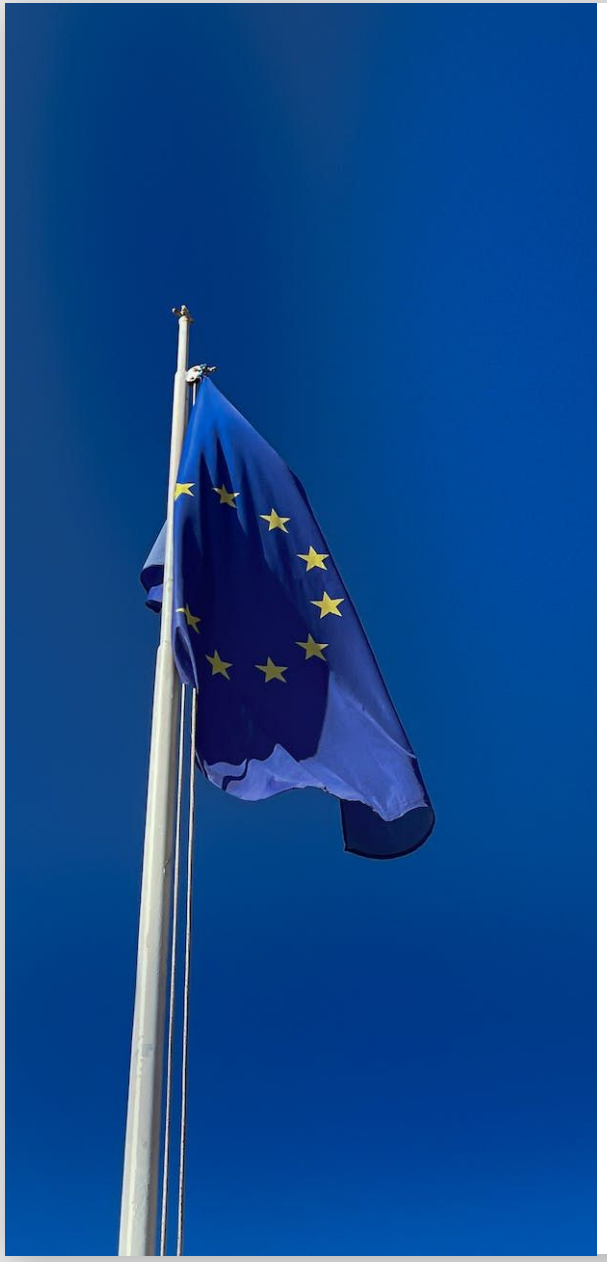
Automated Information System for Control of Technological Processes and Traceability of RAW

KP-SERAW-004



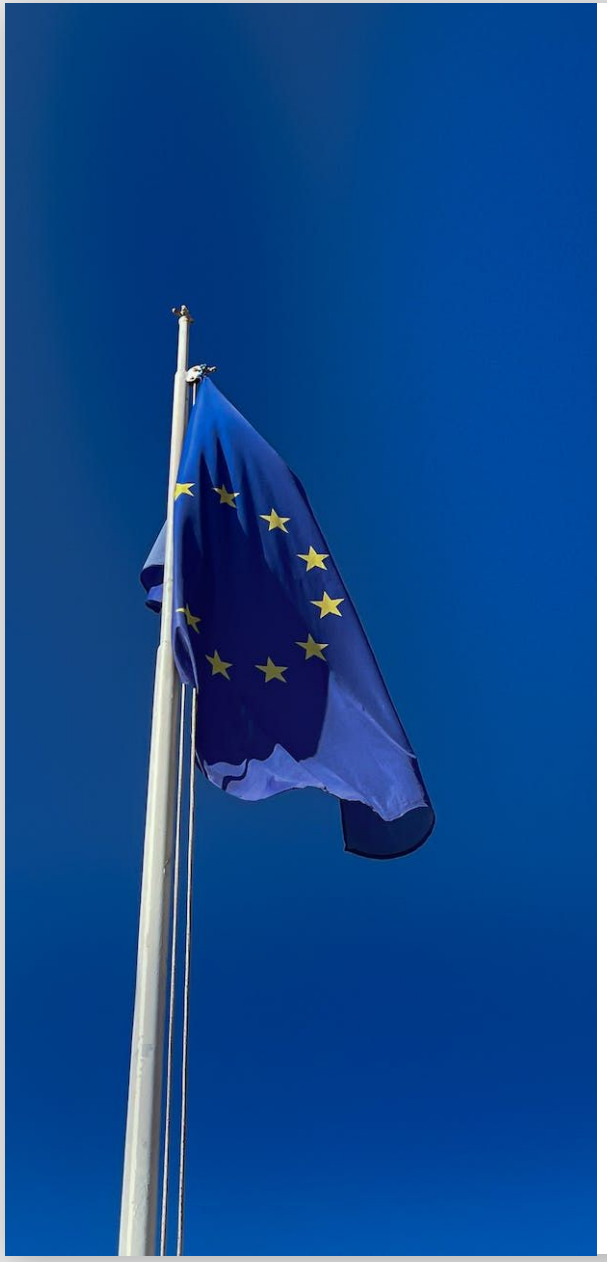
Foreword

In 2021, the European Commission (EC) adopted a new proposal for a Council Regulation establishing a dedicated financial programme for decommissioning nuclear facilities and managing radioactive waste. This instrument covers the co-funding of the decommissioning programmes of Bulgaria, Slovakia, and the decommissioning of the Joint Research Centre (JRC). A separate Council Regulation was adopted for the decommissioning programme of Lithuania.

The EC JRC is mandated to foster the spread of decommissioning knowledge across all the European Union Member States and facilitate knowledge sharing arising from implementing the abovementioned decommissioning programmes, funded by the Nuclear Decommissioning Assistance Programme (NDAP).

The decommissioning operators from the NDAP (NDAP Operators) implemented and tested a knowledge management methodology in 2021 through Project ENER/D2/2020-273. Using this methodology, the NDAP Operators can develop Knowledge Products that are currently available to share with other European stakeholders. In addition, this methodology is under implementation in the JRC Nuclear Decommissioning and Waste Management Directorate (NDWMD), which becomes a knowledge generator extracting the knowledge from the ongoing decommissioning activities at the different sites (Geel, Ispra, Karlsruhe, and Petten).

The JRC NDWMD aims to become a Centre of Excellence in nuclear decommissioning knowledge management and develop a decommissioning knowledge platform which allows exchanging information and building on the best practices in the EU inside the multi-annual financial framework (2021 – 2027) strategy. The operational phase of the project is expected to start in 2024 to develop ties and exchanges among EU stakeholders and document explicit knowledge and make it available through multi-lateral knowledge transfers on decommissioning and waste management governance issues, managerial best practices, technological challenges, and decommissioning processes at both operational and organisational level, to develop potential EU synergies.



Product description

The KP-SERAW-004 was prepared by a team of experts from the **Specialised Division of Radioactive Waste - Kozloduy at State Enterprise Radioactive Waste (SERAW)** in Bulgaria. The product conveys the experience gained during the execution of the Decommissioning of Units 1 to 4 of the Kozloduy NPP, co-funded by the European Commission, as well as by the contributors to the Kozloduy International Decommissioning Support Fund (KIDSF) – Austria, Belgium, Denmark, France, Greece, Ireland, the Netherlands, Spain, Switzerland, and the United Kingdom.

The case study presented in this report aims to assist other nuclear decommissioning operators personnel in elaborating automated information systems for control of technological processes and traceability of radioactive waste (RAW).

Abstract
Value & Application
Target Users
Objective & Approach

Keywords

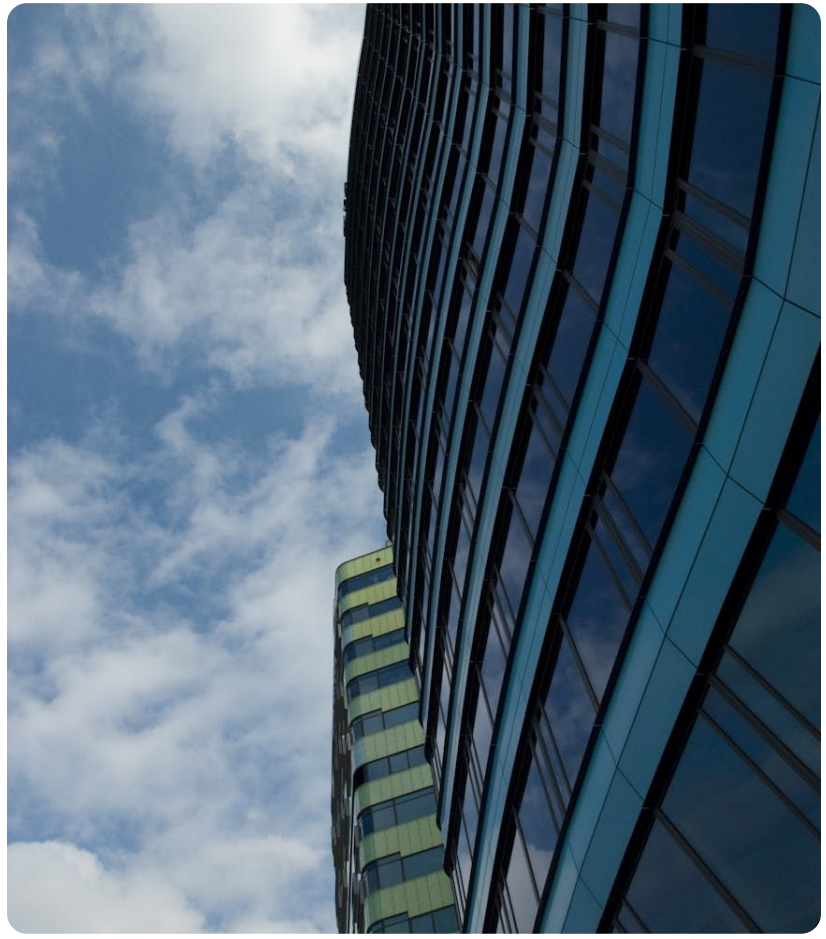
Waste management; Information system
Radioactive waste; Decommissioning
Waste characterization

Target users

Nuclear Decommissioning Operators

All decommissioning operators must implement information systems to control and trace radioactive waste and ensure the full traceability of the streams. Nuclear decommissioning operators in Europe may use this product to design or refine the functionalities of their automated information systems and use the experience of SERAW to improve their use and effectiveness.

This project's users will learn from SERAW´s experience developing and using the AISCTP and will receive recommendations about how to transfer this experience to their own automated information systems for RAW management.

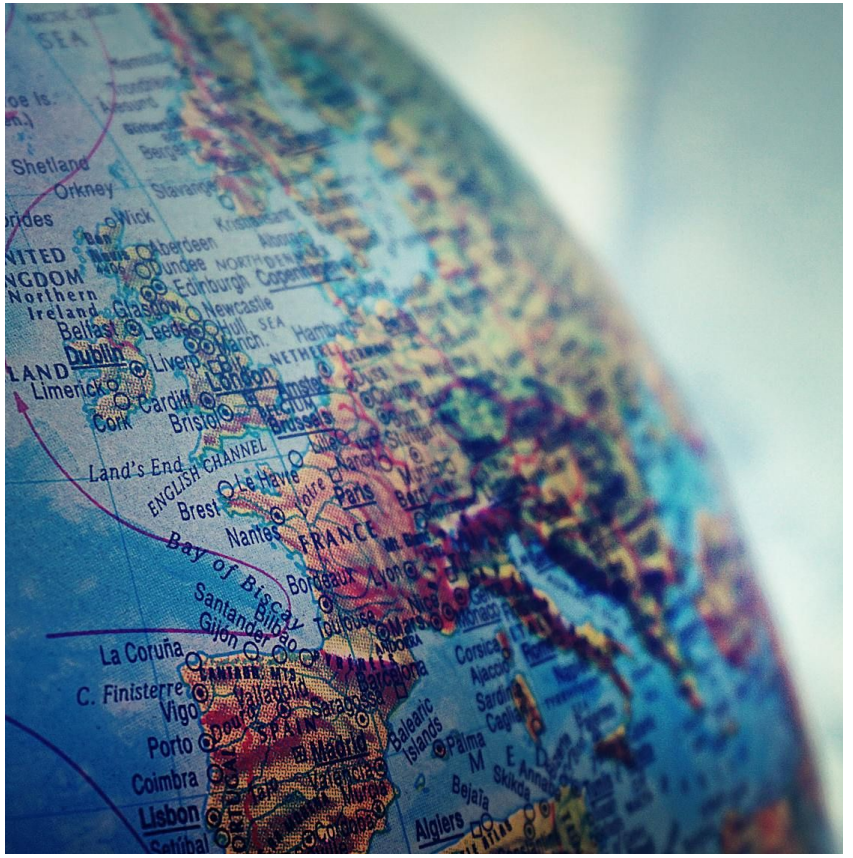


Objective

This knowledge product aims to share the knowledge gained by SERAW in developing and using a web-based information system to manage RAW with other stakeholders (mainly nuclear decommissioning operators) of European decommissioning programs.

