



pan-European Management of Biological toxin incidents through standaRdisAtion
initiatives for Crisis response Enhancement

D7.1

BRSB Requirements and Architectural Framework



**Funded by
the European Union**

EMBRACE is funded by the European Union's Horizon
Europe Research and Innovation funding programme,
Grant Agreement N° 101168322.

Lead author(s)	Kyriaki Charalampous, Andria Hadjithekli
Lead beneficiary	IANUS Technologies
Status	Final
Version	1.0
Due Date	30 th September 2025
Delivery Date	29/09/2025
Dissemination Level	PU
Work Package	7
Task	7.1
Contributors	ARC, PUI, TEL, RAN, DCNA, VER, MUG, SMU, PRO, LC, TPEB
Reviewers	Iliana Korma (PUI)
Language	English
Format	Report
Keywords	Requirements, Architecture
Abstract	The Biotoxin Reference and Stakeholder Hub (BRSH) is designed as a federated web platform that will consolidate validated knowledge regarding biotoxins and associated disaster preparedness and response. In this deliverable its architecture, user roles, and integration steps necessary to enable use by responders, policymakers, and researchers are described.
Referencing this document	EMBRACE_D7.1_IANUS_Version_1.0
Disclaimer	The information and views set out in this publication are those of the author(s) and do not necessarily reflect the official opinion of the European Communities. Neither the European Union institutions and bodies, nor any person acting on their behalf, may be held responsible for the use which may be made of the information contained herein

Revision history

Version	Date	Partner	Description / Modification
0.1	1/7/2025	IANUS	Table of Contents
0.2	20/7/2025	IANUS	Section 1, 2, 3
0.3	1/8/2025	IANUS	Section 4 - 10
0.4	4/8/2025	IANUS	Executive summary, Section 11, Abbreviations
0.5	1/9/2025	IANUS	Feedback incorporation after first round of review (PRO, DCNA, ARC, PUI, RAN)
0.6	23/09/2025	IANUS	Feedback incorporation after internal review (PUI)
0.7	26/09/2025	IANUS	Feedback incorporation (TEL)
1.0	30/09/2025	TEL	Revision checks

Abbreviations

API	Application Programming Interface
BfR	German Federal Institute for Risk Assessment
BTF	Biotoxin Task Force
BRSH	Biotoxin Reference and Stakeholder Hub
CBRNe	Chemical, Biological, Radiological, Nuclear, explosives
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CIG	CBRNe Information Group
CMINE	Crisis Management Innovation Network Europe
CONOPS	Concepts of Operation
EMBRACE	pan-European Management of Biological toxin incidents through standardisation initiatives for Crisis response Enhancement
EU	European Union
NGO	Non-Governmental Organisation
PEERS	PractiCE Ecosystem for standardS
SSO	Single-Sign On
SOP	Standard Operating Procedures
TAP	Trial Action Plan
UX	User Experience
WP	Work Package

Table of Contents

Executive Summary.....	8
1 Introduction.....	9
1.1 Background.....	9
1.2 Purpose and Scope.....	10
1.3 Document Structure	10
2 Background.....	11
2.1 BRSB within the Project Context	11
2.2 Intended Users and Stakeholders.....	11
3 Stakeholder Landscape and Integration Context.....	13
3.1 Key Stakeholder Groups.....	13
3.2 Integration Imperatives and Interoperability Goals.....	14
4 Functional Requirements.....	15
4.1 User Roles and Access Management	15
4.2 Knowledge Base and Content Repository.....	17
4.3 Tool Integration and Access	19
4.4 Document and Output Management	20
4.5 Syndication and Collaboration Features.....	20
4.6 Notifications and Workflow Management.....	21
5 Non-Functional Requirements	23
5.1 Security and Privacy.....	23
5.2 Usability and Accessibility	23
5.3 Performance and Scalability	24
5.4 Interoperability and Modularity.....	24
5.5 Maintainability and Extensibility	25
6 Data Model and Storage Design	26
6.1 Key Entities and Relationships	26
6.2 Metadata and Tagging Structures	26
6.3 Data Governance and Ownership	27
7 System Architecture.....	29
7.1 High-Level Architectural Overview.....	29
7.2 Presentation Layer.....	29
7.3 Application Layer	30
7.4 Integration Layer.....	30

7.5	Data Layer.....	30
7.6	Security and Identity Management	31
8	Integration with External Systems.....	32
8.1	CMINE Platform and Stakeholder Engagement.....	32
8.1.1	Key Features.....	32
8.2	Biotoxin Task Force.....	33
8.3	EMBRACE Tools.....	34
9	User Interface Design.....	36
9.1	User Experience Principles.....	36
9.2	Role-Based Dashboards	37
9.3	Mobile and Responsive Design	37
10	Risks, Assumptions, and Dependencies	39
10.1	Technical Risks	39
10.2	Mitigation Strategies	40
10.3	Organisational Dependencies.....	41
11	Conclusion and Next Steps	42

Figures

Figure 1	The BRSB Homepage	18
Figure 2	BRSB Architecture Overview.....	31
Figure 3	Current Homepage of the DRSB Hub.....	33

Tables

Table 1.	The EMBRACE Consortium.....	7
Table 2	BRSB Target Groups.....	13
Table 3	Primary user roles and rights for the BRSB	16
Table 4	BRSB development expected timeline	19
Table 5	BRSB Key Entities.....	26
Table 6	The Architectural layers of the BRSB.....	29
Table 7	User Dashboard Description	37
Table 8	Technical Risks	39
Table 9	Risk Mitigation Strategies.....	40
Table 10	Key Dependencies	41

EMBRACE PARTNERS

The consortium consists of 18 partners from 14 countries, a core group which EMBRACE aims to build upon to create a thriving biotoxin expert community.

Partner	Partner	Acronym	Country
1	TELESTO TECHNOLOGIES PLIROFORIKIS KAI EPIKOINONION EPE	TEL	Greece
2	DCNA DISASTER COMPETENCE NETWORK AUSTRIA	DCNA	Austria
3	OSTERREICHISCHES ROTES KREUZ	ARC	Austria
4	POMPIERS DE L'URGENCE INTERNATIONALE	PUI	France
5	MEDIZINISCHE UNIVERSITAT GRAZ	MUG	Austria
6	HELSINGIN YLIOPISTO	VER	Finland
7	SAITAMA MEDICAL UNIVERSITY EDUCATIONAL CORPORATION	SMU	Japan
8	BIOTALENTUM TUDASFEJLESZTO KFT	BIOT	Hungary
9	AIRSENSE ANALYTICS GMBH	AIRS	Germany
10	MOBILITY ION TECHNOLOGIES SL	MION	Spain
11	PROMETECH BV	PRO	Netherlands
12	IANUS TECHNOLOGIES LTD	IANUS	Cyprus
13	THE LISBON COUNCIL FOR ECONOMIC COMPETITIVENESS ASBL	LC	Belgium
14	TECHNOLOGICKA PLATFORMA ENERGETICKABEZPECNOST CR	TPEB CR	Czech Republic
15	CESKA AGENTURA PRO STANDARDIZACI	CAS	Czech Republic
16	URAD PRE NORMALIZACIU, METROLOGIU A SKUSOBNICTVO SLOVENSKEJ REPUBLIKY	UNMS	Slovakia
17	RESILIENCE ADVISORS LTD	RAN	United Kingdom
18	BIOXHALE LTD	BIOX	United Kingdom

Table 1. The EMBRACE Consortium

EXECUTIVE SUMMARY

The Biotoxin Reference and Stakeholder Hub (BRSH), developed under Task 7.1 of the EMBRACE, is a federated, web-based platform intended to consolidate and provide structured access to validated, knowledge on biotoxin preparedness and response. BRSH aims to serve a wide spectrum of users, including first responders, researchers, policymakers, and public health authorities, as well as address the need for a centralised knowledge environment aligned with the open science and standardisation goals of the Horizon Europe programme.

