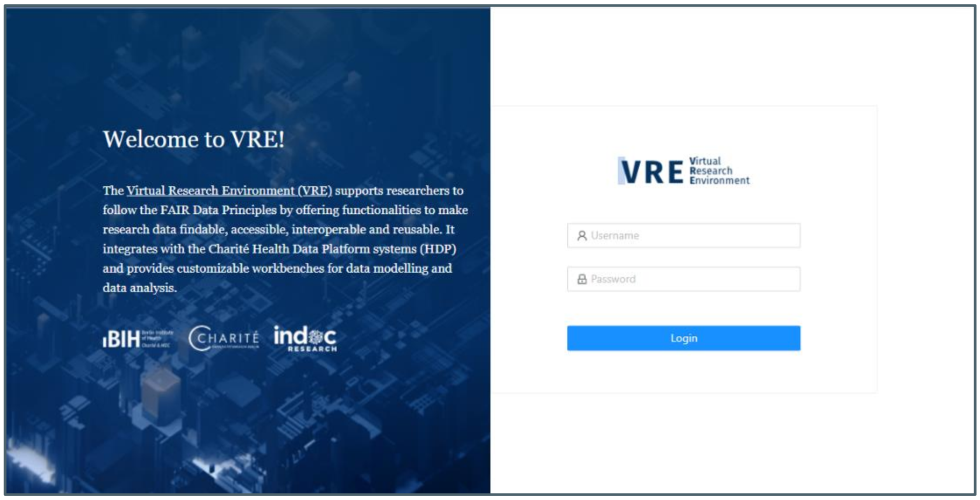
VRE Virtual Research Environment

USER GUIDE



CHARITÉ UNIVERSITÄTSMEDIZIN BERLIN

BIH Berlin Institute of Health Charité & MDC

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Contents

1 Introduction

1.1 About the Platform

The Virtual Research Environment (VRE) was designed to make it easier for Researchers to find and securely access health data. Built on the FAIR guiding principles – Findability, Accessibility, Interoperability and Reusability – the VRE provides interoperability with international data commons like those developed under the European Open Science cloud, such as the Virtual Brain Cloud or the Human Brain Project and operates as an extension of the Charité Health Data Platform (HDP) systems.

The VRE platform was designed by the Charité in collaboration with Indoc Research to extend and complement the functionalities of the Charité Health Data Platform (HDP). The VRE provides additional specialized methodology and technology capabilities for data processing, data management, visualization, and analysis including:

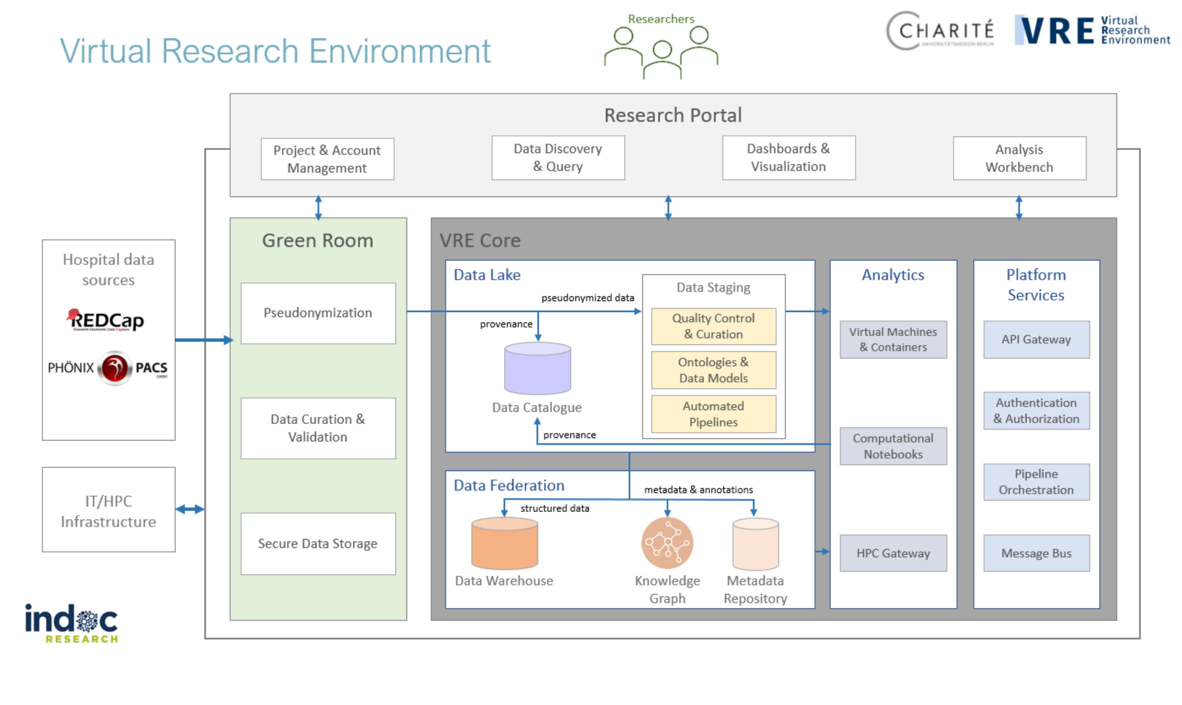
1. Workflows for radiologic imaging data
2. A model for cataloguing data and making it easier to find
3. Workbenches for modelling, simulating, and analyzing data
4. A Research Portal that is open also for external users who do not belong to Charité
5. Interoperability with international data commons like those developed under the European Open Science cloud, for example the Virtual Brain Cloud or the Human Brain Project

The development and requirement gathering process of the platform is ongoing. Existing architecture such as the Data Lake and data federation systems are designed to support the eventual integration of additional data sources and modalities such as clinical systems, electronic medical records, and genomics workflows.