Approach

This product is presented as a case study that describes the functionalities and use of AISCTP, an automated information system that records, documents, and ensures the traceability of RAW at Kozloduy NPP. It is an interactive presentation that can be accessed via laptops and smartphones, allowing users to navigate through the system's screenshots while gaining user insights interactively.



Value & Application

Automated information systems facilitate monitoring the efficiency of waste processing facilities and the effectiveness of processing methods, improving safety in decommissioning, real-time inventory, and process traceability.

Once implemented, these systems can automatically receive information about every step of the technological process with radioactive waste. They ensure **full traceability** of waste by type, activity, quantity, radionuclide, chemical composition, point of generation/storage destination, and package type used for the conditioned waste.

Decommissioning license holders using this product can potentially **reduce the volume and the associated costs** of materials produced from decommissioning, requiring storage.

The system designed by SERAW:

- Allows **on-demand queries** by providing detailed and accurate information about any given package.
- Generates the so-called **“passport of conditioned packages”**, with basic information about the package accompanying it to its storage destination.
- Allows **full traceability** by recording tags of all radioactive waste packages.

The records maintained in the system facilitate the optimisation of the storage configurations in the storage facilities, ensuring that **package self-shielding is optimised** for operator inspections and maintenance activities.

Abstract

AISCTP

Automated Information System for Control of Technological Processes of the RAW

Automated information systems are used to record, document, and ensure the traceability of RAW. This knowledge product presents the case study of the AISCTP, a web-based information system developed by SERAW to track the RAW processing and management processes.

It describes the tool's main functionalities and modules with a practical example of RAW management at Kozloduy NPP. The process covers the receipt, processing, and conditioning of solid and liquid RAW, the transfer of RAW to a Plasma Melting Facility, the Physical and chemical Control, and interim storage of RAW.

This project's users will learn from SERAW´s experience developing and using the AISCTP and will receive recommendations about how to transfer this experience to their own automated information systems for RAW management.

HOME

Challenge & Solution

Relevance

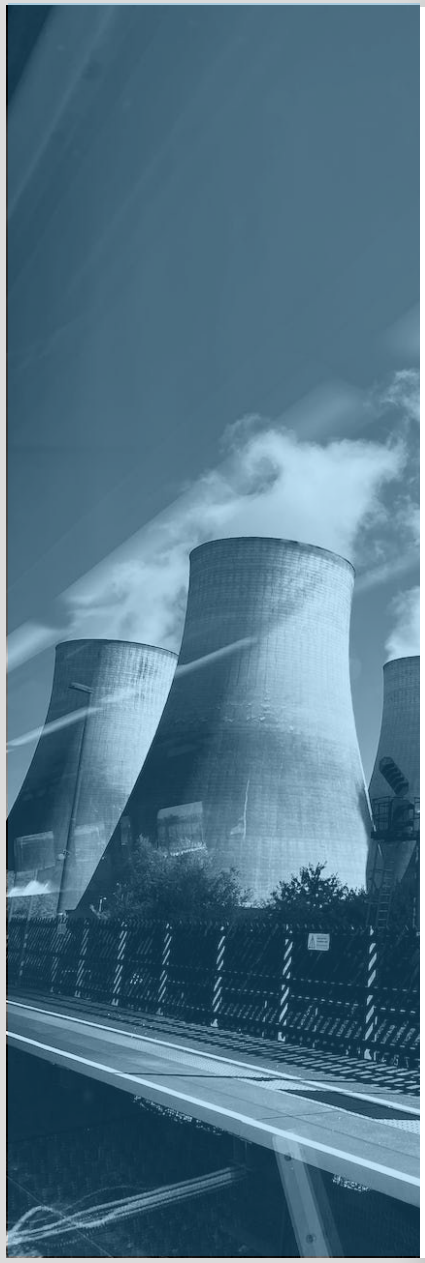
Case Study

Benefits

Key Takeaways

Objective

Present a case study of Kozloduy NPP on the use of an Automated Information System to track the entire process of managing solid and liquid RAW



The challenge of RAW traceability in nuclear decommissioning

Introduction

The Kozloduy Nuclear Power Plant, Units 1 to 4, has four reactors VVER 440/B-230. They were commissioned in 1974, 1976, 1980, and 1982 respectively.

Units 1&2 were shut down permanently in 2002, while Units 3&4 were shut down permanently in 2006; all currently under decommissioning.

Under the administrative supervision of the Ministry of Energy, **State Enterprise for Radioactive Waste (SERAW)** is the licensed operator in charge of the decommissioning of Units 1 to 4 and the construction and operation of a National Disposal Facility for Low- and Intermediate-level Radioactive Waste.

Before dismantling the reactors and components at each unit, a full chemical decontamination of the primary circuits has been carried out to minimise the dose rates. This has facilitated the dismantling activities and allowed the continued decommissioning of the reactors in compliance with the ALARA principle.

As of 2024, SERAW has made significant progress in dismantling primary circuit components at all four units. The first steam generator from Unit 3 was transported to the former Turbine Hall in December 2023 for the subsequent fragmentation. Four additional Steam Generators from Unit 3 followed between January and April 2024, and two steam generators from Unit 4.

According to the EU Nuclear Decommissioning Knowledge Management initiative and in compliance with **Council Regulation (Euratom) 2021/100 of 25 January 2021**, SERAW has continued developing knowledge products yearly since 2021. These are uploaded to and made accessible online via the EU Nuclear Decommissioning Knowledge Management (NDKM) Platform, so-called 'EUKLIDE Platform'.

SERAW's main mission is the safe management of radioactive waste on the territory of the Republic of Bulgaria.

The challenge

Proper information about radioactive waste at every step of the technological process is crucial for its proper management and decision-making. It is also very important to track every batch of waste through the technological process from the point of generation until the endpoint of waste management to enable every stakeholder to have a justified ground for decision-making at every point.

The solution

Before the **AISCTP** development, traceability and information registration were done through formal paper documen tation.

The **AISCTP** offers a means of ensuring that all important information created during the waste management process is fully registered and available for use at every step.

Why the AISCTP | What is AISCTP

Motivation

From paper to digital tools

Before the development of AISCTP, traceability and information registration were done through formal paper documentation. The main reason for initiating the development of AISCTP is that a considerable **amount of paper documentation is difficult to use** in day-to-day operations and a source of potential mistakes.

SERAW required a method to seamlessly transfer available information between technological points and improve waste traceability.

- Need for improvement in **information transfer**
- Need for **traceability** of the waste
- Reduce the **risk of mistakes** in the characterisation

The solution used in Kozloduy NPP

A tool from scratch

SERAW decided to develop its automated information system since the specific technological challenges required a software solution unique to our activities. Therefore, no market solutions were available.

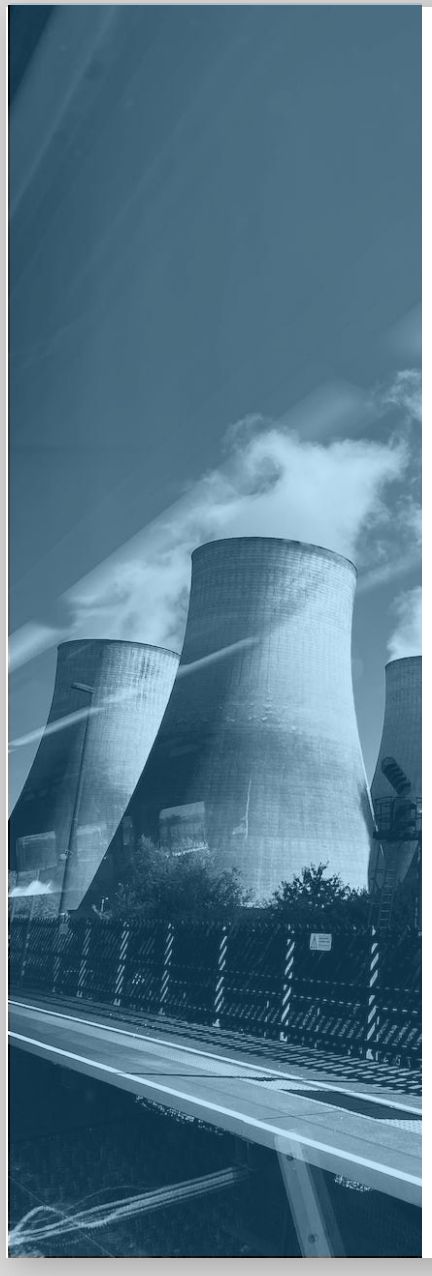
The system's design and functionality were developed in full compliance with SERAW's technological and normative requirements for each step of the applied waste management technology.

General features of the AISCTP

The system's core is a database in which every participant in the technological process registers the information created/gathered at each step of the management process. Conversely, the entered information is available for the next step.

Another main attribute is that the system automatically assesses the acquired information and proposes the available solutions for the next technological step based on technological and normative requirements to prevent mistakes in the operation.

The system also gives the respective manager a detailed overview of all the processes in their area of work.



The relevance of an AISCTP alike system for other operators

The **AISCTP** provides detailed information about the state of each waste batch and makes all previously gathered information operational for the personnel engaged in the respective technological step.

Impact on SAFETY MEDIUM

The implementation of an AISCTP traceability system significantly reduces the risk of mischaracterisation and misplacement of RAW being treated in the facility.

Impact on PERFORMANCE HIGH

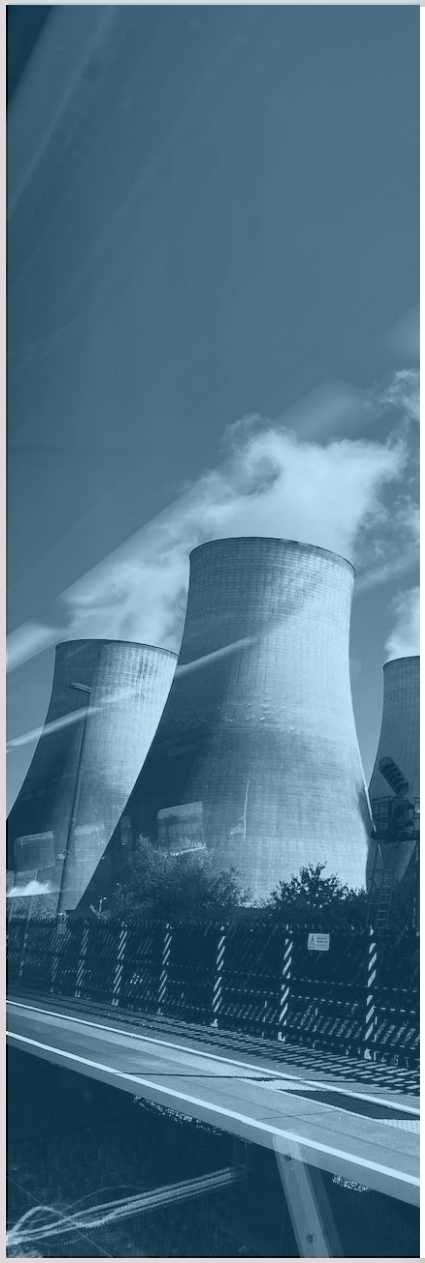
The AISCTP allows to trace every batch of RAW through the waste management processes and presents comprehensive information for decision making.

Knowledge VULNERABILITY LOW

AISCTP alike systems are widely implemented by almost all nuclear decommissioning operators.

Knowledge APPLICABILITY HIGH

This is a must-have system in the RAW management process. Features shared can be applied to the design of other automated information systems.



Case Study: An Automated Information System for the Control of Technological Processes (AISCTP) and for Traceability of RAW

The process of RAW management at Kozloduy NPP

The following processes were accounted for during the design of the AISCTP. As SERAW's experience, the processes shown below are to be included in the information system to ensure the integral RAW traceability. The processes are not sequential, meaning that, for instance, the transport or storage of RAW are processes that may occur during different phases of the RAW management general process. The purpose of enumerating the RAW management processes is strictly showing the processes accounted for in the design of the AISCTP.

Gathering RAW

Activities are related to gathering information from the RAW generator during the RAW handover.

Treatment of liquid RAW

Liquid RAW reception, characterisation, treatment, and hand over for conditioning.

Store of RAW

Activities related to safe and proper storage of the RAW between the technological operations or conditioned RAW until its final disposal.