D7.1 defines the functional and non-functional requirements, system architecture, user roles, technology stack, and integration pathways of the BRSH. It also outlines how the platform will interface with related initiatives such as CMINE and the Biotoxin Task Force, as well as tools developed across EMBRACE work packages. The report also reflects both technical planning and stakeholder feedback gathered through structured partner meetings and workshop engagements, with a strong focus on interoperability, modularity, and long-term sustainability.

1 INTRODUCTION

1.1 Background

The growing complexity and scope of biotoxin threats across Europe underline the critical importance of effective crisis management and preparedness. Biotoxins, substances derived from biological organisms with potentially severe effects on human health, public safety, and security, pose distinctive challenges due to their diverse nature, complex identification requirements, and rapid potential escalation in incident scenarios. Effective response mechanisms require comprehensive and timely access to validated scientific data, operational guidelines, response protocols, standards, and policy frameworks, in combination with multi-agency collaboration.

Due to these needs, the EMBRACE project (pan-European Management of Biological toxin incidents through standaRdisAtion initiatives for Crisis response Enhancement) aims to significantly enhance the EU's preparedness and response capabilities against biotoxin threats through innovative technical, operational, and organisational solutions. One of the main objectives of EMBRACE is the establishment of the Biotoxin Reference and Stakeholder Hub (BRSH), a federated knowledge-sharing platform designed to serve as a central reference point for stakeholders across Europe.

The BRSH, currently being developed under Task 7.1 of Work Package 7 (WP7), is designed to offer structured, secure, and curated access to biotoxin-related data. Its purpose is to strengthen intersectoral cooperation, improve interoperability, and support informed decision-making in the context of biotoxin preparedness and response. The platform will host a wide range of resources, including scientific literature, regulatory frameworks, policies, standards, and response protocols. In addition, it will integrate tools developed within the EMBRACE project which aim to enhance situational awareness and operational readiness during biotoxin incidents.

The BRSH will be designed in a similar way to that of PEERS's CBRNe Knowledge Hub, providing specialised content, and highly curated data governed by a team of experts. Initially, the BRSH is expected to be hosted by IANUS Technologies with potential future hosting by CMINE. There will be strong links of the BRSH to the Disaster Risk Stakeholder Hub (DRSH) on the Crisis Management Innovation Network Europe (CMINE) platform through sign-posts. There will be an intention to share the broader data set collected through EMBRACE activities through the Stakeholder Hub where it will carry a form of creative common license for accredited use by researchers in future (complying with open science principles of Horizon). This data will carry a form of Creative Commons license, allowing accredited researchers to use it in the future in accordance with the open science principles set out under Horizon Europe. Currently, CMINE stakeholder management occurs through two primary stakeholder groups:

- CBRNe Information Group (CIG): An open-interest group
- Biotoxin Task Force (BTF): A group which is restricted to members of the project and invited members of the Task Force.

Access to the BRSH can be initially provided through existing BTF membership, with the use of a verification process to streamline secure access management. The platform's user-authentication strategy can also include the potential for Single Sign-On (SSO) integration via platforms such as LinkedIn, in alignment with protocols already established by CMINE.

D7.1 defines the core requirements and system architecture for the development of the BRSH and provides a structured overview of the needs identified by stakeholders, outlines the key technical and operational features of the platform, and sets the groundwork for its design and implementation in the next phases of the project.

1.2 Purpose and Scope

The purpose of this document is to establish a clear understanding of the objectives, functional expectations, and technical design principles that will guide the development of the BRSH. This deliverable provides the foundation for the work carried out under Task 7.1 by outlining how the development of the BRSH platform will progress, based on discussions with end-users and project partners. It also highlights how the platform will contribute to the broader objectives of the EMBRACE project. Specifically, D7.1 presents how the BRSH can help strengthen Europe's capacity to anticipate, manage, and respond to biotoxin-related threats, while promoting long-term knowledge sharing, collaboration, and alignment with standardisation and policy initiatives across relevant sectors.

The scope of this document includes an overview of the BRSH's intended user base, as identified through engagement with consortium partners and end-users. It specifies the types of data, tools, and resources the platform will incorporate. In addition, the document defines the core functional and non-functional requirements of the BRSH, including user roles, access control, content governance, scalability, security, and system performance. It further addresses how the platform may interface with other systems, such as CMINE and the Biotoxin Task Force (BTF), and outlines the approach for defining the system architecture, user interface, and underlying technology stack.

In summary, this deliverable outlines the intended functionality and integration pathways of the BRSH. It provides a structured plan for translating stakeholder expectations and technical specifications into a reliable, adaptable, and interoperable platform that will support the broader goals of the EMBRACE project.

1.3 Document Structure

This document is organised into a series of structured sections that reflect the flow of the BRSH development process, from context setting to technical implementation. It begins by outlining the background, purpose, and scope of the BRSH within the EMBRACE project, establishing its role in consolidating knowledge and supporting stakeholder engagement.

Following this, the document introduces the platform's intended users and stakeholders, as well as the key functional and non-functional requirements identified through end-user discussions and project partner input.

The main sections of the deliverable describe user roles, access management, metadata frameworks, integration with EMBRACE tools, interoperability strategies, and interface design. Additional chapters focus on platform performance, security, sustainability planning, and risk mitigation measures.

2 BACKGROUND

2.1 BRSB within the Project Context

The BRSB is a key outcome of the EMBRACE project, developed under WP7 to support improved coordination, knowledge exchange, and strategic alignment in response to biotoxin-related threats. It addresses the need for a structured environment where relevant, highly reliable information can be accessed and shared securely among trusted stakeholders.

Within the EMBRACE project, BRSB plays an important role as a platform for aggregating, organising, and disseminating the project's key outputs related to biotoxin preparedness and response. The outputs of several Work Packages within EMBRACE will be consolidated in the BRSB and will include the Biotoxin Trial Toolbox and the Biotoxin Escalation Pathway. The BRSB is intended to also bring together existing scientific knowledge (e.g. biomarker identification, toxicity data), policy guidance (e.g. standardisation pathways, regulatory frameworks), operational elements (e.g. response protocols, training tools), and technology outputs (e.g. risk assessment software, diagnostics) developed across the consortium. These will be curated and structured within the BRSB to ensure discoverability, consistency, and long-term usability by trusted stakeholders.

Beyond internal integration, the BRSB plays an important role in extending the project's outreach. Through links with CMINE and the gradual onboarding of expert users via the Biotoxin Task Force, it supports broader objectives related to sustainability, interoperability, and stakeholder engagement. Its implementation reflects EMBRACE's commitment to creating a durable, user-oriented resource that aligns with wider European efforts in disaster preparedness and response.

2.2 Intended Users and Stakeholders

BRSB is designed to support a diverse set of users involved in biotoxin preparedness, response, research, and policy, including both institutional and operational stakeholders who require access to trusted knowledge and practical resources relevant to biological toxin incidents. The BRSB is being developed tailored to the needs of these users, ensuring that its content structure, interface design, and access permissions reflect the real-world operational contexts and responsibilities of its intended stakeholders.

Intended users include researchers and scientists working in the fields of toxicology, public health, environmental safety, epidemiology, biotechnology, and forensic analysis, who may seek reference materials, exposure data, or standardised procedures to support scientific assessments, laboratory work, or academic studies. In addition, the BRSB will support the needs of policymakers, standardisation bodies, and regulatory authorities seeking evidence-based input for decision-making and harmonisation efforts.

D7.1 - BRSB Requirements and Architectural Framework

BRSB is also intended for use by public health authorities, food safety agencies, environmental health institutions, and medical services that are responsible for the surveillance, monitoring, and management of biotoxin-related risks. These users may rely on access to response guidelines, escalation protocols, and sampling procedures to develop public protection strategies.

Operational responders, such as CBRN units, emergency services, firefighters, police and non-governmental organisations (NGOs) represent another key user group, who may use BRSB for fast, structured access to actionable knowledge during emergency scenarios, including threat identification support, decontamination protocols, and interoperability tools that facilitate coordination across agencies and jurisdictions.