1.2 Platform Architecture

The architecture of the VRE includes two distinct data storage areas: The Green Room and the VRE Core. The Green Room is a segregated data zone for the storage of data with personally identifiable information. The VRE Core supports the full lifecycle of data after being deidentified in the Green Room. The VRE provides a Researcher Portal to manage research projects, files and users, data storage via Data Lake and Data Warehouse, and workbenches for researchers to perform secure modelling, simulation and analysis of data with Shared Services and Analytic Resources (**Figure 1**).

Figure 1. Schematic Diagram of VRE Components



1.3 Definitions

Charité/BIH Infrastructure and Services
Various IT systems and services are integrated to provide networking, computing, storage, and other infrastructure required by the VRE. Services include transfer of data from existing research and clinical data sources (e.g., file stores, REDCap, PACS) into the Green Room; Hadoop and other systems deployed within the Health Data Platform; high performance computing clusters for running preprocessing pipelines; and backup, recovery, and data archival systems that ensure that data are kept safe and available at all times.

Data Controller
Has the meaning ascribed to it under GDPR.

Data Gateway API
An application programming interface that enables the Research Portal to exchange data and metadata with VRE systems and allows the VRE to be interoperable with other data platforms, data sources and systems.

Data Lake

A zone within the VRE in which data of any type can be received, stored, catalogued, and ultimately ingested into platform databases. Standard data models and ontologies are applied to allow datasets to be aggregated and processed. Data can be further de-identified here for broader sharing. Quality assurance, quality control and preprocessing pipelines prepare the data for visualisation and analysis.

Data Processor
Has the meaning ascribed to it under GDPR.

Data Staging Pipelines
Workflows built into the VRE to allow automated processing of data. Pipelines help to eliminate or minimize manual intervention and facilitate a smooth flow of data from one stage to the next. Pipelines can be deployed to automate quality assurance, quality control, curation, validation, streaming, transformation, pre-processing, archival, and aggregation of data for downstream processes such as report generation, visualization, or query.

Data Warehouse
A set of databases and services which transform diverse data into a unified, federated context. Federation is critical for harmonizing data and metadata so that information about participants and datasets can be queried, visualized, and analyzed across studies, data sources, and modalities. The Metadata Repository and Knowledge Graph implement standardized and extensible schemas to represent metadata derived from datasets as well as annotations generated by researchers.

GDPR
The European Union General Data Protection Regulation.

Green Room

An environment in which hospital data, such as data derived from electronic health records (EHRs), picture archiving and communication systems (PACS), laboratories, and other sources, can be de-identified, transformed, and prepared prior to being transferred to VRE Core systems and made available for research use.

Research Portal
The primary interface for researchers to access VRE functions and resources, including data capture tools, interactive dashboards and viewers, query tools, and analysis workspaces.

Virtual Research Environment

A platform designed by the Charité in collaboration with Indoc Research to facilitate secure data storage, analysis, and collaboration among members of a research project.

VRE Core

An environment in which de-identified hospital data, such as imaging, clinical and molecular data derived from electronic health records (EHRs) and other sources, can be securely stored, federated, and analyzed. Data is transferred to the VRE Core after undergoing de-identification and transformation pipelines in the VRE Green Room.

Workbench
A Workbench is a flexible and interactive environment in which users can access, visualise, and analyse their data with a range of analysis and visualisation tools. Workbenches are supported by underlying computing infrastructure and single sign-on protocols to permit data to be provisioned according to project and user role.

2 Getting Started

2.1 Creating a Project in the Virtual Research Environment

Researchers interested in using the VRE should contact the VRE Support Team at vre-support@charite.de to discuss the application process and next steps. As the Data Controller, the Principal Investigator of each research project is expected to obtain all necessary data sharing agreements, research ethics approvals, and institutional data protection office endorsements to protect the rights of the data subjects before using the VRE.

After these requirements have been met and the project is approved by the Charité, the VRE administrative team will initiate the Project in the VRE, invite the first Project Member, and grant them the role of Project Administrator. The Project Administrator can invite additional members of their research team.

2.2 User Account Registration

If you have been invited to a VRE Project, you will receive an email containing an invitation link. Click on the link to create your VRE account. You will be asked to provide:

- Username (between 6 – 20 characters long, may only contain lowercase letters and numbers; must be unique in the VRE)
- Your First and Last Name
- Your choice of password (see Section 2.5.3 Password Requirements)

You will also be asked to review the Terms of Use and click **Agree** to finalize your registration. You are now a member of the VRE Project.

