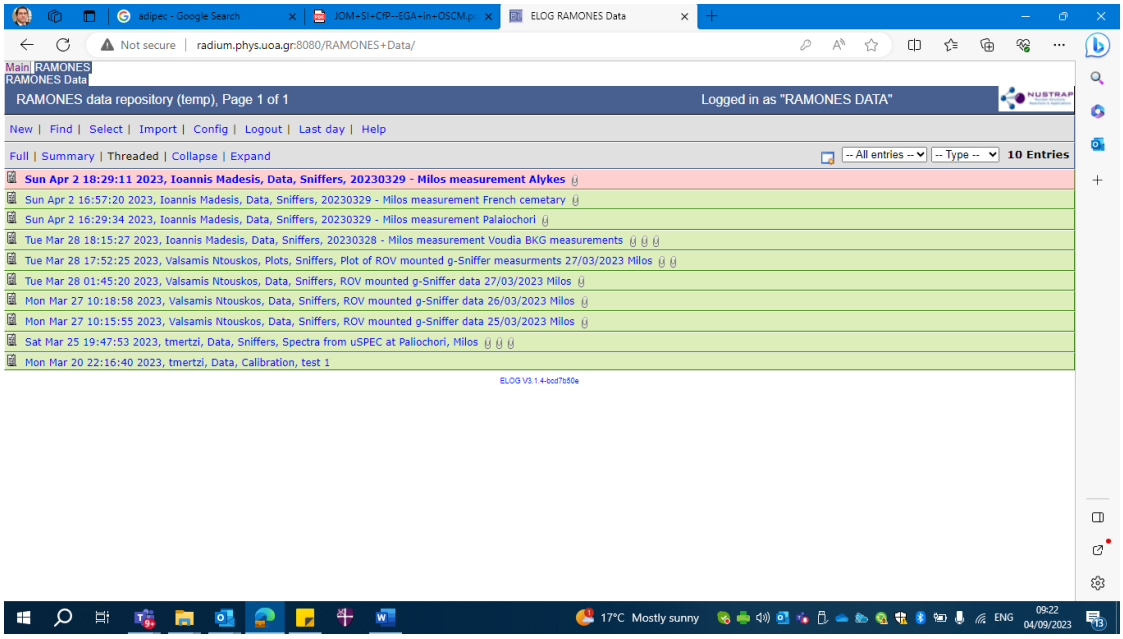

Figure 1. The Repository of POIS2ON

2.2 Database Design

The Tables of the POIS2ON Relational Database

We decided to opt for the flexibility, simplicity and speed of a relational database, for the prototype to be implemented (in D5.4) in broadly-used, open access MySQL.

The following list of eight (8) tables is not exhaustive, but is considered rather complete at this stage. Also, the contents of each table are not fully determined yet, but again almost completed. The tables are interconnected via the following Database Schema:

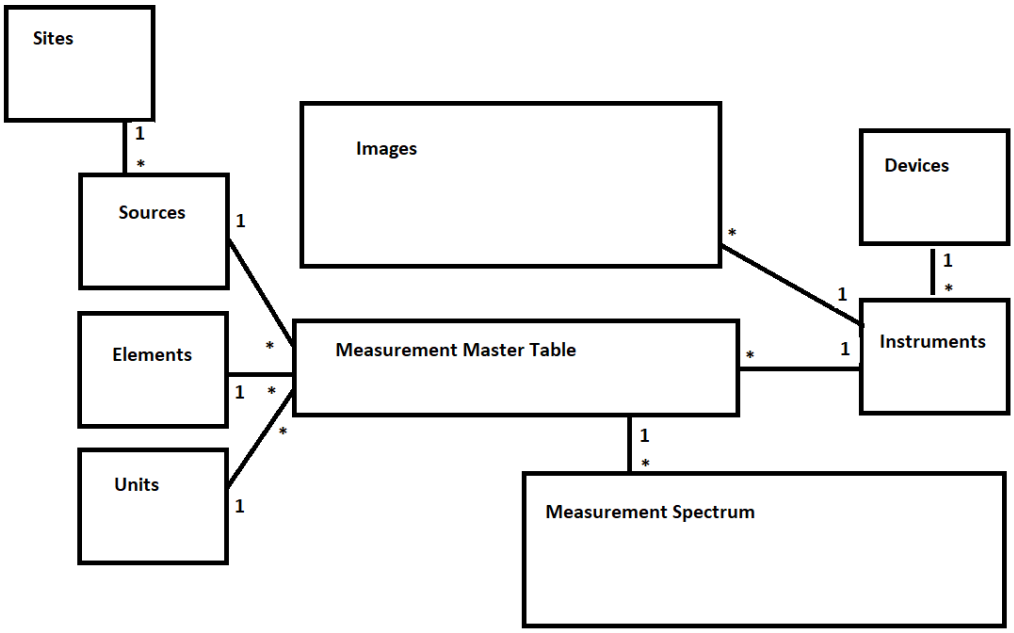

Figure 2. Database Schema. Every box in the diagram represents a different table (see T1-T8 below)

T1. ELEMENTS

PRIMARY KEY	
ELEMENT_ID	ELEMENT_NAME
1	Cs-137
2	Rn-222
3	Ra-226
4	Pb-214
5	Pb-210
6	Bi-214
7	Tl-208
8	Pu-239
9	Pu-240
10	K-40

T2. INSTRUMENTS

PRIMARY KEY	
INSTRUMENT_ID	INSTRUMENT_NAME
1	GASPAR
2	γ-Sniffer 1
3	γ-Sniffer 2
4	γ-Sniffer 3
5	aSPECT
6	CHERI
7	SUGI

T3. DEVICES

PRIMARY KEY	
DEVICE_ID	DEVICE_NAME
1	Underwater Glider 1
2	Underwater Glider 2
3	ASV (Autonomous Surface Vehicle)
4	Benthic Lab

T4. UNITS

PRIMARY KEY	
UNIT_ID	**UNIT_NAME**
1	nanoSieverts per hour (nSv/h)
2	Bq
3	nanoGray per Second (Gy/h)

T5. SITES

PRIMARY KEY	
SITE_ID	**SITE_NAME**
1	Milos, Greece
2	Kolumbo, Greece
3	Methana, Greece
4	Unspecified Location, France

T6. SOURCES

PRIMARY KEY	
SOURCE_ID	**SOURCE_NAME**
1	Hydrothermal
2	Volcanic
3	Nuclear Waste Site
4	Oil Extraction Site

T7. IMAGES

PRIMARY KEY						
IMAGE_ID	**INSTRUMENT_ ID**	**IMAGE_ NAME**	**IMAGE_ DESCRIPTION**	**IMAGE_TYPE**	**FILE_NAME**	**FILE_PATH**
1	UV	…	…	…	…	…
2	optical	…	…	…	…	…
3	SUGI					
4	CHERI					

T8. MEASUREMENTS

As each measurement is practically a spectrum which involves multiple hundreds of energy values (in keV) for the implementation a master table is needed that provides a measurement id. In a secondary table ("measurement spectrum"), the actual spectra are recorded and become available for further exploitation. In the latter table, the key is the measurement id ("foreign key") and the frequency.

Measurement Master Table

PRIMARY KEY							
FOREIGN KEY					FOREIGN_KEY	FOREIGN_KEY	FOREIGN_KEY
INSTRUMENT_ID	TIME	DEPTH	LATITUDE	LONGITUDE	SOURCE_ID	ELEMENT_ID	UNIT_ID