Treatment of solid RAW

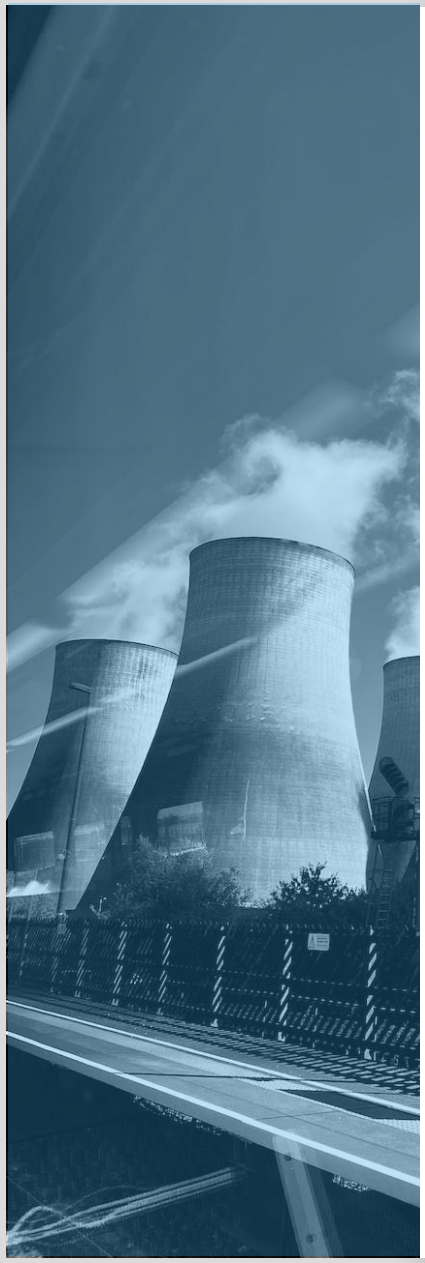
Solid RAW reception, characterisation, treatment, and hand over for conditioning.

Transport of RAW

Transporting the RAW to the appropriate facility for the next technological step.

Physical and chemical control

Characterisation activities of the RAW.



Case Study: An Automated Information System for the Control of Technological Processes (AISCTP) and for Traceability of RAW

What is the AISCTP tool

The AISCTP is a web-based information system that tracks the RAW processing and management processes. The system is created as a PHP and MySQL database.

How does it work

Inputs: The operator inputs the respective data into different modules, depending on the process. The data is stored in tables.

Assessment: The system registers and asseses these input data using scripts to assess the information.

Outputs: The system returns the information needed for the next technological step to the operator based on the previous assessment.

From **traceability and management** point of view, the system runs queries through the database and returns reports in different customised formats.

General functionalities

The main functionalities of the AISCTP are:

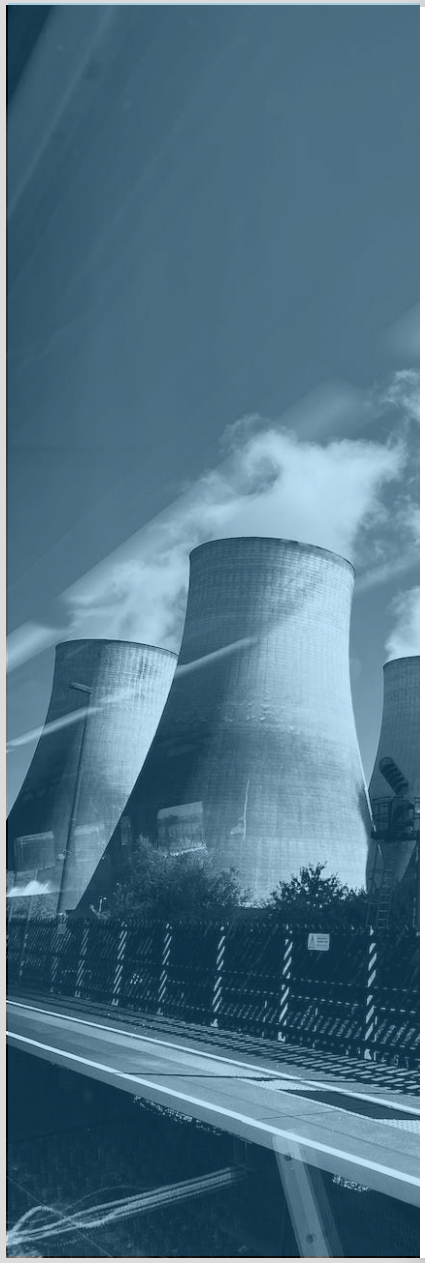
Overview and traceability: The performance of facilities and the efficiency of RAW processing methods can be traced. The system enables management to overview the execution of the work programs at any point in time and take necessary action if necessary.

Operational safety improvement: The system includes interlocks preventing the operator from performing activities contradicting technological and normative constraints. It also provides all available information for the specific batch of RAW to mitigate the possibility of wrong decision-making.

RAW updated inventory: The database provides the fullest RAW inventory possible by gathering detailed day-to-day information about the treated raw.

AISCTP Design

Explore the AISCTP



Case Study: An Automated Information System for the Control of Technological Processes (AISCTP) and for Traceability of RAW

Schedule
This module outlines the annual planning and receipt of RAW by the established schedule.

Physical & Chemical Control
This module deals with the spectrometry and the physical and chemical control of RAW.

SDRW
This module RAW accepted for processing in the **SRDW** and the generated Solid RAW

Solid RAW
This module details the reception and processing of Solid RAW at **SD** RAW-Kozloduy.

RAW Storage
A module with information about the RCC production process and the location of RAW.

Kozloduy Nuclear Power Plant Menu
Information related to the RAW generated by Kozloduy NPP is entered in this section.

Liquid RAW
This module details the receiving, processing, and conditioning of liquid RAW at **SD** RAW-Kozloduy.

PMF: Plasma Melting Facility
This module provides information on RAW accepted for processing in the **PMF**.

Reports module
This section provides information on planned, received, processed, and stored RAW for a selected time period.

Modular design

The **AISCTP** includes tools to track and report the entire process of anticipating, receiving, processing, conditioning, transferring, treating/melting, measuring and storing solid and liquid RAW. For this reason, a modular design based on the RAW management technological process is optimum.

The **AISCTP** is built upon different modules. Clicking on each module a brief functionality description is included to draw the **AISCTP** structure.

Solid RAW

This section details the reception and processing of Solid RAW at Specialised Division (SD) RAW-Kozloduy, encompassing the following subsections.

For Receiving
This subsection handles new orders for receiving RAW from external generators.

Received RAW
Operators update data from received orders, create RAW batches, and determine the RAW management (RAWPP, PMF, SRDW or RAWF).

Processing in the RAWPP
Operators enter data for batches accepted for processing in the RAWPP with follow-up treatment determined by an automatic system assessment.

Received by Facilities
Provides information on the RAW received by facilities and per selected period of time.

PMF Reports and SRDW Reports
Operators generate reports for the handover of RAW from SD RAW-Kozloduy to the PMF and SRDW.

Solid RAW Streams
Contains a list of Solid RAW streams.

RAWPP: Radioactive Waste Processing Plant; **PMF:** Plasma Melting Facility; **SRDW:** Size Reduction & Decontamination Workshop.

Kozloduy Nuclear Power Plant

Information related to the RAW generated by Kozloduy NPP is entered in this section. It includes the following subsections:

Daily records
In this section, an operator from the generator's staff prepares daily records to collect RAW from the permanent points in the CA of EP-2.

Solid RAW – Reports
In this section, an operator prepares handing-over records by entering the available information about the batches of RAW which are to be handed over to Specialised Division of RAW.

Physical and chemical control

This section contains information related to spectrometric measurements and the physical and chemical control of RAW. It includes the following subsections:

Drums
Operators enter data about the 210-litre drums and upload files from their spectrometric measurements.

Batches
Operators upload files from the spectrometric measurements of existing batches and enter data for batches with reports.

Physical & Chemical Control of EvCE
Operators enter data from analysis reports of the EvCE in the RAWPP.

RAW Codes
Contains a list of RAW identifiers.

RAWPP: Radioactive Waste Processing Plant; **EvCE:** Evaporator Concentrate Evaporation.

Liquid RAW

This section provides information on the receiving, processing, and conditioning of liquid RAW at Specialised Division (SD) RAW-Kozloduy, as well as the conditioning of Solid RAW in RCCs. It includes the following subsections:

Receiving
Operators enter data from reports for the received liquid RAW

Evaporation
Operators enter data on the blank forms of the EvCE subsystem

Conditioning
Operators enter data from blank forms to condition liquid RAW.

Solid RAW packaging
Operators enter data about the RCC status and the numbers of drums and batches conditioned therein.

Liquid RAW Streams
Contains a list of liquid RAW streams.

EvCE: Evaporator Concentrate Evaporation; **RCC:** Reinforced Concrete Container.

Plasma Melting Facility (PMF)

This section provides information on RAW accepted for processing in the PMF, including low-level solid RAW generated from the PMF and solid RAW from the Specialised Division of Decommissioning. It includes the following subsections:

RAW to be treated
Provides information on handing-over records for RAW to be treated in the PMF.

Drums of Low-level Solid RAW
A. Entry of RNS: Operators upload files of spectrometric measurements of low-level solid RAW drums.
B. Low-level Solid RAW Reports: Operators prepare handing-over records for low-level solid RAW drums placed in RCCs and create maps for characterisation.

Daily records
Operators prepare daily records for the collection of RAW from permanent points in the **CA** of the Specialised Division of Decommissioning.

Solid RAW – Reports
Operators prepare handing-over records by entering available information about batches of RAW to be handed over to Specialised Division of RAW.

PMF: Plasma Melting Facility; **RNS:** Radionuclide Spectrum; **RCC:** Reinforced Concrete Container.

Size Reduction and Decontamination Workshop (SRDW)

This section provides information about RAW accepted for processing in the SRDW and the generated Solid RAW. It includes the following subsections:

RAW to be treated
Explains the process for handling handing-over records for RAW to be treated in the SRDW.

SRDW Drums
Entry: Operators enter data about newly created drums of RAW.
Reports: Operators prepare handing-over records for drums to be handed over to Specialised Division of RAW.

Collected RAW
Operators enter daily data about the collected RAW in a container and generate a daily record when the container is loaded.

Solid RAW – Reports
Operators prepare handing-over records by entering available information about batches of RAW to be handed over to Specialised Division of RAW.

SRDW: Size Reduction and Decontamination Workshop.

RAW Storage

This section contains information about the RCC's production process and the location of RAW. It includes the following subsections:

LTC, SFPSRAW, & Site №1
Operators enter data about accepted and retrieved RAW from the respective facility.

RCC Passports
Operators prepare a passport for a package of conditioned RAW.

By facilities
Provides information about the stored RAW per selected month and year by facility.

SFCRAW & Site N°2
Operators enter data about RCCs stored in SFCRAW and Site №2, with information on rearrangements and previous locations.

Stored RCCs
Provides information about the RCCs being stored and their previous locations.

SCP-1 and RCS
Operators enter data from reports for receiving in SCP-1 and RCS.

SFCRAW and Site N°2 Maps
Provides information about the RCC's location as of the selected date.

RCC: Reinforced Concrete Container; **SFCRAW:** Storage Facility for Conditioned RAW; **SCP:** Spray Cooling Pond; **RCS:** Repository for Contaminated Soils; **LTC:** Large-tonnage Containers; **SFPSRAW:** Storage Facility for Processed Solid RAW;

Case Study: Modules

The Automated Information System for waste traceability in the process of RAW management is a web-based Information System developed using PHP, JavaScript and MySQL core technologies with the aim of tracking the RAW treatment and management processes.

The Automated Information System includes tools to track and report the entire process of anticipating, receiving, processing, conditioning, transferring, treating/melting, measuring and storing solid and liquid RAW.