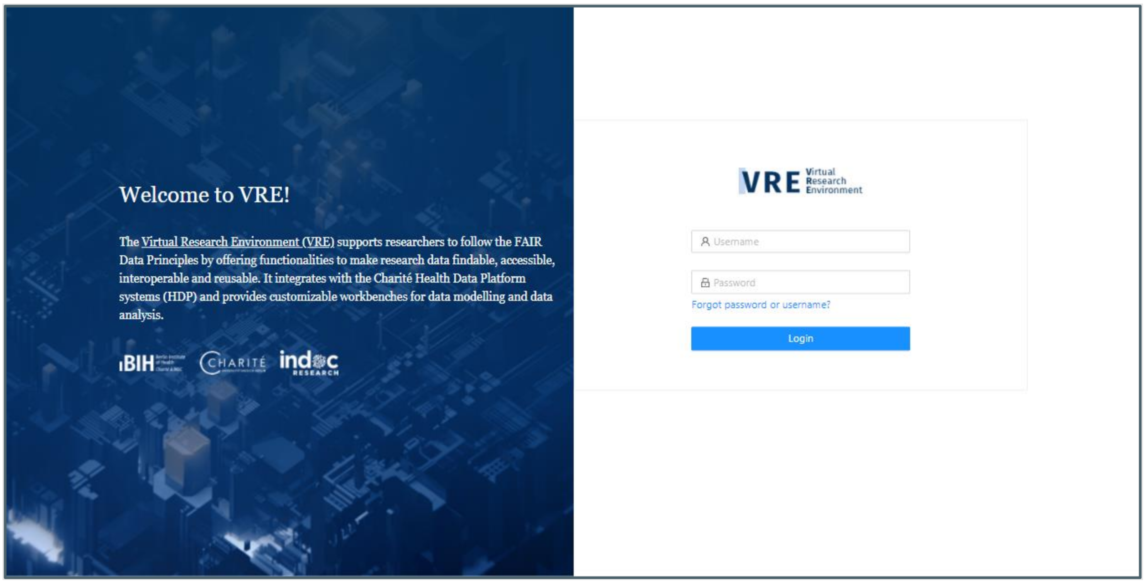
Note: The VRE portal can be accessed using Google Chrome, Firefox, Microsoft Edge, and Safari. Some older browser versions as well as Internet Explorer may not be supported.

2.3 Logging into the Virtual Research Environment

2.3.1 How to Log in and out of the VRE

To access the Virtual Research Environment (VRE) start by opening a supported web browser (Chrome, Firefox, Safari, or Edge).

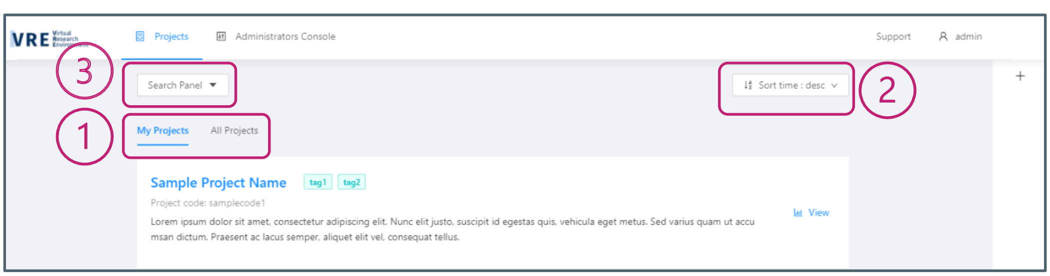
1. Visit the VRE portal at https://vre.charite.de/vre in your browser, click **Login** and enter your username and password.



2. To log out of your session manually, click on your username in the top right of the Main Menu and select **Logout**. For security reasons, after 30 minutes of inactivity you will be warned that your session will expire and if no further action is performed your session will be logged out automatically.

2.3.2 Finding Projects in the Landing Page

The **Landing Page** is the first entry point after login. From here you can browse basic information about Projects in the VRE and access your Project.



1. The **My Projects** tab displays a list of the Projects to which you have been given access, along with some basic information about the project. The **All Projects** tab displays all the projects registered in the VRE. Even though you can discover and

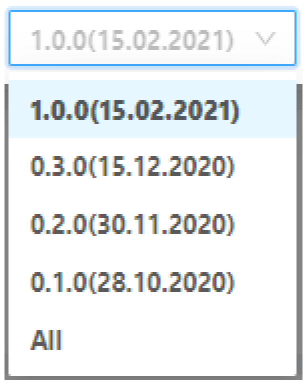
browse the basic information about all projects, you can still only access the projects to which you have been given access.

2. Click **Sort** to order the Projects by different sort criteria.
3. Open the **Search Panel** to search by various project attributes.

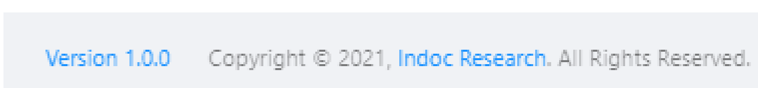
2.4 Platform Updates and Versions

The VRE is continuously evolving to meet the needs of the Platform users. When a new version is released you will receive a notification the first time you log in, click the embedded link to view the latest version release notes.

To view the new features and bug fixes implemented in previous versions click the dropdown menu in the bottom corner of the window and select the *Version Number* and *Release Date*, of the release notes you wish to view.