3 STAKEHOLDER LANDSCAPE AND INTEGRATION CONTEXT

3.1 Key Stakeholder Groups

The development and long-term sustainability of the BRSH depend on engagement with a clearly defined set of stakeholder groups, each contributing to and benefiting from the platform in different ways. The stakeholder community includes both institutions and operational end-users who play a role in biotoxin preparedness, detection, response, regulation, and knowledge dissemination.

Based on discussions and workshop outcomes, Table 2 presents the target groups which have been identified as key stakeholders for the BRSH. These groups will be able to interact with the BRSH at varying levels, depending on their roles and access rights, and their involvement is critical to ensure the platform remains relevant, trusted, and practically useful over time.

Table 2 BRSH Target Groups

Target group	Platform Use
Researchers and Scientists	Individual contributing scientific data or consulting research relevant to biotoxins and risk mitigation e.g. individuals working in toxicology, biosecurity, public health or environmental risk assessment
Public Health and Food Safety Authorities	Access validated information to support surveillance, incident reporting, and public health response
First Responders	Use BRSH for operational guidance, incident alerts, and biotoxin-specific protocols, such as CBRN units, fire and rescue services, police forces, and humanitarian organisations, the Red Cross etc
Medical Services	Individuals who are involved in emergency care or hospital preparedness and need access to decontamination procedures, biotoxin-specific information etc
Forensic Laboratories	Support evidence-based identification and safe handling of biotoxin samples
Policy-Makers	Rely on technical and operational insights to guide regulations and crisis governance
Standardisation Bodies	Support harmonisation of methods, terminology, and procedures related to biotoxin preparedness and response
Non-Governmental Organisations (NGOs)	Use BRSH to inform actions in humanitarian response, health emergencies or community-level resilience initiatives

3.2 Integration Imperatives and Interoperability Goals

A core objective of the BRSH is to ensure that biotoxin-related knowledge and tools developed within EMBRACE can be accessed, used, and shared effectively across different systems, stakeholder environments, and operational contexts. For this reason, integration and interoperability are key considerations in both the design and governance of the platform.

The BRSH is being developed as an independent platform in terms of infrastructure and content management, with a modular structure inspired by systems like the PEERS CBRNe Knowledge Hub. At the same time, it is expected to maintain strong external links, particularly through sign-posts provided on the Disaster Risk Stakeholder Hub within the CMINE platform. This will support accessibility, cross-platform navigation, and greater alignment with existing European initiatives in disaster risk management. To promote long-term accessibility and reuse of project results, the broader data set collected through EMBRACE will be made available via CMINE under a form of Creative Commons license, supporting accredited use by researchers and institutions, and complying with Horizon Europe's open science principles.

The platform will also integrate selected outputs from EMBRACE, including tools such as the Biotoxin Risk Assessment (BioRA) Tool, CBRN Toolbox, Trial Action Plan (TAP), Biotoxin Trials and Exercises Handbook, and the Biotoxin Escalation Pathway Tool. These tools will be accessible through the BRSH interface to support user workflows related to biotoxin risk assessment, incident escalation, and field-level response coordination.

In addition, the BRSH will reference external data sources and databases that provide trusted content relevant to biotoxins. These include the German BfR, the UK's CEFAS system, SafetyHUD, STELAR, and open scientific repositories such as Zenodo, PubMed, and ResearchGate. The platform will not duplicate or replace these resources but will direct users to them in a structured and curated manner.

Together, these integration and interoperability strategies aim to position the BRSH as a flexible, connected, and reusable knowledge asset that extends the value of EMBRACE beyond the project's duration.

4 FUNCTIONAL REQUIREMENTS

4.1 User Roles and Access Management

The BRSB will implement a role-based access model to manage user experience within the platform, ensure secure handling of information, and provide clarity around who can manage, view, submit, or modify content.

A registration and role-approval mechanism will be in place, initially linked to Biotoxin Task Force (BTF) membership or project partner invitations. This controlled process will ensure that contributors and editors are appropriately verified based on institutional affiliation and role-specific needs.

Quality control checks for submitted or updated content have been considered and discussed. However, due to the volume of material and the liability associated with formal validation, assigning this responsibility to a dedicated expert group could be impractical. Instead, the platform can potentially adopt a community-driven reporting mechanism. Users can have the option to report errors or questionable content through a contact form or reporting function within the platform, which could be developed to increase the platform's reliability. These reports can be reviewed by platform managers or editors, who will decide whether corrective actions are needed. A disclaimer can be included on the platform to clarify that while content is provided by trusted and highly reliable sources, it is not subject to systematic verification by a dedicated group of experts.

The four primary user roles and their rights on the BRSB are summarised in Table 3.

Table 3 Primary user roles and rights for the BRSH

User roles	Access Rights	Publishing Rights	Can report errors	Typical User Group
Administrator	Full platform access, including system configuration, user management, and control over overall structure and permissions.	Yes	Yes	Platform administrators
Editor	Responsible for curating and updating content on the platform. Editors can input and edit content directly.	Yes	Yes	Designated content managers
Contributor	Can submit content to the platform but does not have publishing or editing rights. Their input can be added, viewed and flagged by others post-publication.	No	Yes	Registered experts, project partners
Viewer	Can access and read content but cannot make changes or submit new material.	No	Yes	Broader stakeholder community

The BRSH is expected to be hosted by IANUS Technologies for the duration of the EMBRACE project. Following the completion of the project, the possibility of transferring the BRSH to CMINE will be assessed, considering sustainability, governance, and long-term accessibility. Alternatively, continued hosting by IANUS may remain a viable option depending on community needs and technical feasibility.

4.2 Knowledge Base and Content Repository

The BRSH will be developed into a federated knowledge database designed to provide secure, structured, and easy access to biotoxin-related content. The repository will consolidate diverse categories of material relevant to preparedness, response, detection, and research, with a focus on practical usability and trusted sourcing.

The content repository will include:

- Scientific publications and research outputs
- Guidance material and reference documents
- Concepts of Operations (CONOPS)
- Recommendations on protective measures and decontamination protocols
- Regulatory and policy documentation
- Documentation on detection instruments
- Biomarker dashboards and structured data outputs
- Standard Operating Procedures (SOPs) relevant to sampling, decontamination, detection, response etc
- Hardware Brochures and Product Links - informational material from EMBRACE hardware solution providers, offering technical overviews and contact points for operational technologies featured or tested in the project

The platform will also link to external open-access scientific repositories such as PubMed, ResearchGate, and Zenodo. Where applicable, metadata and source references will accompany each entry for transparency and traceability.

In addition, the BRSH will include links to external institutional databases, such as the German BfR, UK CEFAS, SafetyHUD, and STELAR. These links will be curated and integrated in a way that enables users to navigate external datasets directly from the BRSH interface while maintaining context.

The platform is likely to be structured to support multilingual access. Where possible, guidance documents and reference materials will be made available in multiple languages for convenience and to accommodate a broader audience. While the BRSH is not intended to function as a real-time operational feed, it will act as a centralised reference point for structured, validated, and well-organised information relevant to biotoxins.

The BRSH can be accessed through the following domain <https://embracebrsh.com/>. Screenshots of the homepage of BRSH are presented below in Figure 1.