Schedule

Expected RAW to be processed

Solid RAW

Receipt and conditioning of solid RAW

Liquid RAW

Receipt, evaporation and conditioning of liquid RAW

Plasma melting facility

Transfer and acceptance of melt filled drums

Physical & Chemical Control

Measurement and chemical composition

RAW storage

Interim storage of RAW

Receipt of solid RAW

Протоколи за приети твърди РАО

		Дата на протокол	Номер на протокол	Обект	Посл. управление	Забележка	Завършен
		x	x	Всички x	x	x	Всички
1	+	03.05.2023	36	КЗ-2	СПИ	М 125	да
2	+	02.05.2023	35	КЗ-2	СПИ	М 125	да
3	+	28.04.2023	34	КЗ-2	СПИ	М 125	да
4	+	28.04.2023	1	ЦПРАО	СПИ	аерозолни филтри	да
5	+	27.04.2023	33	КЗ-2	ЦПРАО	М 117	да
6	+	27.04.2023	32	КЗ-2	СПИ	АФ - 12 бр.	да
7	+	26.04.2023	11	ХОГ	СПИ	ХОГ	да
8	+	26.04.2023	15	СП "ИЕ 1-4 блок" ЦНРД	ЦПРАО	18бр. в-ли./ МТ;СО	не
9	+	26.04.2023	5	Варово стопанство - ГТК	ЦПРАО	15 бр. ГТК 12 утайки	да
10	+	25.04.2023	30	КЗ-2	ЦПРАО	М 117	не
11	+	25.04.2023	31	КЗ-2	ЦПРАО	М 117	не
12	+	24.04.2023	13	СП "ИЕ 1-4 блок" ЦНРД	ЦПРАО	метал бт3 за мерене	не
13	+	24.04.2023	14	СП "ИЕ 1-4 блок" ЦНРД	ЦПРАО	24бр.в-ли;Дропс,СЖ,МТ	не
14	+	24.04.2023	40	СП "ИЕ-1-4 блок" 3-4 бл., СК2, Сп. П-1	СПИ	СПИ	да
15	+	24.04.2023	41	СП "ИЕ-1-4 блок" 3-4 бл., СК2, Сп. П-1	ЦПРАО	ТК 2	не
16	+	21.04.2023	28	КЗ-2	СПИ	М 125	да
17	+	21.04.2023	29	КЗ-2	ЦПРАО	М 117	да

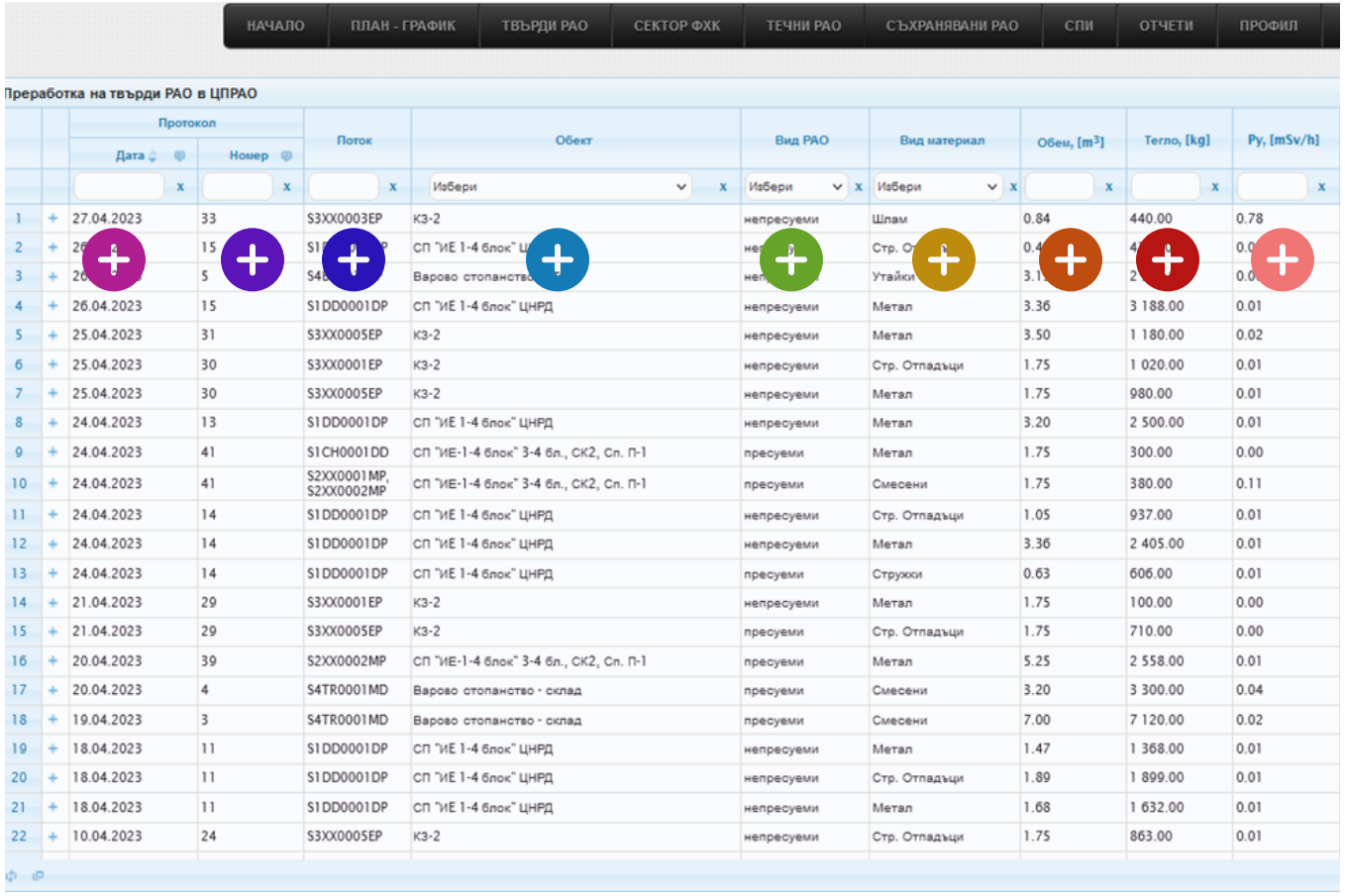
Solid RAW

This section collects information related to receiving and processing of Solid RAW in **SD** RAW-Kozloduy.

This is where new orders for acceptance of RAW from external RAW generators are received. An operator accepts the orders, thereafter they supplement the data. They create the batches of RAW and determine the subsequent management thereof (**RAWPP, PMF, SRDW, RAWF**). The batches intended for RAWPP are entered information about the processing. Based on an assessment made automatically by the system by defined criteria, an operator determines the follow-up processing thereof. For the batches forwarded to the PMF and **SRDW**, they create RAW handing-over records.

Back to Modules

Processing of solid RAW at the RAW Processing Plant



Преработка на твърди РАО в ЦПРАО

		Протокол		Поток	Обект	Вид РАО	Вид материал	Обем, [m³]	Тегло, [kg]	Ру, [mSv/h]
		Дата	Номер							
					Избери	Избери	Избери			
1	+	27.04.2023	33	S3XX0003EP	К3-2	непресуеми	Шлам	0.84	440.00	0.78
2	+	26	15	S1	СП "ИЕ 1-4 блок" Ц	не	Стр. О	0.4	4	0.0
3	+	26	5	S4	Варово стопанство	не	Утайки	3.1	2	0.0
4	+	26.04.2023	15	S1DD0001DP	СП "ИЕ 1-4 блок" ЦНРД	непресуеми	Метал	3.36	3 188.00	0.01
5	+	25.04.2023	31	S3XX0005EP	К3-2	непресуеми	Метал	3.50	1 180.00	0.02
6	+	25.04.2023	30	S3XX0001EP	К3-2	непресуеми	Стр. Отпадъци	1.75	1 020.00	0.01
7	+	25.04.2023	30	S3XX0005EP	К3-2	непресуеми	Метал	1.75	980.00	0.01
8	+	24.04.2023	13	S1DD0001DP	СП "ИЕ 1-4 блок" ЦНРД	непресуеми	Метал	3.20	2 500.00	0.01
9	+	24.04.2023	41	S1CH0001DD	СП "ИЕ-1-4 блок" 3-4 бл., СК2, Сп. П-1	пресуеми	Метал	1.75	300.00	0.00
10	+	24.04.2023	41	S2XX0001MP, S2XX0002MP	СП "ИЕ-1-4 блок" 3-4 бл., СК2, Сп. П-1	пресуеми	Смесени	1.75	380.00	0.11
11	+	24.04.2023	14	S1DD0001DP	СП "ИЕ 1-4 блок" ЦНРД	непресуеми	Стр. Отпадъци	1.05	937.00	0.01
12	+	24.04.2023	14	S1DD0001DP	СП "ИЕ 1-4 блок" ЦНРД	непресуеми	Метал	3.36	2 405.00	0.01
13	+	24.04.2023	14	S1DD0001DP	СП "ИЕ 1-4 блок" ЦНРД	пресуеми	Стружки	0.63	606.00	0.01
14	+	21.04.2023	29	S3XX0001EP	К3-2	непресуеми	Метал	1.75	100.00	0.00
15	+	21.04.2023	29	S3XX0005EP	К3-2	пресуеми	Стр. Отпадъци	1.75	710.00	0.00
16	+	20.04.2023	39	S2XX0002MP	СП "ИЕ-1-4 блок" 3-4 бл., СК2, Сп. П-1	пресуеми	Метал	5.25	2 558.00	0.01
17	+	20.04.2023	4	S4TR0001MD	Варово стопанство - склад	пресуеми	Смесени	3.20	3 300.00	0.04
18	+	19.04.2023	3	S4TR0001MD	Варово стопанство - склад	пресуеми	Смесени	7.00	7 120.00	0.02
19	+	18.04.2023	11	S1DD0001DP	СП "ИЕ 1-4 блок" ЦНРД	непресуеми	Метал	1.47	1 368.00	0.01
20	+	18.04.2023	11	S1DD0001DP	СП "ИЕ 1-4 блок" ЦНРД	непресуеми	Стр. Отпадъци	1.89	1 899.00	0.01
21	+	18.04.2023	11	S1DD0001DP	СП "ИЕ 1-4 блок" ЦНРД	непресуеми	Метал	1.68	1 632.00	0.01
22	+	10.04.2023	24	S3XX0005EP	К3-2	непресуеми	Стр. Отпадъци	1.75	863.00	0.01

Solid RAW

This section collects information related to receiving and processing of Solid RAW in **SD** RAW-Kozloduy.

This is where new orders for acceptance of RAW from external RAW generators are received. An operator accepts the orders, thereafter they supplement the data. They create the batches of RAW and determine the subsequent management thereof (**RAWPP, PMF, SRDW, RAWF**). The batches intended for RAWPP are entered information about the processing. Based on an assessment made automatically by the system by defined criteria, an operator determines the follow-up processing thereof. For the batches forwarded to the PMF and **SRDW**, they create RAW handing-over records.

Back to Modules

Processing of solid RAW at the RAW Processing Plant

Receipt

In this section an operator enters data off the reports for received Liquid RAW.

Take a look

Evaporation

In this section, an operator enters data off the blank forms of EvCE (Evaporator Concentrate Evaporation) sub-system.

Take a look

Conditioning

In this section, an operator enters data off the blank forms for conditioning of Liquid RAW.

Take a look

Conditioning of RAW into RCC

In this section, an operator enters data about the **RCC** status, as well as the numbers of the drums and batches conditioned therein.