You may also view current or past release notes by clicking on the **Version Number** listed in the page footer of any page in the VRE Platform

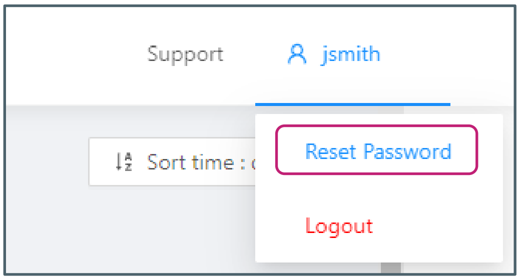


2.5 Account Settings

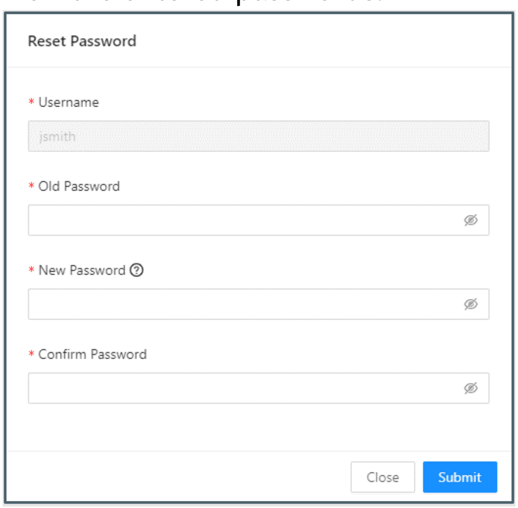
2.5.1 Password Reset

To change your password:

1. Log in to the VRE portal https://vre.charite.de/vre in your browser, click on your username in the top right-hand corner of the *Projects* main page and select **Reset Password** from the dropdown.



2. Enter your username, previous password, and new password. Use the button to view the entered passwords.



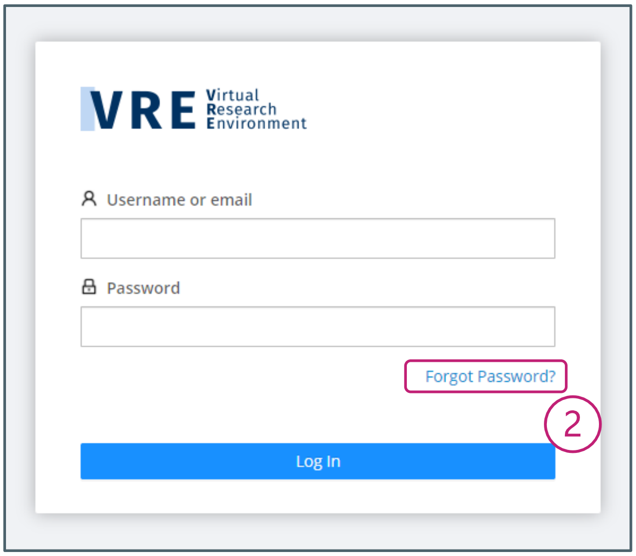
3. Click **Submit**

2.5.2 Forgot Password

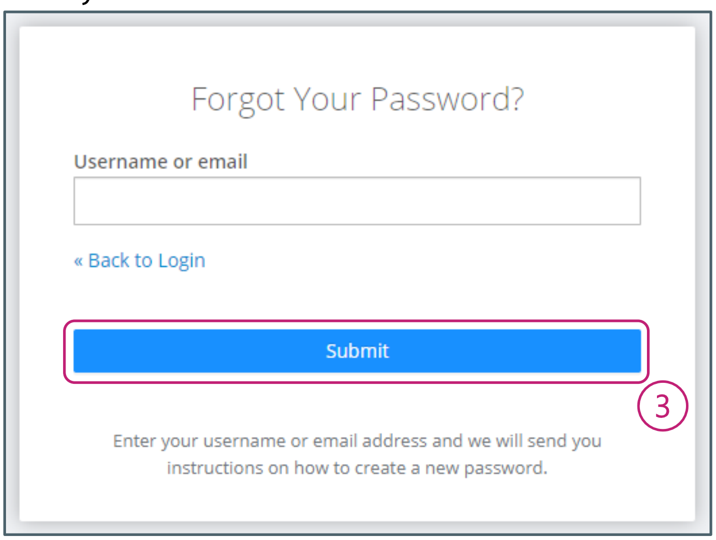
If you have forgotten your password:

1. Navigate to the VRE portal https://vre.charite.de/vre in your browser and click **Login**

2. Click the **Forgot password?** link in the bottom right-hand corner.



3. Enter your username or email address and click **Submit**



4. An email containing a password reset link will be sent to the email address associated with your VRE user account. The password reset link will expire after 5 minutes without action, and/or will be expired immediately when the reset process is finished.

2.5.3 Password Requirements

- Passwords must meet the following criteria:
  - Length between 11-30 characters,
  - at least uppercase letter (ABCDEFG...XYZ)
  - at least one lowercase letter (abcdefg...xyz)
  - at least one number (0123456789)
  - at least one of the following special characters: `- _ ! % & / ( ) = ? * + # , . ;`