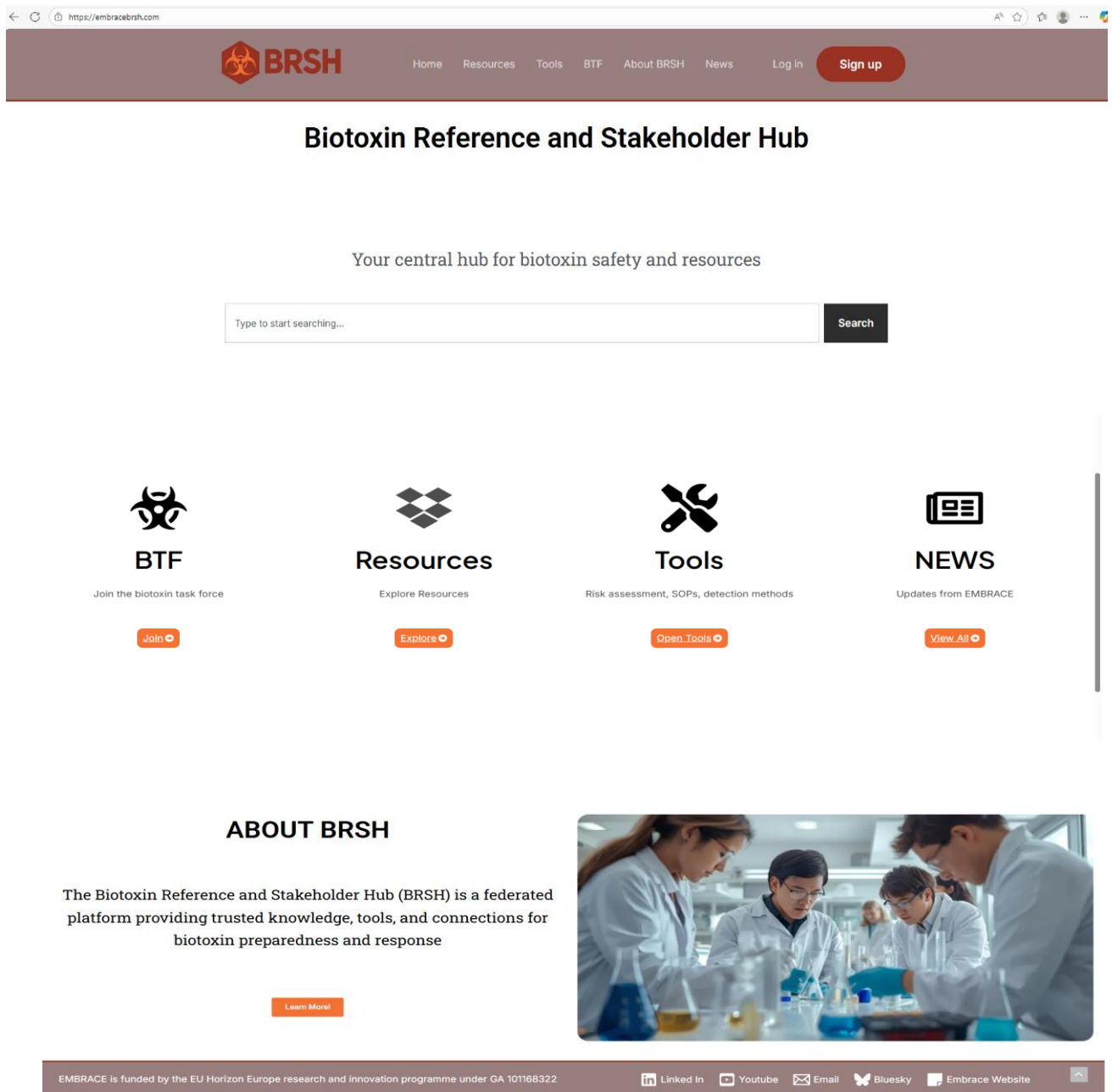


Figure 1 The BRSH Homepage

The expected timeline for the development of the BRSH is shown below in Table 4.

Table 4 BRSH development expected timeline

Month	Expected outcome
M13-M15	Core Platform Development Implement core backend, front-end dashboard templates, role-based access, metadata model
M15-M16	Initial Tool Integration Begin embedding EMBRACE tools (e.g., BioRA)
M16-M17	Alpha Testing with Internal Users
M17-M18	BRSH Community Onboarding and Document Upload Early content contributions by project partners, metadata curation, SOPs, trial content
M19-M20	External Access via CMINE Signposting
M21	Field Trial Readiness BRSH fully functional, key tools and documents uploaded, BTF onboarded
M22-M24	Support Field Trials and Feedback Collection Real-world use of BRSH in parallel to trial activities; KPIs measured
M25-M28	Refinement Phase Improve UX, workflows, dashboards, document tagging based on trial feedback
M29-M33	Sustainability Planning & Governance Model Finalisation Decide on CMINE migration or long-term hosting by IANUS
M34-M36	Final Launch and Knowledge Consolidation Platform maturity, final KPI capture, open-access dataset availability

4.3 Tool Integration and Access

The BRSH will provide integrated access to key tools and resources developed within the EMBRACE project. These tools are directly relevant to biotoxin risk assessment, operational planning, and field-level response. Their inclusion in the BRSH will support stakeholders in applying EMBRACE outcomes in practical contexts, while ensuring that tools are accessible from a single, centralised location.

The following EMBRACE tools and resources will be linked or embedded within the BRSH platform:

- BioRA Tool (IANUS)
- CBRN Toolbox (VER)
- Trial Action Plan (TAP) (IANUS)
- Biotoxin Handbook (IANUS)
- Biotoxin Escalation Pathway Tool (PRO)

Documentation explaining the functionality and handling of other tools will be made available through the BRSH. The additional tools are listed below.

- BreathDraw (BIOX)
- pBDi (AIR)
- DMA (MION)
- Forensics TnT (PRO)
- Casualty TnT (PRO)
- Human Durability Indexing (PRO)

4.4 Document and Output Management

Document and output management within the BRSH should focus on ensuring that all materials hosted on the platform are clearly organised, traceable, and accessible based on user roles and relevance. This includes project-generated content, externally sourced references, and supporting materials related to EMBRACE tools, training, and trials.

All documents uploaded or referenced in the BRSH may be accompanied by structured metadata, including attributes such as title, author or source, date, type, language, and subject keywords. This can support advanced filtering, searchability, and content discovery across the platform. Where applicable, version control can be applied to key documents. Each submitted item can carry version history metadata, allowing users and editors to track content updates and modifications over time. This supports consistency and traceability across evolving guidance, tools, or scientific outputs. The platform could potentially include mechanisms for content lifecycle management, such as archival flags or expiration tags, which allow platform administrators to archive outdated materials or mark resources as superseded.

Role-based access rules will define what users can view or contribute. Contributors will be able to upload new materials through a structured submission interface, with required metadata fields. Editors will be responsible for reviewing and organising submissions in line with content structure and platform conventions.

The platform may also support multilingual content, allowing uploads in multiple languages where available. This is especially relevant for guidance material and operational protocols, where regional adaptation improves usability and outreach.

Over time, as new content is developed or identified, platform managers should ensure that the repository remains updated, well-structured, and aligned with stakeholder needs. The goal is to maintain a reliable and easy-to-navigate library of resources relevant to biotoxin preparedness and response.

4.5 Syndication and Collaboration Features

The BRSH will support selected syndication and collaboration features to promote ongoing stakeholder engagement and facilitate knowledge sharing across domains and disciplines involved in biotoxin preparedness and response.

While the BRSH is not designed to function as a real-time communication platform, it will offer basic collaborative features that enhance the visibility and reuse of content. This might include the ability to highlight new or featured resources, link to relevant initiatives, and guide users toward content relevant to their role or area of interest. Structured tagging and metadata could further support thematic clustering and cross-referencing of content.

To encourage active participation, the platform will include:

- A contact form through which users can ask questions, suggest additions, or flag outdated or problematic content.
- Reporting functionality for identifying inaccuracies or incomplete entries, which will be reviewed by editors or platform managers.
- Links and sign-posts to related initiatives and platforms, including CMINE and other Horizon Europe projects, for broader context and synergy.

Content syndication will also be supported through structured referencing to external sources, such as open-access repositories and institutional datasets. Rather than duplicating content, the BRSH will direct users to these resources with appropriate metadata and context, preserving the source integrity while enhancing access.