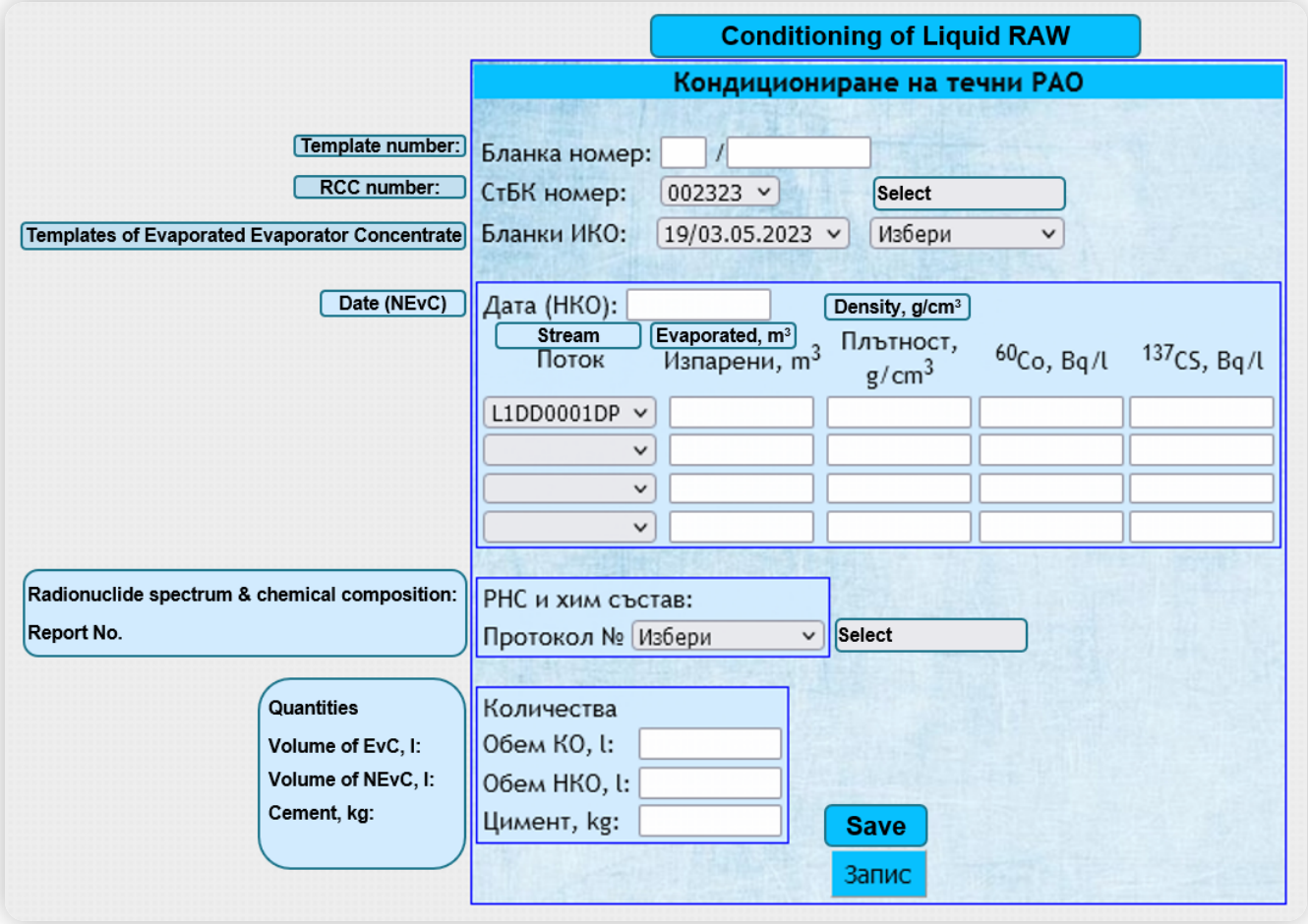
Take a look

Liquid RAW

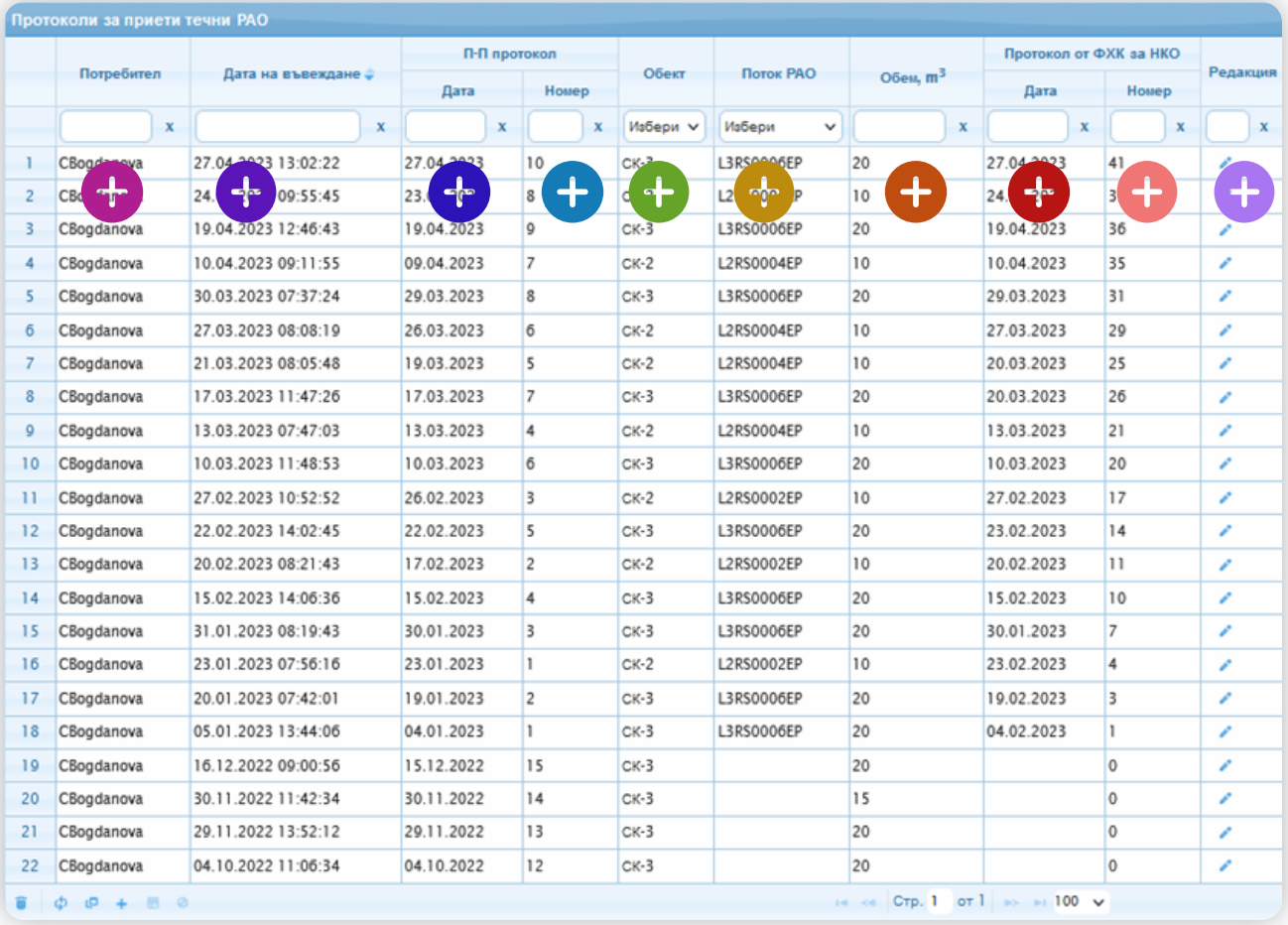
This section collects information related to the receiving, processing and conditioning of Liquid RAW in **SD** RAW-Kozloduy and information about the Solid RAW conditioned in **RCC**s.

Back to Modules

Conditioning of liquid RAW



Receipt of liquid RAW

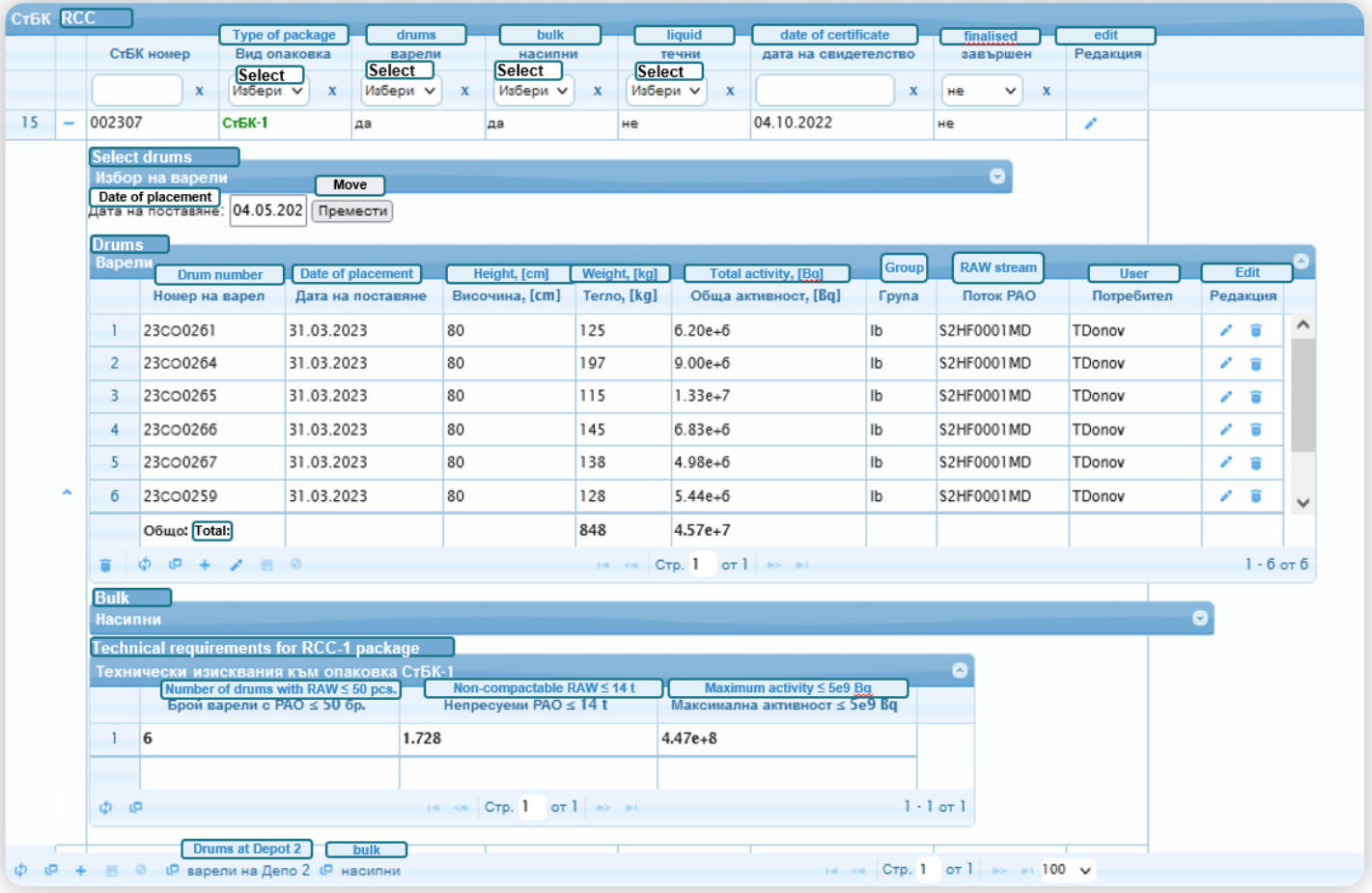


Протоколи за приети течни РАО

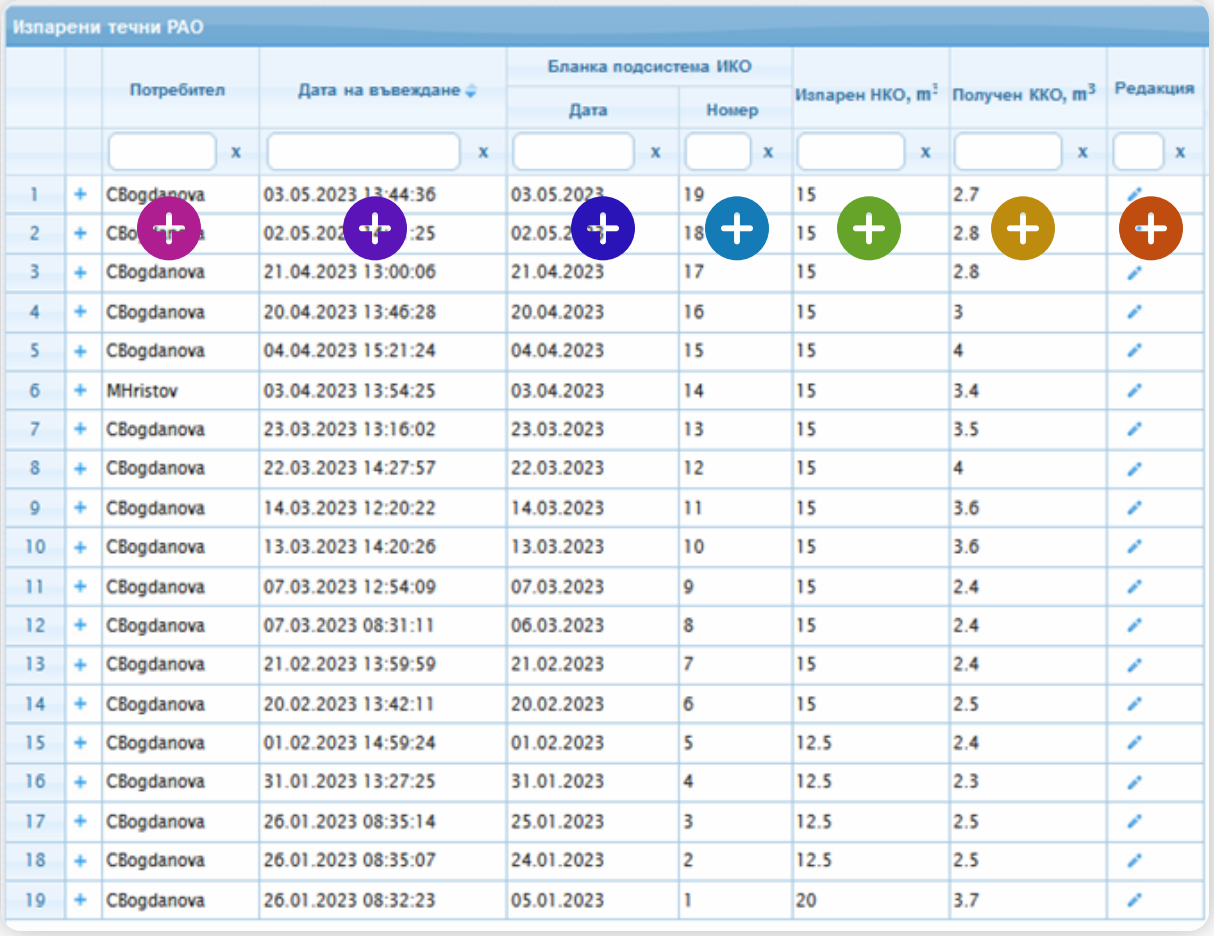
	Потребител	Дата на въвеждане	П-П протокол		Обект	Поток РАО	Обем, m^3	Протокол от ФХК за НКО		Редакция
			Дата	Номер				Дата	Номер	
					Избери	Избери				
1	CBogdanova	27.04.2023 13:02:22	27.04.2023	10	СК-3	L3RS0006EP	20	27.04.2023	41	
2	CBogdanova	24.04.2023 09:55:45	23.04.2023	8	СК-3	L2RS0004EP	10	24.04.2023	38	
3	CBogdanova	19.04.2023 12:46:43	19.04.2023	9	СК-3	L3RS0006EP	20	19.04.2023	36	
4	CBogdanova	10.04.2023 09:11:55	09.04.2023	7	СК-2	L2RS0004EP	10	10.04.2023	35	
5	CBogdanova	30.03.2023 07:37:24	29.03.2023	8	СК-3	L3RS0006EP	20	29.03.2023	31	
6	CBogdanova	27.03.2023 08:08:19	26.03.2023	6	СК-2	L2RS0004EP	10	27.03.2023	29	
7	CBogdanova	21.03.2023 08:05:48	19.03.2023	5	СК-2	L2RS0004EP	10	20.03.2023	25	
8	CBogdanova	17.03.2023 11:47:26	17.03.2023	7	СК-3	L3RS0006EP	20	20.03.2023	26	
9	CBogdanova	13.03.2023 07:47:03	13.03.2023	4	СК-2	L2RS0004EP	10	13.03.2023	21	
10	CBogdanova	10.03.2023 11:48:53	10.03.2023	6	СК-3	L3RS0006EP	20	10.03.2023	20	
11	CBogdanova	27.02.2023 10:52:52	26.02.2023	3	СК-2	L2RS0002EP	10	27.02.2023	17	
12	CBogdanova	22.02.2023 14:02:45	22.02.2023	5	СК-3	L3RS0006EP	20	23.02.2023	14	
13	CBogdanova	20.02.2023 08:21:43	17.02.2023	2	СК-2	L2RS0002EP	10	20.02.2023	11	
14	CBogdanova	15.02.2023 14:06:36	15.02.2023	4	СК-3	L3RS0006EP	20	15.02.2023	10	
15	CBogdanova	31.01.2023 08:19:43	30.01.2023	3	СК-3	L3RS0006EP	20	30.01.2023	7	
16	CBogdanova	23.01.2023 07:56:16	23.01.2023	1	СК-2	L2RS0002EP	10	23.02.2023	4	
17	CBogdanova	20.01.2023 07:42:01	19.01.2023	2	СК-3	L3RS0006EP	20	19.02.2023	3	
18	CBogdanova	05.01.2023 13:44:06	04.01.2023	1	СК-3	L3RS0006EP	20	04.02.2023	1	
19	CBogdanova	16.12.2022 09:00:56	15.12.2022	15	СК-3		20		0	
20	CBogdanova	30.11.2022 11:42:34	30.11.2022	14	СК-3		15		0	
21	CBogdanova	29.11.2022 13:52:12	29.11.2022	13	СК-3		20		0	
22	CBogdanova	04.10.2022 11:06:34	04.10.2022	12	СК-3		20		0	