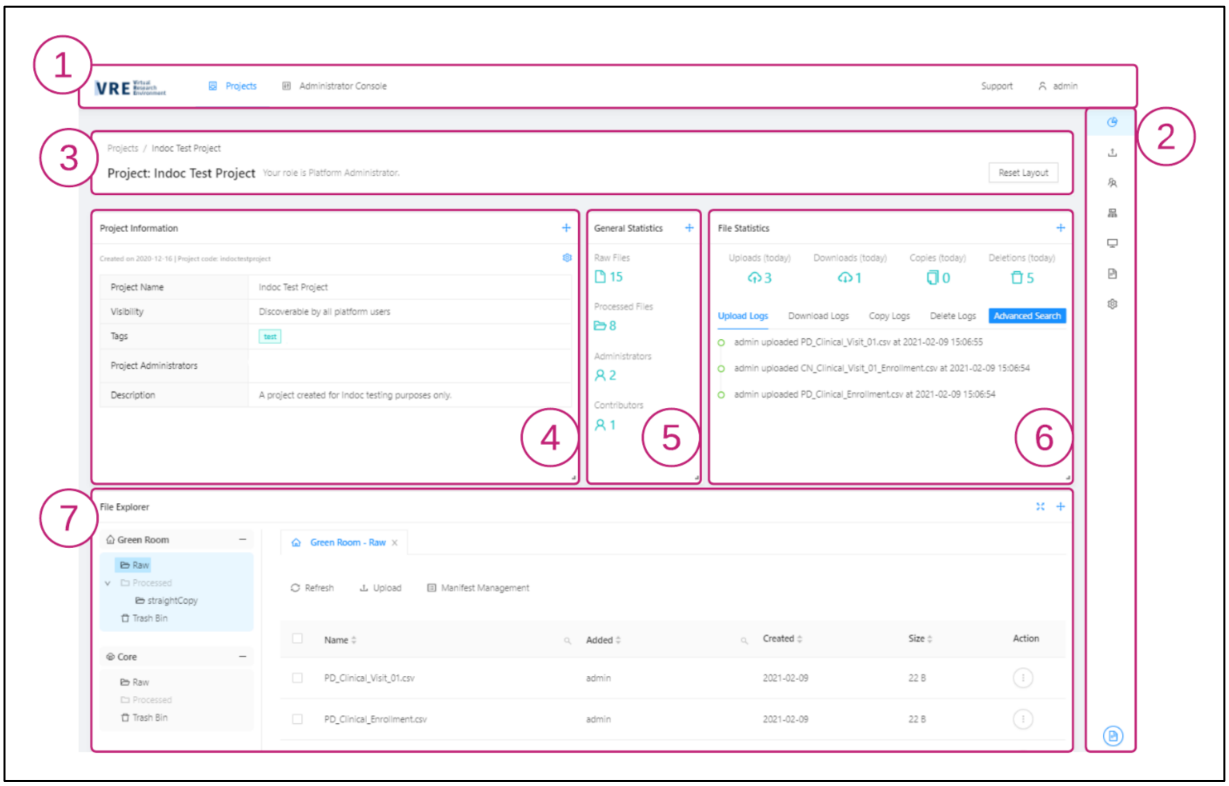
    Other special characters are not permitted.
- Trivial and already compromised passwords as well as first names, family names or usernames (alone and exclusively or as part of the password) are not to be used
- Passwords must be changed after confirmation or if there is a reasonable suspicion that they have been compromised or have been noticed by third parties

3 Project Canvas

3.1 General Layout

The Project Canvas has seven main components:

1) Main Menu
2) Right Sidebar
3) Project Title bar
4) Project Information card
5) General Statistics card
6) File Statistics card
7) File Explorer card



Note: Cards with a blue directional arrow icon can be rearranged by clicking the icon and dragging the card to a new location on the canvas. Click the *Reset Layout* button in the Project Title bar to restore the card configuration to the default layout.

3.1.1 Main Menu

The Main Menu is used to navigate to the *Projects Landing Page, Administrators Console,* and *Support Page*, as well as to access your *Profile* by clicking your username, where you can also log out or reset your password.

3.1.2 Right Sidebar

The Right Sidebar is used to access Project tools:

Canvas

Homepage of a VRE Project. Displays *Project Information*, *General Statistics*, *File Statistics*, and *File Explorer*.

Upload
Opens the *Upload Files* modal where Members can select files from their local machines to upload to the Project.

Teams

Navigation to the *Members* page where Administrators can view all Project Team Members, add Members, change Member's roles, and delete Members from the Project.

Guacamole

When configured in a project, allows access to Apache Guacamole, a clientless remote desktop gateway to facilitate workbench analyses with, for example, containerized pipelines.

JupyterHub

When configured in a project, allows access to JupyterHub, providing access to data science computational environments with pre-installed project resources.

XWiki

When configured in a project, allows project members to access XWiki, an online content management tool for project documentation.

Settings

Opens the *Project Settings* page where the Project name, description, tags, and visibility can be edited. File Manifests can also be created, edited, imported, and exported in the *Settings* page.

Files Panel

Opens the *Files Panel* in the current page. This panel displays the status of files that are currently uploading or downloading as well as the status of previously uploaded files.

3.1.3 Project Title Bar

The *Project Title bar* provides the Project navigation path, the Project Title, your user role in the Project, and allows you to reset the *Project Canvas* to the original card configuration.

3.2 Project Canvas Cards

3.2.1 Project Information

The Project Information card displays basic information about the Project:

- **Created on:** Date the Project was created in the Platform.
- **Project Code:** A code used by VRE backend services to uniquely identify the Project across the VRE. The Project Code cannot be changed.
- **Project Name:** A short and user-friendly title assigned to the Project to make it easier for Members to identify and locate the Project.
- **Visibility:** Provides information on who can see the Project name and description in the *All Projects* view on the Landing Page. If the Project visibility is set to *Discoverable*, the Project will be visible to all platform users; if the Project visibility is set to *Hidden*, the project will be visible to Project Members only.
- **Tags:** Keywords that can be assigned to Projects to help organize and find information in the VRE.
- **Project Administrators:** Displays the Project Administrator(s) for the Project. Click a name to open an email and submit an inquiry to the Project Administrator.
- **Description:** A longer, more informative description of the study. This information can be edited by the Project Administrator on the *Settings* page.

Visible only to Project Administrators: The Project Information card also includes a link to the *Settings* page for Project Administrators to edit the *Project Name, Tags, Visibility,* and *Description*. See Section 4.2.1 Editing Project Information for more details.