MEASUREMENT_ID	DURATION
A/N	

Measurement Spectrum

PRIMARY KEY		
FOREIGN_KEY		
MEASUREMENT_ID	ENERGY (keV)	MEASUREMENT
1	52	1.2 x 10^{-1}
2	1461	1.1 x 10^{-3}
…	…	…

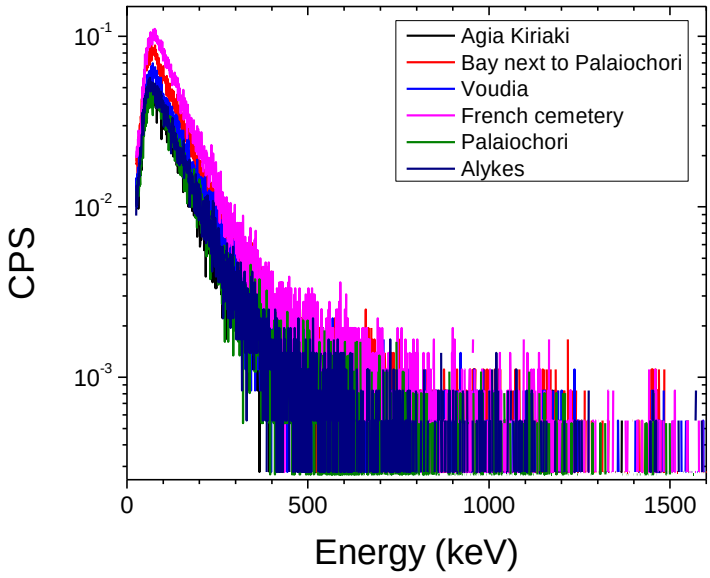

Figure 3. In situ recorded RAMONES spectra with a γ-Sniffer

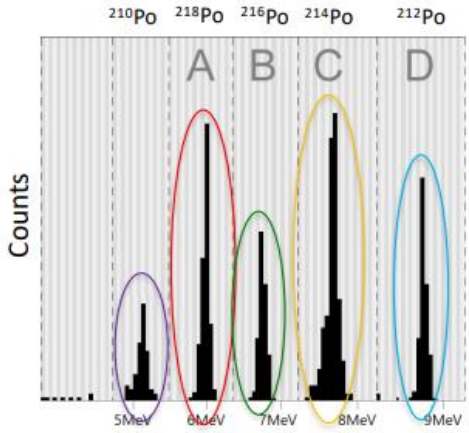

Figure 4. Lab test spectrum recorded with the alpha detector to be used in aSPECT. That will require five (5) different measurement IDs.

The prototype implementation of the Database will be completed in D5.4 with MySQL.

2.3 Linkages to other Databases

The POIS2ON database will be linked with the “Dosages database” (DSDB) that is developed in parallel by UCA and simulates and measures and effectively reports the actual absorbed quantity of a radioactive element from biota at various (predetermined) distances from the measurement source. DSDB is developed via HeidiSQL and the first version will be available in October 2023.

The POIS2ON database will also be linked with the Database of the GIS system that is linked with POIS2ON as per D5.2.

3. Conclusion and the Future

RAMONES aspires to introduce novel monitoring and response channels to inform key socio-political and socio-economics stakeholders at regular intervals at medium (daily, weekly) to low (monthly to inter-annually) time frequencies. To that end, the deliverable D5.3 of Work Package 5 provides the Design for the **Database** of the prototype information system **POIS2ON**, as well the **Repository** currently used in parallel.

Next respective deliverables linked are D5.4 presenting the final **fully working version** of POIS2ON in month **36** (with simulated data) and a fully working database. To be populated with real data by month 48.

In parallel in months 36 onwards further **capabilities for calculating and visualizing Risk indices** will be added to POIS2ON via the deliverables **D5.6-D5.8.**

References

[Me22] T.J. Mertzimekis, P. Nomikou, E. Petra, P. Batista,D. Cabesinhas, A.M. Pascoal, L. Sebastião, J. Escartín, K. Kebkal, K. Karantzalos, A. Mallios, K. Nikolopoulos, and L. Maigne. 2022. Radioactivity Monitoring in Ocean Ecosystems (RAMONES)-Environmental Intelligence. GoodIT2022, Cyprus Larnaca 6-9 Sep 2022