Стр. 1 от 1 100

Conditioning of RAW into RCC



Evaporation of liquid RAW



Изпарени течни РАО

		Потребител	Дата на въвеждане	Бланка подсистема ИКО		Изпарен НКО, m³	Получен ККО, m³	Редакция
				Дата	Номер			
1	+	CBogdanova	03.05.2023 13:44:36	03.05.2023	19	15	2.7	
2	+	CBo	02.05.202 :25	02.05.2	18	15	2.8	
3	+	CBogdanova	21.04.2023 13:00:06	21.04.2023	17	15	2.8	
4	+	CBogdanova	20.04.2023 13:46:28	20.04.2023	16	15	3	
5	+	CBogdanova	04.04.2023 15:21:24	04.04.2023	15	15	4	
6	+	MHristov	03.04.2023 13:54:25	03.04.2023	14	15	3.4	
7	+	CBogdanova	23.03.2023 13:16:02	23.03.2023	13	15	3.5	
8	+	CBogdanova	22.03.2023 14:27:57	22.03.2023	12	15	4	
9	+	CBogdanova	14.03.2023 12:20:22	14.03.2023	11	15	3.6	
10	+	CBogdanova	13.03.2023 14:20:26	13.03.2023	10	15	3.6	
11	+	CBogdanova	07.03.2023 12:54:09	07.03.2023	9	15	2.4	
12	+	CBogdanova	07.03.2023 08:31:11	06.03.2023	8	15	2.4	
13	+	CBogdanova	21.02.2023 13:59:59	21.02.2023	7	15	2.4	
14	+	CBogdanova	20.02.2023 13:42:11	20.02.2023	6	15	2.5	
15	+	CBogdanova	01.02.2023 14:59:24	01.02.2023	5	12.5	2.4	
16	+	CBogdanova	31.01.2023 13:27:25	31.01.2023	4	12.5	2.3	
17	+	CBogdanova	26.01.2023 08:35:14	25.01.2023	3	12.5	2.5	
18	+	CBogdanova	26.01.2023 08:35:07	24.01.2023	2	12.5	2.5	
19	+	CBogdanova	26.01.2023 08:32:23	05.01.2023	1	20	3.7	

Processing of solid RAW at the RAW Processing Plant

Batches

In this section, an operator uploads the respective files from the spectrometric measurements of the already created batches. For the batches, for which there are reports, the data are entered off them.

Take a look

Evaporator Concentrate Analysis

In this section, an operator enters data off the reports of analysis of Evaporator Concentrate (EvC) in **RAWPP**

Take a look

Challenge & Solution | Relevance | Case Study | Benefits | Lessons Learned

Physical & Chemical Control

This section collects information related to spectrometric measurements and physical & chemical control of RAW.
The operator:

- Uploads the respective files from the spectrometric measurements of the already created batches. For the batches, for which there are reports, the data are entered off them
- Enters data off the reports of analysis of Evaporator Concentrate (EvC) in RAWPP

This section provides information about:

- RNS of batches of RAW
- Reports of analysis of EvC

Back to Modules

Batches

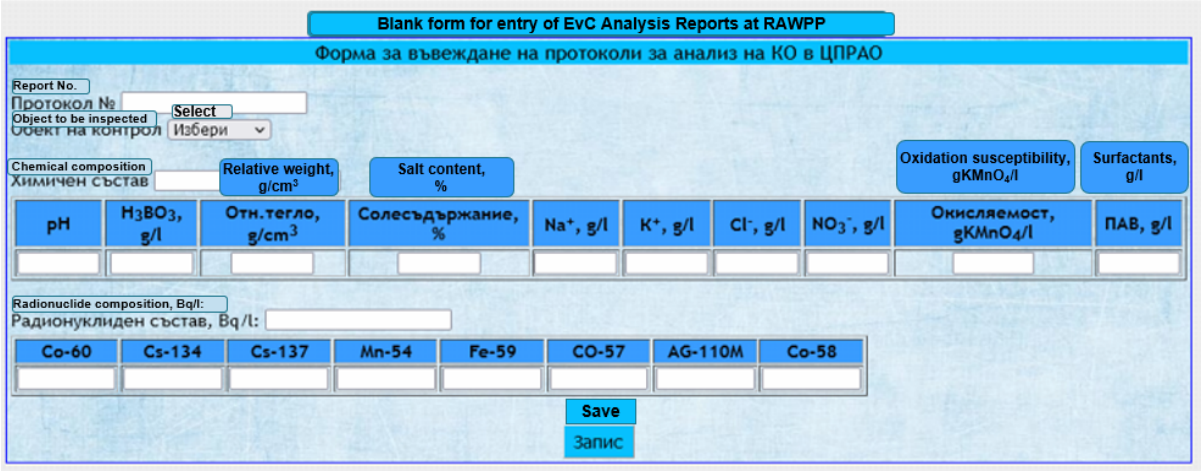
RCC

СтБК

		RCC No. СтБК номер	Weight, kg Тегло, kg	Radionuclide spectrum, Bq/kg: РНС, Bq/kg								Radionuclide spectrum - others, Bq/kg: РНС други, Bq/kg		Group Група	Measurement date Дата на измерване
				Mn54	Fe59	Co58	Co60	Ag110m	Cs134	Cs137	Nb95	Ag108m	Am241		
		x	x	x	x	x	x	x	x	x	x	x	x	x	x
1	+	002284	2980	5.04e+2	2.85e+2	1.99e+2	2.12e+3	0	6.95e+2	3.72e+4	1.31e+3	1.19e+3	0	Ib	25.04.2023
2	+	002299	2950	1.35e+3	9.03e+2	6.84e+2	1.59e+4	0	3.31e+3	1.02e+5	2.05e+3	2.76e+3	0	Ib	25.04.2023
3	+	002314	2684	3.54e+2	1.53e+3	4.02e+2	1.09e+4	0	6.77e+2	6.33e+4	5.59e+2	1.71e+3	0	Ib	25.04.2023
4	+	002289	2832	1.57e+2	1.50e+2	7.65e+1	1.52e+3	6.55e+2	1.67e+2	4.91e+4	5.49e+1	4.53e+2	0	Ib	20.09.2022
5	+	002286	2376	1.73e+2	2.25e+2	1.46e+2	3.13e+3	1.73e+3	3.42e+3	9.46e+4	1.99e+2	4.72e+2	0	Ib	20.09.2022
6	+	002288	2922	1.01e+2	1.38e+2	1.62e+2	2.43e+3	3.85e+2	7.11e+2	4.22e+3	3.43e+1	1.54e+2	0	Ib	16.09.2022
7	+	002273	3247	1.34e+2	2.59e+2	1.44e+2	1.13e+3	7.38e+2	1.54e+3	2.79e+4	9.17e+1	2.54e+2	0	Ib	16.09.2022
8	+	002287	2331	1.36e+2	1.43e+2	1.70e+2	6.55e+2	5.41e+3	1.54e+2	3.94e+4	5.56e+1	2.01e+2	0	Ib	16.09.2022
9	+	002274	2852	2.05e+2	1.87e+2	1.27e+2	9.50e+2	2.90e+2	8.59e+1	5.34e+3	6.82e+1	7.72e+1	0	Ib	16.09.2022
10	+	002269	2730	8.71e+1	3.24e+1	4.36e+1	2.06e+2	3.13e+2	5.94e+2	6.23e+3	6.29e+1	2.99e+2	0	Ib	15.07.2022
11	+	002272	2653	1.56e+2	3.28e+2	1.08e+2	2.65e+3	1.33e+3	1.17e+2	6.68e+3	3.38e+1	2.62e+2	0	Ib	15.07.2022
12	+	002231	2224	1.18e+2	1.18e+2	1.43e+2	7.08e+2	1.04e+2	1.97e+2	2.85e+3	1.53e+2	3.51e+2	0	Ib	15.07.2022
13	+	002268	2643	2.51e+2	1.40e+2	1.55e+2	1.28e+3	6.60e+2	2.81e+2	5.07e+3	2.60e+2	1.38e+2	0	Ib	15.07.2022
14	+	002271	2491	1.64e+2	1.95e+2	1.56e+2	2.11e+3	1.03e+4	0	4.03e+4	9.02e+1	9.64e+2	0	Ib	15.07.2022
15	+	002230	2250	1.28e+2	3.61e+2	1.79e+2	5.35e+3	1.27e+2	4.27e+2	5.43e+3	5.00e+1	3.30e+2	0	Ib	01.07.2022
16	+	002229	2790	2.81e+2	1.57e+2	2.10e+2	3.53e+3	5.82e+3	4.49e+1	3.18e+4	1.91e+2	1.80e+2	0	Ib	01.07.2022
17	+	002236	2350	1.73e+2	1.42e+2	7.23e+1	1.44e+3	5.89e+2	1.40e+2	7.41e+3	1.99e+2	2.33e+2	0	Ib	01.07.2022
18	+	002222	2346	3.28e+2	4.25e+2	2.01e+2	2.27e+3	1.07e+3	3.06e+3	4.93e+4	3.72e+2	1.42e+3	0	Ib	22.06.2022
19	+	002225	2306	1.36e+2	2.34e+2	2.24e+2	2.87e+3	3.22e+2	1.20e+2	1.14e+4	6.98e+1	6.16e+2	0	Ib	22.06.2022
20	+	002237	3658	2.79e+2	3.68e+2	6.65e+1	5.15e+3	4.30e+2	3.76e+3	6.45e+3	5.30e+1	1.73e+2	0	Ib	21.06.2022
21	+	002234	2432	1.50e+2	2.28e+2	1.85e+2	2.29e+3	2.01e+2	4.52e+2	8.94e+3	2.46e+2	5.35e+2	0	Ib	21.06.2022
22	+	002232	2110	3.77e+2	0	5.02e+2	7.29e+3	5.08e+3	8.92e+1	3.19e+4	4.91e+2	5.55e+2	0	Ib	21.06.2022

Стр. 1 от 1 100

Evaporator Concentrate Analysis



Blank form for entry of EvC Analysis Reports at RAWPP

Форма за въвеждане на протоколи за анализ на КО в ЦПРАО

Report No.
Протокол №
Object to be inspected
Обект на контрол
Select
Избери

Chemical composition
Химичен състав
Relative weight, g/cm^3
Salt content, %
Oxidation susceptibility, gKMnO$_4$/l
Surfactants, g/l

pH	H_3BO_3, g/l	Отн.тегло, g/cm^3	Солесъдържание, %	Na^+, g/l	K^+, g/l	Cl^-, g/l	NO_3^-, g/l	Окисляемост, gKMnO$_4$/l	ПАВ, g/l

Radionuclide composition, Bq/l:
Радионуклиден състав, Bq/l:

Co-60	Cs-134	Cs-137	Mn-54	Fe-59	CO-57	AG-110M	Co-58

Save
Запис

RCC in Storage Facility for Conditioned Radioactive Waste (SFCRAW)

In this section is entered the information related to the location of RAW

Take a look

RCC Storage

This section provides information about the information related to the RAW location and date

Take a look

RAW Storage

This section collects information related to the RAW location.
The operator:

- Enters data about **RCC**s being stored in the **SFCRAW** and Site №2. Here, **RCC**s could be rearranged, as the system saves information about previous location thereof
- Prepares a Passport for a package of conditioned RAW
- Enters data off the reports for receiving in **SCP**-1 and **RCS**
- Enters data about the accepted and retrieved RAW from LTC (Large-tonnage containers), SFPSRAW (Storage Facility for Processed Solid RAW) and Site №1.