3.2.2 General Statistics

Visible only to Project Administrators. Four statistics are displayed:

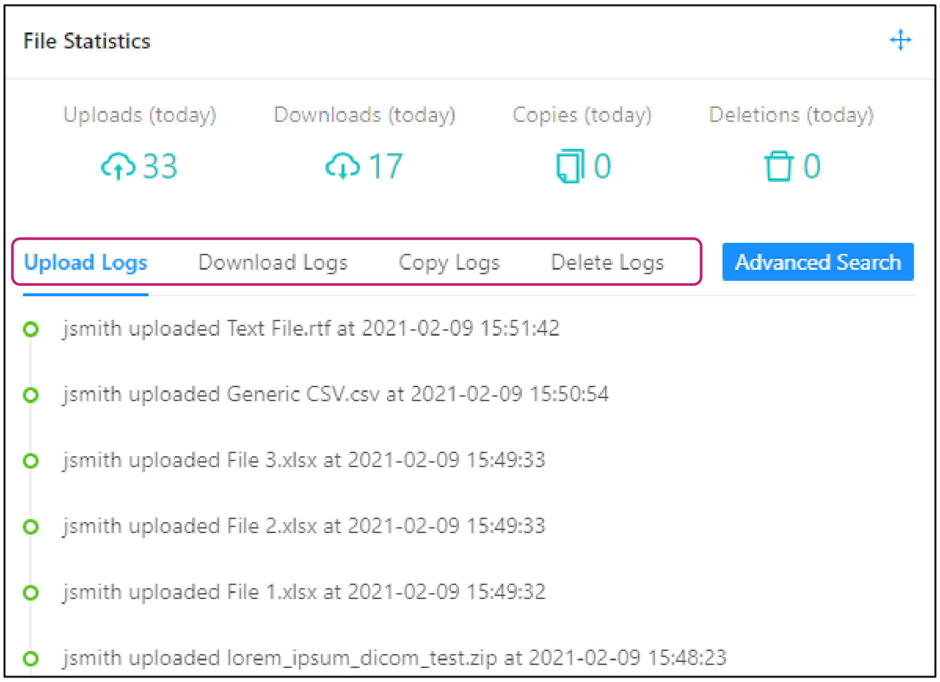
1. Number of **Raw files** in the Project (files uploaded)
2. Number of **Processed files** in the Project (files processed by pipelines; if applicable)
3. Number of Project Members with the **Project Administrator** role
4. Number of Project Members with the **Contributor** role.

3.2.3 File Statistics

Four statistics are displayed:

1. **Uploads (today)**: Number of files uploaded to the Project today
2. **Downloads (today)**: Number of files downloaded from the Project today.
3. **Copies (today)**: Number of files copied from one folder to another today.
4. **Deletions (today)**: Number of files moved to the Trash Bin today.

A list of Today's **event logs** for each event type can be seen in the File Statistics card by clicking on the Log type.

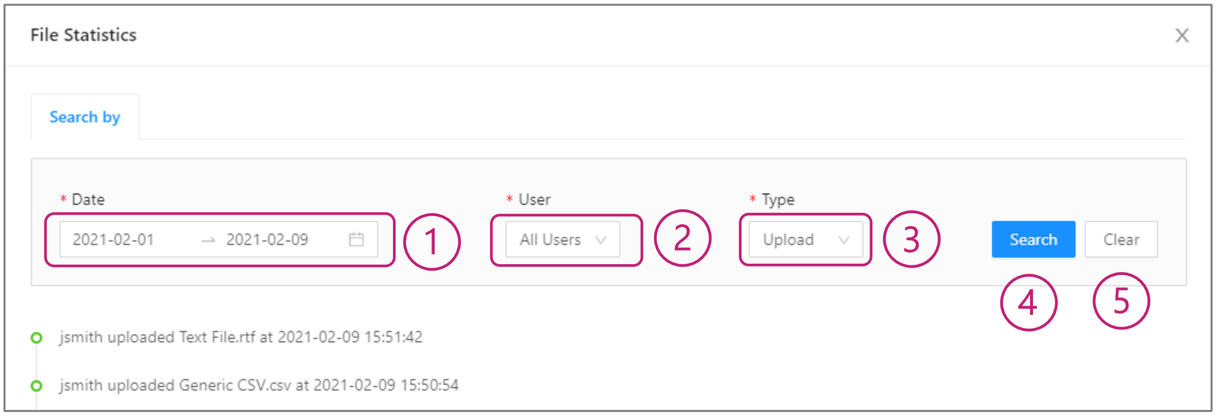


Note: Information displayed in the File Statistics card depends on a user's role.

3.2.4 File Statistics – Advanced Search

Search and view detailed file activity logs by clicking **Advanced Search** in the *File Statistics* card to open the File Statistics Search panel.

Project Administrators can explore statistics for the entire Project, whereas Contributors and Collaborators can only explore statistics for their own files and actions.