4.6 Notifications and Workflow Management

The BRSH will include basic notification and workflow management functionalities to support user engagement, content awareness, and administrative oversight. These features are intended to streamline contributions, ensure transparency in platform updates, and maintain overall usability for both end-users and platform editors.

Notification features can be potentially implemented to keep users informed about:

- New content uploads or updates (e.g., recently added/updated SOPs, documents, or tools)
- Highlighted or featured resources
- Platform changes such as policy updates or interface enhancements
- Responses to submitted feedback or flagged content

Notifications may appear within the user dashboard and, where applicable, be sent via email to registered users based on their access level and subscription preferences. This helps ensure that contributors, editors, and general users remain informed without requiring them to manually monitor updates.

The BRSH will support a structured content submission and review workflow. While content will not undergo formal pre-publication validation, it will be subject to the following process:

- Contributor uploads content via a dedicated submission form, including required metadata.
- Editors review the submission for completeness, relevance, and categorisation before final placement in the platform.

D7.1 - BRSB Requirements and Architectural Framework

- Platform managers address any issues raised through the reporting system or contact form.

This model ensures that content can be updated continuously while preserving a minimum level of editorial oversight. Notifications will be used internally to inform editors of pending submissions or flagged issues requiring attention.

5 NON-FUNCTIONAL REQUIREMENTS

5.1 Security and Privacy

Security and privacy are critical considerations in the design and deployment of the BRSB. The platform will be structured to ensure that user data, submitted content, and system operations are protected in accordance with relevant data protection regulations and good practice standards.

Access to the BRSB will be role-based, with defined permissions that limit exposure of sensitive functions or content to only those users who require it. User authentication will follow secure login protocols, with Single Sign-On (SSO) integration, such as LinkedIn, being explored to enhance both security and user convenience. Credentials and user roles will be managed centrally by platform administrators. Platform security will be managed by IANUS Technologies during the lifetime of the EMBRACE project, with secure hosting infrastructure and access control mechanisms in place.

5.2 Usability and Accessibility

Usability and accessibility are essential to ensure that the BRSB can be effectively adopted by its diverse user pool, which includes researchers, responders, policymakers, and institutional stakeholders from different countries and technical backgrounds. The platform's design will prioritise clarity, intuitive navigation, and ease of use across all user roles.

The user interface will be developed with a clean and consistent layout, guided by common design standards and best practices for web-based knowledge platforms. Key features and tools, such as search, filtering, role-specific dashboards, and content submission forms, will be easy to locate and interact with. Content can be structured using metadata, categories, and tagging to support efficient access and thematic organisation.

The BRSB will also aim to support multilingual content, particularly for critical resources such as operational guidelines and reference material. This reflects the platform's pan-European scope and the need to accommodate users from various backgrounds.

In terms of accessibility, the platform will follow established web standards to support users with varying device preferences. This includes responsive design to ensure usability on mobile devices, tablets, and desktop environments, as well as interface features that facilitate navigation across different user contexts. Compatibility with assistive technologies such as screen readers, appropriate contrast levels for readability, and keyboard navigation for users with limited dexterity should be considered to improve usability for all user groups. The goal is to provide an inclusive environment where users can easily locate, access, and contribute information, regardless of technical expertise or location.

5.3 Performance and Scalability

The BRSH platform will be developed with performance and scalability in mind to ensure responsiveness, reliability, and the ability to accommodate growth over time. These qualities are essential to maintaining a smooth user experience and supporting increased usage as the platform matures and reaches a broader audience.

From a performance perspective, the system will be optimised to provide fast content retrieval, efficient browsing, and responsive interactions across various devices. The underlying infrastructure will be configured to handle concurrent users without compromising stability or speed, particularly during periods of increased activity, such as after major updates.

Scalability will be addressed at both the content and user levels. As new documents, tools, and datasets are added over time, the platform architecture could support content indexing, structured categorisation, and metadata tagging to maintain search efficiency.

Hosting by IANUS Technologies during the project phase will ensure controlled resource management. In case the platform migrates to another environment, such as CMINE, scalability considerations will inform the selection of infrastructure and hosting model to support long-term growth.

These measures aim to ensure that the BRSH remains stable and usable as its content base and user community expand beyond the project's lifecycle.

5.4 Interoperability and Modularity

The BRSH is being developed with interoperability and modularity as core design principles, ensuring that the platform can interact with related systems and evolve over time without major structural overhauls. These qualities are essential for aligning with broader initiatives in disaster risk management and enabling future expansion beyond the initial project scope.

In terms of interoperability, the platform will include structured links to trusted external sources, including scientific repositories (e.g. PubMed, Zenodo), institutional datasets (e.g. BfR, CEFAS), and EMBRACE project tools. The use of metadata standards and consistent content structuring will allow seamless referencing and navigation across systems. This approach will also support future alignment with platforms such as CMINE, where content and tool visibility may be extended through signposting or cross-linking.

Modularity refers to the ability to develop, deploy, and manage individual components of the platform independently. Key modules within the BRSH will include the knowledge base, user access and role management, content submission and curation tools, and embedded or linked project tools. This separation of functions will enable targeted updates, the introduction of new features, or the replacement of components with minimal disruption to the overall platform.

This modular architecture will also allow flexibility in hosting and maintenance. Initially hosted by IANUS Technologies, the BRSH could be migrated to another environment, such as CMINE, without requiring full re-development. By maintaining clearly defined functional blocks and integration points, the system will remain adaptable to both technical and operational requirements over time.

5.5 Maintainability and Extensibility

The BRSB platform is being designed with long-term maintainability and future extensibility. This ensures that the system can be updated, adapted, and expanded with minimal effort as stakeholder needs evolve or new requirements emerge.

Maintainability will be supported through clear codebase documentation, modular backend architecture, and adherence to established development practices. Platform components, such as content management tools, access controls, and metadata structures, will be developed in a way that allows for isolated updates without affecting core functionality. Routine updates and bug fixes will be manageable by the hosting provider without requiring full system downtime or redevelopment.

Extensibility refers to the platform's ability to integrate new features, tools, or data sources in the future. This includes the potential to add additional stakeholder groups, expand content categories, and interface with external systems beyond those currently foreseen. The use of standard Application Programming Interfaces (APIs) and flexible data schemas will support the integration of additional functionalities over time.

6 DATA MODEL AND STORAGE DESIGN

6.1 Key Entities and Relationships

The BRSH data model will be structured around a set of core entities that reflect the types of content, users, and operational elements managed by the platform. These entities, which will serve as the foundation for organising, indexing, and retrieving information efficiently, are presented in Table 5.

Table 5 BRSH Key Entities

Key Entities	Description
Documents	Reports, SOPs, guidance material, policies, and training resources. Each document should carry metadata including title, author, source, publication date, type, language, and associated tags.
Tools	Digital resources developed in EMBRACE (e.g. BioRA Tool, CBRN Toolbox) and linked tools from external partners. These can be defined by attributes such as name, provider, description, and access level.
Users	Categorised by role (Admin, Editor, Contributor, Viewer), with attributes including user ID, affiliation, and access permissions (see Table 3 for details on role-based access rights)
Stakeholder groups	Such as the BTF or the broader biotoxin interest group, used for grouping users and managing role-specific visibility.
External Resources	Referenced databases and repositories, linked via structured records including URL, source organisation, and type of content provided.

Relationships between these entities will allow for meaningful associations across the platform. For example:

- Documents may be linked to tools they reference.
- Users may be associated with specific stakeholder groups or contributors of specific content.
- External sources may be tied to documents or datasets curated within the platform.

6.2 Metadata and Tagging Structures

Metadata and tagging structures will play a central role in how content is organised, filtered, and retrieved within the BRSH. By attaching descriptive attributes to each piece of content, the platform will enable users to locate relevant information efficiently and understand its origin, relevance, and intended use.