This section provides information about:

- Location of **RCC**s in **SFCRAW** and Site № 2 as of selected date;
- Stored RAW as per selected month and year by facilities.

Back to Modules

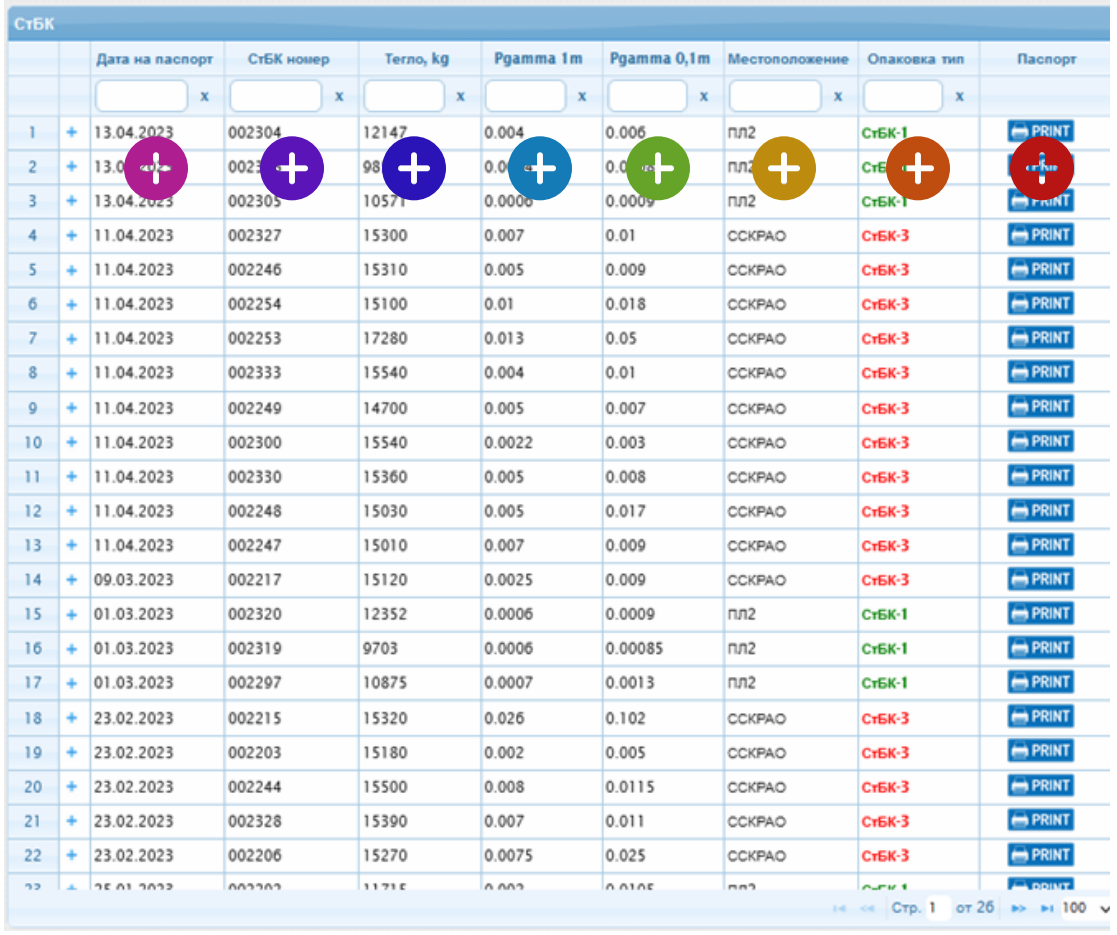
RCC in Storage Facility for Conditioned Radioactive Waste (SFCRAW)

Report number:	Протокол номер:
Date:	Дата:
RCC number:	Номер на СтБК: RCC-1
Package:	Опаковка: СтБК-1
Gross weight, kg:	Тегло Бруто, kg:
Surface contamination:	Повърхн. замърсяване:
Equivalent gamma-radiation dose rate (P) at a distance of 0.1 m, mSv/h:	P гама на 0,1m, mSV/h:
Equivalent gamma-radiation dose rate (P) at a distance of 1 m, mSv/h:	P гама на 1m, mSV/h:
Positioning of the container:	Позициониране на контейнера
Level: Row (east-west): Row (north-south):	Ниво: 1 Ред (Изток-Запад): A Ред (Север-Юг): 1

Запис

Save

Evaporator Concentrate Analysis



СтБК

		Дата на паспорт	СтБК номер	Тегло, kg	Pgamma 1m	Pgamma 0,1m	Местоположение	Опаковка тип	Паспорт
1	+	13.04.2023	002304	12147	0.004	0.006	пл2	СтБК-1	PRINT
2	+	13.0	0023	98	0.0	0.0	пл2	СтБ	PRINT
3	+	13.04.2023	002305	10571	0.0006	0.0009	пл2	СтБК-1	PRINT
4	+	11.04.2023	002327	15300	0.007	0.01	ССКРАО	СтБК-3	PRINT
5	+	11.04.2023	002246	15310	0.005	0.009	ССКРАО	СтБК-3	PRINT
6	+	11.04.2023	002254	15100	0.01	0.018	ССКРАО	СтБК-3	PRINT
7	+	11.04.2023	002253	17280	0.013	0.05	ССКРАО	СтБК-3	PRINT
8	+	11.04.2023	002333	15540	0.004	0.01	ССКРАО	СтБК-3	PRINT
9	+	11.04.2023	002249	14700	0.005	0.007	ССКРАО	СтБК-3	PRINT
10	+	11.04.2023	002300	15540	0.0022	0.003	ССКРАО	СтБК-3	PRINT
11	+	11.04.2023	002330	15360	0.005	0.008	ССКРАО	СтБК-3	PRINT
12	+	11.04.2023	002248	15030	0.005	0.017	ССКРАО	СтБК-3	PRINT
13	+	11.04.2023	002247	15010	0.007	0.009	ССКРАО	СтБК-3	PRINT
14	+	09.03.2023	002217	15120	0.0025	0.009	ССКРАО	СтБК-3	PRINT
15	+	01.03.2023	002320	12352	0.0006	0.0009	пл2	СтБК-1	PRINT
16	+	01.03.2023	002319	9703	0.0006	0.00085	пл2	СтБК-1	PRINT
17	+	01.03.2023	002297	10875	0.0007	0.0013	пл2	СтБК-1	PRINT
18	+	23.02.2023	002215	15320	0.026	0.102	ССКРАО	СтБК-3	PRINT
19	+	23.02.2023	002203	15180	0.002	0.005	ССКРАО	СтБК-3	PRINT
20	+	23.02.2023	002244	15500	0.008	0.0115	ССКРАО	СтБК-3	PRINT
21	+	23.02.2023	002328	15390	0.007	0.011	ССКРАО	СтБК-3	PRINT
22	+	23.02.2023	002206	15270	0.0075	0.025	ССКРАО	СтБК-3	PRINT
23	+	25.01.2023	002202	11715	0.002	0.0105	пл2	СтБК-1	PRINT

Стр. 1 от 26 100

Plasma Melting Facility Menu

This section covers the processes of transfer of RAW to the **PMF** and acceptance of melt filled drums from the **PMF**

Take a look

Plasma Melting Facility

This section gives information about RAW accepted for processing in the **PMF**. In it is entered information related to the generated Low-level Solid RAW from the **PMF** and Solid RAW from **SD** Decommissioning of Units 1 to 4. This section contains the following sub-sections:

RAW to be treated

This section gives information about the handing-over records for receiving of RAW to be treated in the **PMF**.

Drums of Low-level Solid RAW

In sub-section "Entry of **RNS**", an operator from the generator's staff uploads the files of the spectrometric measurement of the drums of Low-level Solid RAW. In sub-section "Low-level Solid RAW reports" they prepare handing-over records for drums of Low-level Solid RAW placed in **RCC**s and maps for characterisation thereof.

Daily records

In this sub-section, an operator from the generator's staff prepares daily records for collection of RAW from the permanent points in the **CA** of **SD** Decommissioning of Units 1 to 4.

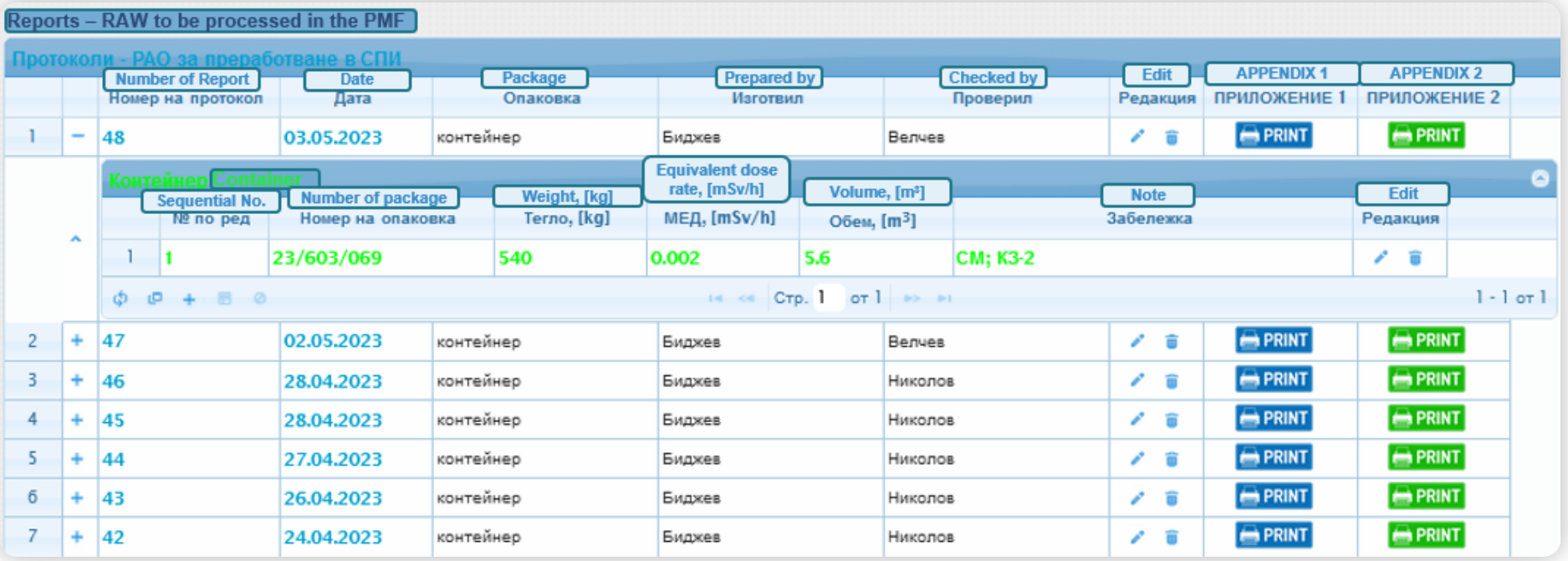
Solid RAW – reports

In this section, an operator from the generator's staff prepares handing-over records by entering the available information about the batches of RAW, which are to be handed over to **SD** RAW-Kozloduy.