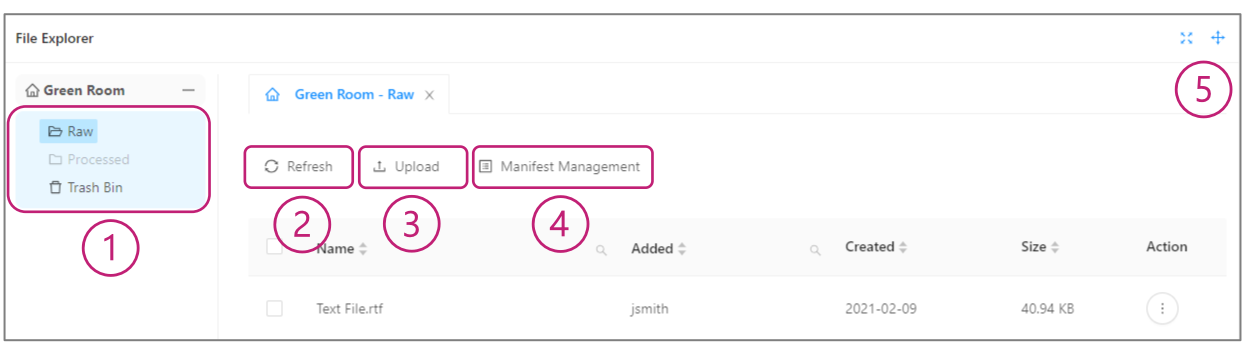


1. Choose the date range you wish to search by entering the desired start and end dates in the format YYYY-MM-DD, or click the calendar icon to clear the dates and select a new date range from the dropdown
2. *Project Administrators only:* Select the Project Member you wish to search by selecting their username from the *User* dropdown
3. Filter the Log type by selecting **Upload**, **Download, Copy,** or **Delete** from the *Type* dropdown
4. Click **Search** to view all Log entries that match your search criteria
5. Click **Clear** to begin a new search

3.3 File Explorer

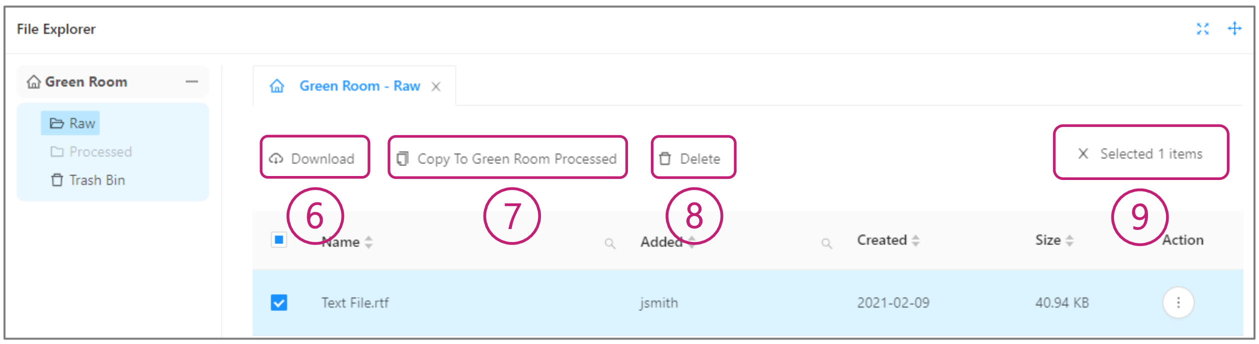
3.3.1 Layout

The *File Explorer* offers several features to view, upload, and manage files and to search and sort files. The folders displayed may vary from the example below depending on your project.



1. **File Explorer Folder list** shows the available folders. Click a folder to view its contents in the **File List**. If you don't see a folder, it may be because your user role does not allow you to see it. Contact the Project Administrator for questions about access. Folder tabs can be closed by clicking the **X** beside the folder name.
2. **Refresh** button refreshes the File list from the database. Refreshing your browser page will also refresh the File list.
3. **Upload** button. See Section 3.4 File Upload for more details.
4. **Manifest Management** button. See Section 3.3.4 Manifest Attributes for more details.
5. **Expand** icon expands the *File Explorer* into a larger window.

When a file is selected in the *File Explorer* additional actions are made available.



6. **Download** button. See Section 3.5 File Download for more details.
7. **Copy** button. See Section 3.7 3.7Copying Data from Green Room to the VRE Core for more details.
8. **Delete** button. See Section 3.9 File Deletion for more details
9. **Selection Items Count**. Click the X to unselect all selected files.

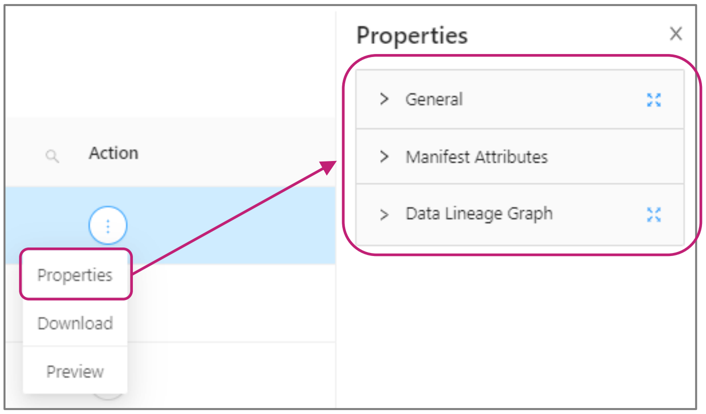
The following columns and options are available in the **File List** of the selected folder:

- **Name**: search and sort by filename.
- **Added**: search and sort files by the user who uploaded/created the file.
- **Created**: sort files by the uploaded/created date.
- **Size**: sort files by size.
- **Action**: For more file actions, click the *Action menu* (vertical ellipsis). Available actions are *Properties*, *Download*, and *Preview* (Zip files only). See Section 3.3.2 File Properties for more information.