Each content type, such as documents, tools, or linked external resources, will be associated with a set of predefined metadata fields. These may include:

- Title

- Author or Source Organisation
- Date of Publication or Upload
- Content Type (e.g. SOP, Policy, Handbook)
- Language
- Keywords/Tags
- Associated Stakeholder Group or Tool
- Access Level or Visibility
- Link to Source (if external)

Tagging will be implemented as a flexible system that supports both predefined vocabularies (e.g. biotoxin types, response domains) and user-generated keywords, allowing for refinement over time. This will support thematic filtering and cross-referencing of related content across different categories.

The metadata schema will also enable role-based visibility and multilingual filtering, ensuring that users only see content relevant to their access level and language preferences. Additionally, metadata will support content lifecycle management, allowing platform editors to track versions, updates, and usage frequency.

Well-structured metadata and tagging can enhance the discoverability, consistency, and long-term usability of the BRSB knowledge base, forming the foundation for scalable content integration and navigation features.

6.3 Data Governance and Ownership

Effective data governance is essential to ensure that the BRSB operates as a reliable, trustworthy, and sustainable knowledge platform. Governance in this context refers to the processes and responsibilities related to how data is contributed, curated, accessed, and maintained throughout the platform's lifecycle.

All content uploaded to the BRSB will remain the intellectual property of the original authors or source organisations. Contributors will be responsible for ensuring that their submissions are accurate and appropriately licensed for public or restricted use. Where applicable, content will carry references or licensing information, such as Creative Commons labels, to clarify usage rights.

The platform itself will not perform data validation, but users will have the ability to report errors or concerns through a built-in reporting mechanism. Reported issues will be reviewed by designated editors or platform managers, who can take appropriate corrective action. A disclaimer will be present to clarify that, while content is sourced from trusted contributors, it is not formally verified or endorsed by EMBRACE or its partners.

IANUS Technologies will be responsible for access control, and administrative oversight. This includes management of metadata standards, content categorisation, and access permissions. After the project's conclusion, the governance structure may evolve depending on whether the platform is transferred to CMINE or remains hosted by IANUS. In either case, a governance plan should be

developed to ensure long-term maintenance and clarity regarding content ownership and platform responsibilities. These measures will ensure that the BRSH remains credible, transparent, and aligned with open science principles, while respecting the rights of contributors and safeguarding the platform's integrity.

7 SYSTEM ARCHITECTURE

7.1 High-Level Architectural Overview

The BRSH is designed as a modular, web-based platform structured to ensure scalability, maintainability, and secure role-based access. Its architecture follows a layered approach that separates user interaction, application logic, system integration, and data storage, allowing for efficient development and long-term adaptability.

The core layers of the architecture of the BRSH are presented in Table 6.

Table 6 The Architectural layers of the BRSH

Architectural Layer	Description
Presentation Layer	The front-end interface that enables users to search, browse, and interact with platform content and tools. It will be accessible via standard web browsers.
Application Layer	Responsible for executing key functions such as user authentication, role-based access control, content management, and submission workflows. This layer governs how users interact with the platform's logic and services.
Integration Layer	Handles connections with external tools and data sources, enabling interaction with EMBRACE-developed resources, third-party repositories, and external authentication providers.
Data Layer	Manages structured storage of documents, tools, metadata, and user information. It supports content indexing, versioning, tagging, and efficient retrieval operations.

7.2 Presentation Layer

The presentation layer forms the user interface component of the BRSH platform. It is responsible for delivering an intuitive and accessible interface that allows users to browse, search, filter, and interact with content based on their role and access level.

The layout will be structured to prioritise ease of navigation, with clearly defined sections for categories such as publications, tools, regulations, and external resources. Users will be able to access role-specific dashboards, view featured content, and submit materials through guided forms.

Attention will be given to responsive design to ensure compatibility across desktop, tablet, and mobile devices. The interface could also support multilingual content filtering, enabling users to view resources available in their preferred language when such versions exist.

7.3 Application Layer

The application layer involves the core operational logic of BRSH. It is about user authentication, role-based access control, content submission workflows, and internal notifications.

This layer enforces permissions according to the defined roles, Admin, Editor, Contributor, and Viewer, and determines how users interact with content based on their assigned access level. When contributors submit content, the application layer should process the metadata, validate required fields, and route the input to editors for review and categorisation.

Workflow components will also include automated notifications for editors when new content is submitted, and alerts to users when content is updated or flagged for review. Additionally, this layer governs the integration of internal tools and facilitates communication with the data and integration layers, without exposing backend complexity to the user.

7.4 Integration Layer

The integration layer manages all connections between the BRSH and external systems, tools, and data sources. It enables the platform to reference, interact with, or redirect users to content and services that reside outside the BRSH environment.

Key functions of this layer include:

- Linking to external scientific repositories (e.g. PubMed, Zenodo)
- Referencing institutional databases such as BfR, CEFAS, SafetyHUD, and STELAR
- Providing access to EMBRACE tools, including BioRA, TAP, and the CBRN Toolbox
- Supporting user authentication via third-party services (e.g. SSO mechanisms)

Where full integration is not feasible, this layer supports structured outbound links with contextual metadata. It also ensures that content hosted externally is discoverable through the BRSH without duplication.

7.5 Data Layer

The data layer underpins the storage, organisation, and retrieval of all content and metadata within the BRSH. It supports structured data models that align with the platform's core entities, including documents, tools, user roles, and external references.

Content is stored in a format that supports efficient indexing and search, with metadata used to categorise and filter resources. Document versioning, tagging, and multilingual support are managed at this level to ensure consistency and traceability.

The architecture allows for scalable storage to accommodate new content types over time and ensures that access permissions defined at the application level are enforced at the data level, preserving content integrity across the system. An overview of the BRSH architecture is presented in Figure 2.

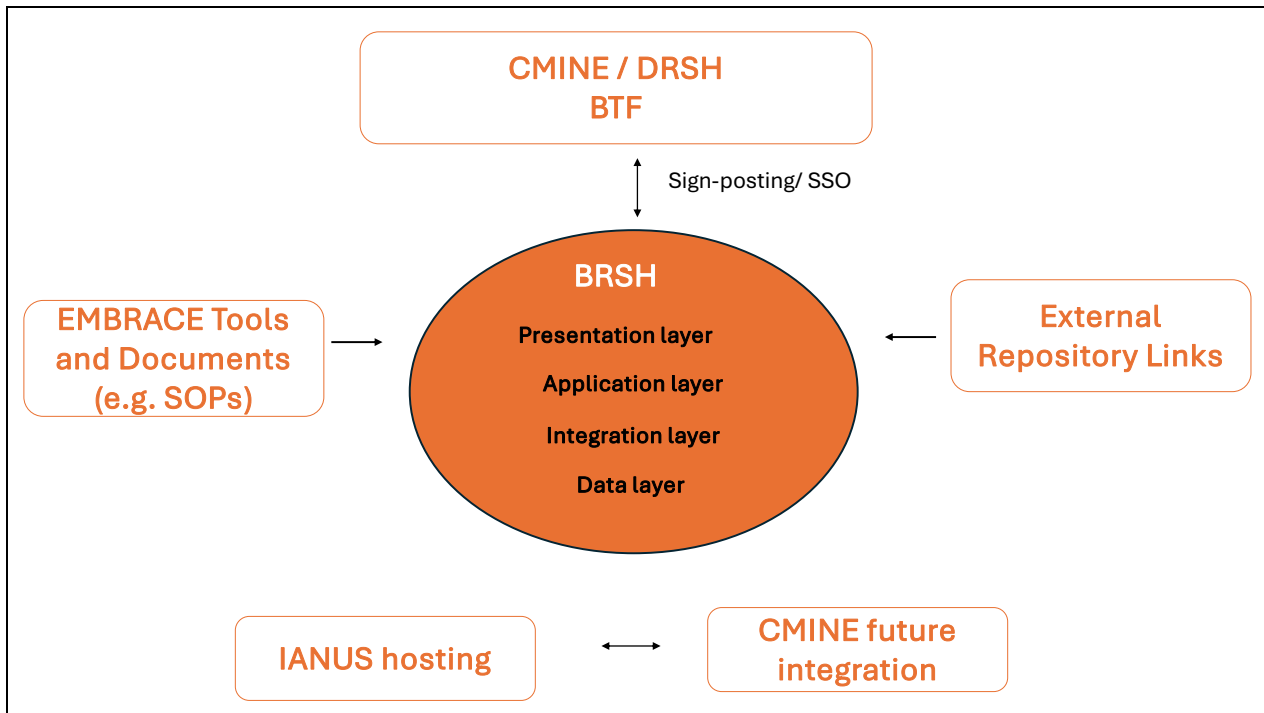


Figure 2 BRSH Architecture Overview

7.6 Security and Identity Management

The security and identity management framework of the BRSH is responsible for safeguarding platform access and protecting content from unauthorised use or modification. It enforces authentication procedures, manages user roles, and governs session control.