See the PMF

Back to Modules

Plasma Melting Facility Menu



Reports – RAW to be processed in the PMF

Протоколи - РАО за преработване в СПИ

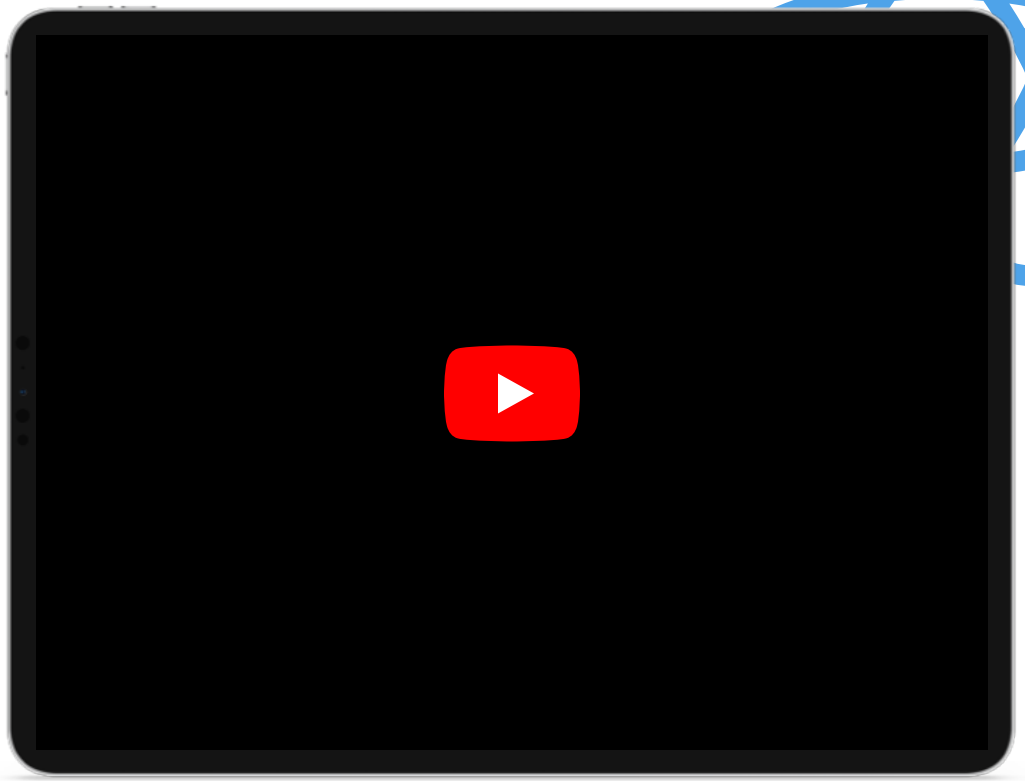
		Number of Report Номер на протокол	Date Дата	Package Опаковка	Prepared by Изготвил	Checked by Проверил	Edit Редакция	APPENDIX 1 ПРИЛОЖЕНИЕ 1	APPENDIX 2 ПРИЛОЖЕНИЕ 2
1	−	48	03.05.2023	контейнер	Биджев	Велчев		PRINT	PRINT

Контейнер Container

	Sequential No. № по ред	Number of package Номер на опаковка	Weight, [kg] Тегло, [kg]	Equivalent dose rate, [mSv/h] МЕД, [mSv/h]	Volume, [m³] Обем, [m³]	Note Забележка	Edit Редакция
1	1	23/603/069	540	0.002	5.6	СМ; К3-2	

Стр. 1 от 1 — 1 - 1 от 1

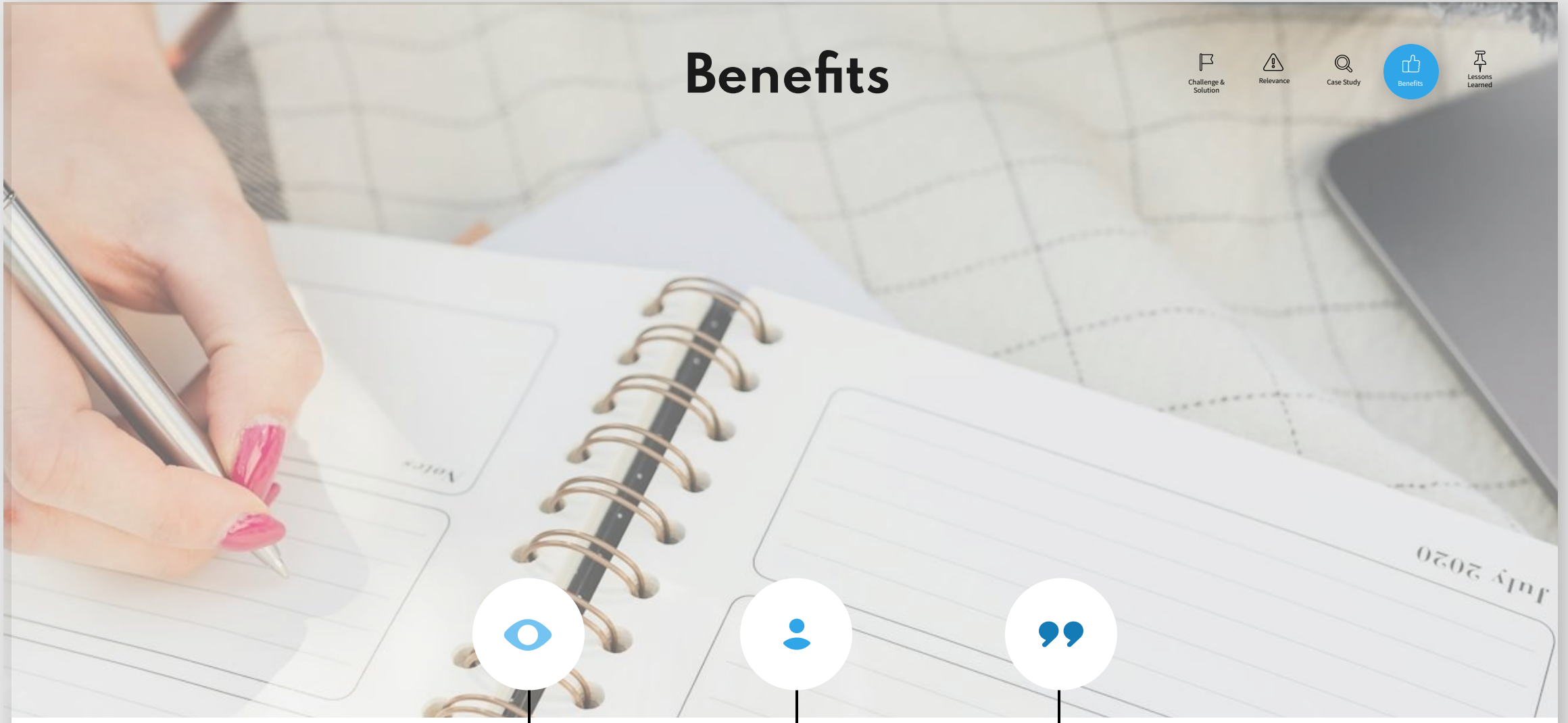
2	+	47	02.05.2023	контейнер	Биджев	Велчев		PRINT	PRINT
3	+	46	28.04.2023	контейнер	Биджев	Николов		PRINT	PRINT
4	+	45	28.04.2023	контейнер	Биджев	Николов		PRINT	PRINT
5	+	44	27.04.2023	контейнер	Биджев	Николов		PRINT	PRINT
6	+	43	26.04.2023	контейнер	Биджев	Николов		PRINT	PRINT
7	+	42	24.04.2023	контейнер	Биджев	Николов		PRINT	PRINT



Plasma Melting

It is intended for high-temperature processing and conditioning of low- and intermediate-level short-lived solid RAW. The main specific feature of the project is the high degree of reduction of the initial volume of treated RAW.

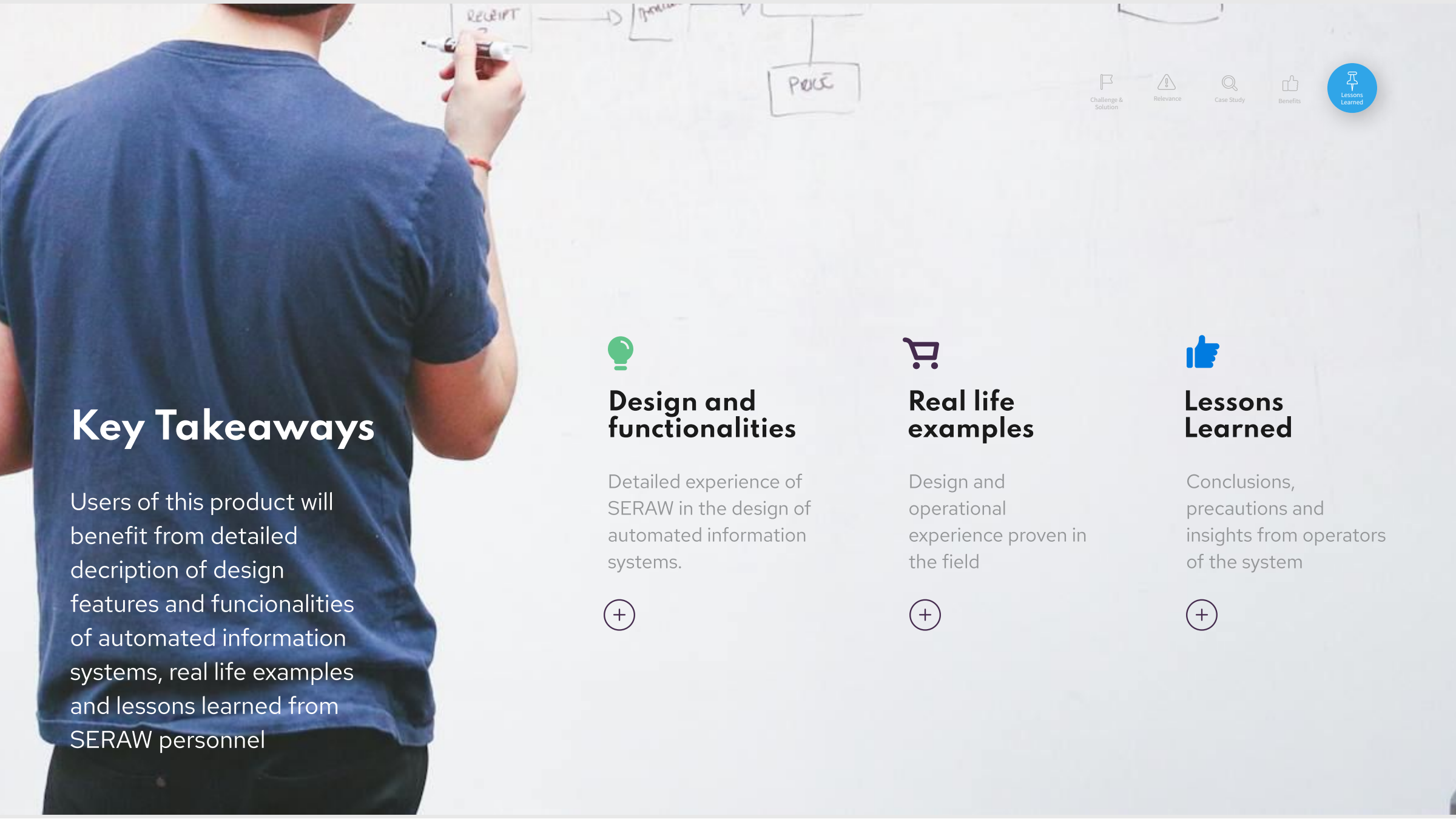
Benefits



Clarity

Mistakes

Operability



Key Takeaways

Users of this product will benefit from detailed decription of design features and funcionalities of automated information systems, real life examples and lessons learned from SERAW personnel

Design and functionalities

Detailed experience of SERAW in the design of automated information systems.

Real life examples

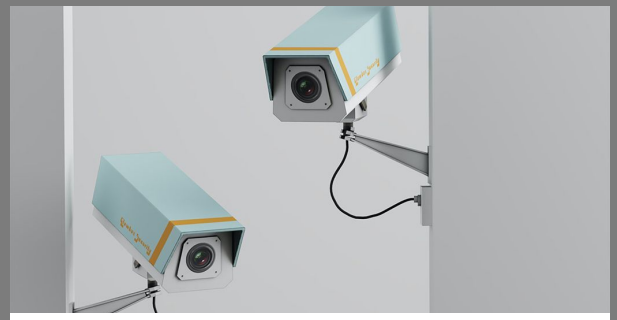
Design and operational experience proven in the field

Lessons Learned

Conclusions, precautions and insights from operators of the system

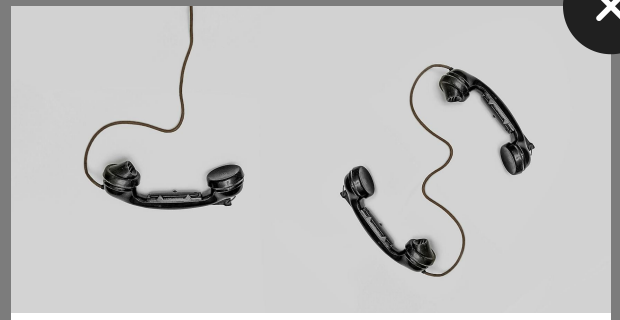
Quality

The quality team must participate and be present in all stages of system development.



Regulatory

When planning, it is a good approach to incorporate the regulatory restraints and conditions as interlocks in the technological process.



Iterative Design

Iterative communication with the user is essential durung the SW design phase, to increase the user-friendliness of the system.