Role-based access is centrally administered, ensuring that users only interact with content appropriate to their permissions. Authentication mechanisms may include traditional login credentials as well as integration with third-party identity providers for Single Sign-On (SSO).

The system tracks login activity, manages password resets, and supports account lifecycle management. These functions are embedded within the platform's application and infrastructure layers to ensure both usability and control.

8 INTEGRATION WITH EXTERNAL SYSTEMS

8.1 CMINE Platform and Stakeholder Engagement

The BRSH intends to deliver a highly curated dataset governed by a team of experts yet to be established.

It is proposed to be a stand-alone system in a similar way to that of the PEERS CBRNe Knowledge Hub

There will be strong links (signposts) to the BRSH through the Disaster Risk Stakeholder Hub on CMINE. The Hub is being developed as an entry-level reference point for stakeholders in Disaster Risk Management including:

- Citizens
- Local Organisations
- Responders and Municipal / Regional Authorities
- National and International bodies,
- Researchers and Policy Makers

Its aim is to present a **comprehensive starting point** for stakeholders to search for relevant supporting information and data as they develop their own DRM strategies, policies and procedures as well as for those looking to increase their professional knowledge and undertake further research.

The Hub presents access to existing data sets produced by international bodies, research and innovation projects and individual organisations and will be searchable through a structured menu and AI driven search facilities. It also provides links to other tools such as EC's CORDIS and the UN's Disaster Risk Gateway.

8.1.1 Key Features

- Information and signposts to **Baseline Knowledge & Tools** such as:
 - Terminology • Disaster Databases • Impact Chains • Hazard Data • Exposure • Vulnerability and Loss and Damage Data • Risk Reduction Measures and • Best Practice, where identified
- **Simulations** engines including:
 - Impact Chain Generators • Hazard Assessment Tools • Risk Assessment and Reduction Tools and • Serious Games
- A **Community** for knowledge sharing through:
 - An interactive and dynamic members forum and • Events including Webinars, conferences and exhibitions
- **Search of Knowledge Bases & Tools:** Users can access disaster datasets categorized by subject/theme and a free AI-based search of all available knowledge.
- Links and information on **projects continuing relevant research** and development of knowledge and tools.

Currently, the Hub hosts around 300 tools and knowledge bases, with ongoing enhancements for user searchability and access. It is hosted amongst a user-base of some 3,000 members.

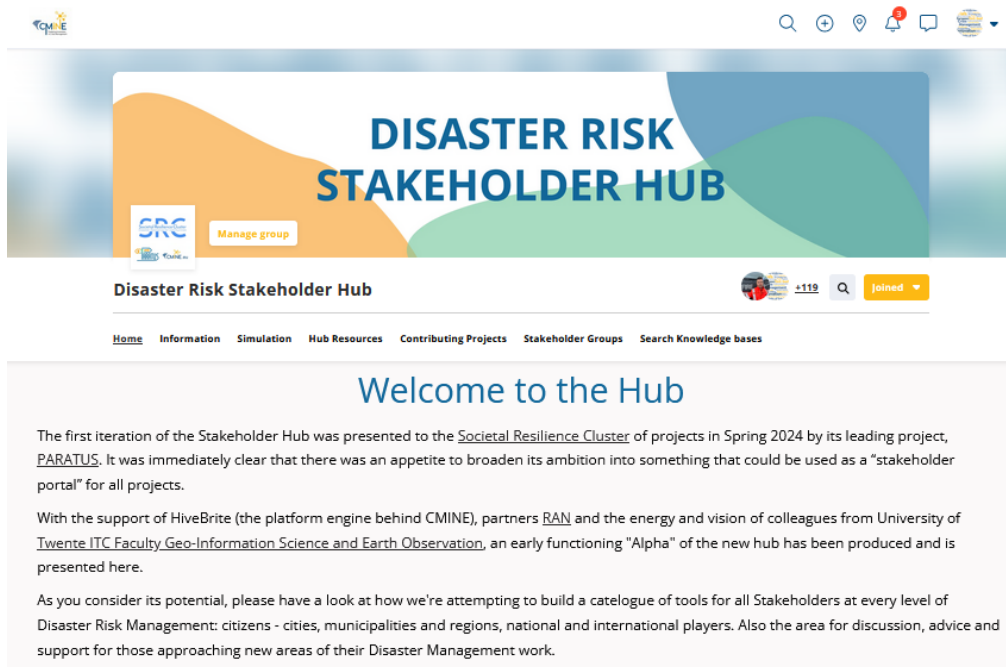


Figure 3 Current Homepage of the DRSH Hub

There will be an intention to share the broader data set collected through EMBRACE activities through the Stakeholder Hub where it will carry a form of creative common license for accredited use by researchers in future (complying with open science principles of Horizon).

Stakeholder management at present is managed through:

- The CBRNe Information Group (CIG) which is an open interest group
- The BTF Group which is restricted to members of the project and invited members of the Task Force.

CMINE incorporates an SSO protocol with LinkedIn if preferred but it's anticipated that access to the BRSH platform will perhaps start with the BTF membership (making the most of a single verification process) in the first instance."

8.2 Biotoxin Task Force

The Biotoxin Task Force (BTF) is a dedicated, pan-European stakeholder network established to foster collaboration and knowledge exchange on biotoxin preparedness, detection, and response. It brings together civil protection authorities, first responders, crisis managers, technologists, researchers, and solution developers with a shared interest in improving resilience against biotoxin incidents.

Hosted as a structured community space on the CMINE platform, the BTF supports ongoing interaction through a set of dedicated tools and resources, including:

- Announcements - for updates and BTF communications

- BTF Home - providing an overview of the group's purpose and main contacts
- Discussions
- Documents and Files - offering access to shared materials, draft outputs, and reference content
- Events - highlighting relevant meetings, workshops, and collaborative sessions
- Members - presenting a directory of participants for networking and collaboration

Through these features, the BTF operates not only as an expert advisory body but also as an active professional network. The BTF will support the development of the BRSH by facilitating stakeholder-driven feedback and acting as one of the user groups for early access to the platform.

The BTF contributes to the long-term vision of EMBRACE by anchoring a connected community that bridges science, policy, and operations, helping to ensure that outcomes from the project remain sustainable, relevant, and aligned with end-user needs.

8.3 EMBRACE Tools

Several tools will be developed within EMBRACE, which are designed to enhance preparedness, risk assessment, and operational coordination in response to biotoxin incidents. These tools are part of the project's broader effort to consolidate validated knowledge and digital resources into a coherent ecosystem accessible through the BRSH.

Key tools include:

- Biotoxin Risk Assessment Tool (BioRA) - A digital biotoxin risk assessment tool enabling the evaluation of biotoxin incident scenarios.
- CBRN Toolbox - A database for CBRN agent identification.
- Trial Action Plan (TAP) - A digital plan to support the design, execution, and evaluation of biotoxin trials.
- Biotoxin Trials and Exercises Handbook - A guide for planning, designing, executing and evaluating biotoxin trials and exercises.
- Biotoxin Escalation Pathway Tool - A tool that attempts to identify and notify of biotoxin poisonings before they are identified through traditional means.
- Additional tools - Supporting documents that describe the purpose, operational context, and usage instructions for relevant biotoxin tools will be included in the BRSH. These tools include:
 - BreathDraw (BIOX)
 - pBDi (AIR)
 - DMA (MION)
 - Forensics TnT (PRO)
 - Casualty TnT (PRO)
 - Human Durability Indexing (PRO)

D7.1 - BRSB Requirements and Architectural Framework

The tools will be integrated into the BRSB through direct embedding, linking, or referencing, depending on their technical structure and access requirements.

9 USER INTERFACE DESIGN

9.1 User Experience Principles

The user experience (UX) design of the BRSH prioritises clarity, usability, and accessibility across a diverse set of user roles and technical backgrounds. The platform is intended to serve operational personnel, researchers, policymakers, and contributors, requiring a clear interface that supports both information search and content submission.

Key user experience principles guiding the design include:

- **Simplicity and clarity** - Interfaces will be streamlined, avoiding unnecessary complexity, with clear menus and page layouts.
- **Role-based relevance** - Users will only see features and content relevant to their assigned access level (e.g. Admin, Contributor, Viewer), supporting task-focused interaction.
- **Consistency** - Navigation, buttons, and terminology will follow common patterns across the platform to support user familiarity and reduce learning time.
- **Responsiveness** - The interface will adapt to different screen sizes and devices, enabling mobile and tablet access without loss of functionality.
- **Guided interaction** - Submission workflows, filters, and feedback mechanisms will be designed to guide users step-by-step through key actions such as uploading content or reporting issues.
- **Accessibility** - Basic web accessibility standards will be followed to support inclusive use, including readable font sizes, adequate contrast, and support for multilingual display.

These principles ensure the platform remains user-friendly for users while offering efficient navigation and meaningful functionality for contributors and editors.

9.2 Role-Based Dashboards

The BRSB interface will feature role-specific dashboards designed to provide each user type with relevant content, actions, and navigation options tailored to their responsibilities within the platform.

The user dashboards are summarised in Table 7.

Table 7 User Dashboard Description

User Dashboard	Description
Administrator	Provides access to user management, content categorisation, platform settings, and system functions. Admins can accept or reject user accounts, manage metadata structures, and monitor flagged submissions.
Editor	Focused on content curation. Editors will see pending submissions, flagged content reports, and tools for updating and publishing approved materials. They should be also able to edit data, organise files, and maintain consistency across the knowledge base.
Contributor	Offers tools for uploading content, entering data, and tracking the status of submitted documents. Contributors can also have access to submission guidelines and reporting options for suggesting corrections.
Viewer	Provides access to publicly available and role-appropriate content. Viewers can browse, search, filter, and download documents, but cannot contribute or edit content.

Each dashboard can include quick links to relevant tools (e.g. BioRA, Handbook), display recently updated content, and offer guidance appropriate to the user's role.

9.3 Mobile and Responsive Design

The BRSB will be designed to provide a consistent and fully functional experience across a range of devices, including desktop computers, tablets, and smartphones. Given the diverse professional backgrounds and operational contexts of its users, the platform should be easily accessible from an office environment, field location, or during travel.

Responsive design principles will be applied to ensure that the layout, navigation, and content presentation automatically adapt to different screen sizes and orientations. Key interface elements, such as search bars, document viewers, dashboards, and submission forms, should remain usable and legible across devices.

This approach improves both accessibility and convenience, particularly for contributors and stakeholders who may interact with the platform in non-desktop settings. Compatibility across major

browsers and operating systems will be tested as part of the development process to support reliability and performance on all supported devices.

10 RISKS, ASSUMPTIONS, AND DEPENDENCIES

10.1 Technical Risks

The development and deployment of the BRSH involves several technical risks that should be monitored and mitigated to ensure successful implementation and long-term sustainability. These risks reflect uncertainties related to integration, scalability, security, and system performance under operational conditions. The technical risks are presented in Table 8.

Table 8 Technical Risks

Technical Risk	Technical Risk Description
Integration Complexity	The BRSH is intended to connect with external tools, data repositories, and authentication systems. Differences in data formats, APIs, or access protocols may create interoperability challenges.
Scalability Constraints	As the platform grows in user base and content volume, performance may degrade if the system is not properly optimised. Efficient database design and modular backend architecture will be necessary to support future growth.
Security Vulnerabilities	Improper handling of user authentication, permissions, or data transmission could expose the platform to unauthorised access or content manipulation. Adherence to established security practices and regular audits will be essential.
User Contributions or Metadata Quality	Without standardised input and validation rules, user-contributed content may become inconsistent or difficult to manage. This can affect search functionality and content credibility.
Technology Stack Mismatch	Choosing frontend or backend technologies that are not adequately supported or maintained could limit the system's extensibility and support options in the future.
Platform Transition Risks	If the BRSH is migrated to a different hosting environment post-project, technical handover processes should be carefully planned to prevent loss of functionality or data.

10.2 Mitigation Strategies

To ensure the successful development and long-term sustainability of the BRSB, a series of mitigation strategies might need to be implemented to address the potential risks. Key mitigation strategies are described in Table 9.

Table 9 Risk Mitigation Strategies

Mitigation Measure	Technical Risk Description
Incremental Development	Platform features could be rolled out in stages, allowing early testing and feedback before full-scale deployment. This reduces the risk of system-wide issues and enables quick improvements.
Modular Architecture	The use of a modular design allows for independent development and replacement of components, improving maintainability and reducing the impact of potential failures in isolated parts of the system.
User Feedback and Error Reporting Mechanisms	A built-in contact form and content reporting feature will enable users to flag errors, suggest amendments, or raise concerns about the accuracy or relevance of published material. This supports ongoing quality assurance without requiring continuous expert validation.
Security-by-Design Principles	Security will be embedded in all layers of the system from the outset, with routine checks, user role isolation, and secure authentication mechanisms in place to reduce vulnerabilities.
Sustainability Coordination	Dedicated planning will be undertaken to address long-term hosting and governance, including discussions with networking environments such as CMINE.

10.3 Organisational Dependencies

The successful development and operation of the BRSH depends on coordinated input and sustained collaboration among several project partners and external stakeholders. These organisational dependencies include technical development, content provision, stakeholder engagement, and long-term governance. The key dependencies are presented and described in Table 10.

Table 10 Key Dependencies

Key dependency	Description
Technical Development Partners	IANUS Technologies, which is the responsible organisation for platform development and integration of tools, aims to deliver a stable and functional platform.
Content Contributors	The BRSH relies on material provided by EMBRACE partners, CBRN experts, and stakeholders. Timely submission of documents, tools, and data is essential for populating the knowledge base.
Biotoxin Task Force (BTF)	As the primary stakeholder group and early access community, the BTF plays an important role in testing, feedback, and improvement of the BRSH. Engagement from its members can boost the platform's usability and relevance.
Dissemination and Integration Partners	Collaboration with CMINE and other networks can be beneficial for visibility, access facilitation, and long-term uptake.
Sustainability Planning	The sustainability of the BRSH will require the establishment of a defined sustainability framework for operational continuity, content maintenance, and stakeholder engagement after the project ends.

11 CONCLUSION AND NEXT STEPS

The BRSB is envisioned as a strategic outcome of EMBRACE, bridging technical outputs, policy recommendations, and stakeholder needs through a secure and accessible digital infrastructure. By consolidating biotoxin-related knowledge into a role-based platform, the BRSB aims to strengthen Europe's capacity to anticipate and manage biological toxin threats. The deliverable outlines the foundational requirements and architectural requirements that will guide the development of the platform through its remaining implementation phases.

As the development of BRSB is ongoing, the platform's functionality will continue to be refined through feedback from users and partners to improve it and tailor it to the end users' needs. Sustainability strategies and future hosting arrangements will be clarified as the platform matures and gains traction across its stakeholder base.