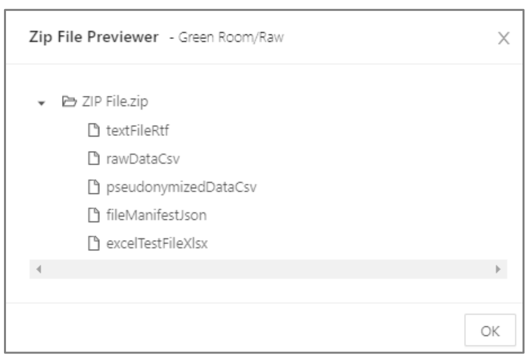
Note: To view the upload and download logs of your current session click the **Files** icon at the bottom of the Right Sidebar to open the *Files Panel.*

3.3.2 File Properties

A File's **Properties** can be viewed by clicking the *Action menu* ⓘ icon beside the file and selecting *Properties.*

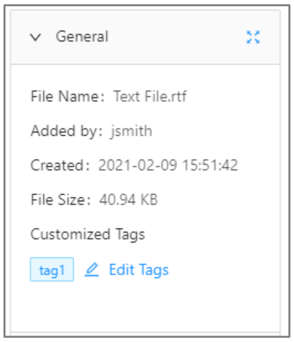


1. **General** – Displays *File Name, Added by, Created, File Size* and *Tags.*
2. **Manifest Attributes** – Displays and allows editing of the key value pairs in a file's manifest attributes. See Section 3.3.4 Manifest Attributes for more details.
3. **Data Lineage Graph** – Displays a history of the file's processing activity. See Section 3.3.5 Data Lineage Graph for more details.
4. **Preview** – The Action menu for ZIP files will include the option to preview the contents of the ZIP file.



3.3.3 General

The **General** section of the File Properties displays the file's name, the user that added the file to its current folder, the date and time the file was created, and the size of the file.

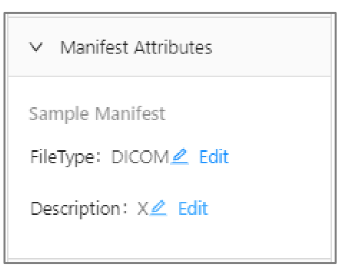


Customized Tags – Displays the file tags. If no tags have been assigned, click **New Tag** to add one or more file tags.

To modify or remove existing tags, click **Edit Tags**. When adding a new tag, press the **Enter** key to complete entry of the new tag. When done editing tags, select **Finish Edit**.

3.3.4 Manifest Attributes

The **Manifest Attributes** section of File Properties displays the name of the manifest applied to the selected file and allows you to view and edit the File's Attributes.



To change a file's attribute, click the **Edit** button next to the attribute, make the required change and click **Save.** File Attributes can be edited by the File Uploader or a Project Administrator. To learn about creating and configuring File Manifests please see Section 4.3 File Manifests.

3.3.5 Data Lineage Graph

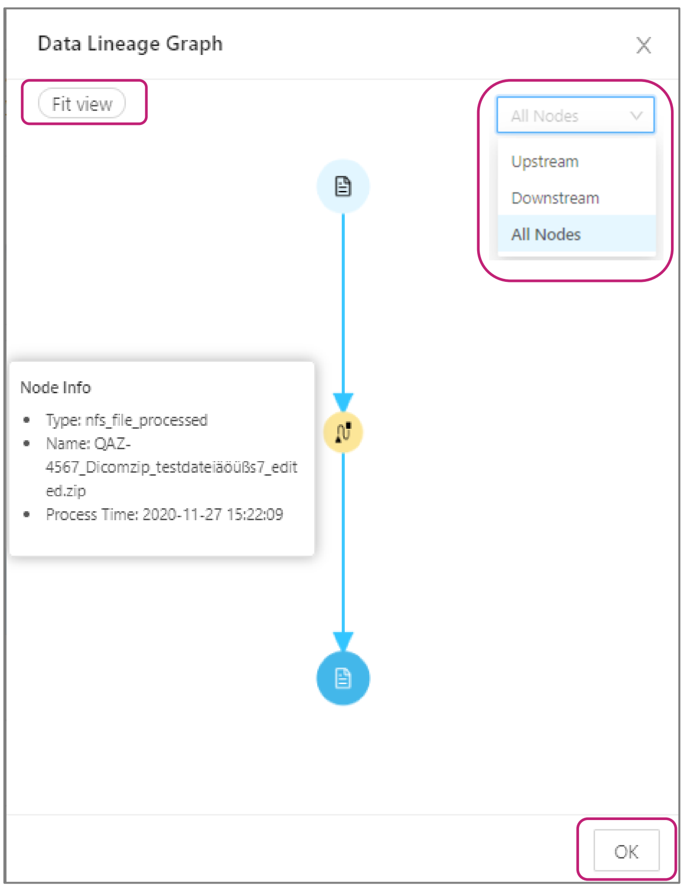
The **Data Lineage Graph** displays metadata about what happened to the file from upload to its current destination. This data provenance can be useful for discovering the data lifecycle of the file and for auditability and data governance.

The Data Lineage Graph can be accessed from the File Explorer by clicking the *Action menu* ⋮ icon beside a file and selecting *Properties > Data Lineage Graph*.

Exploring the Data Lineage Graph

To view the Data Lineage Graph in a larger window, click the expand icon

1. The data lineage graph can be explored by scrolling with a mouse or scrolling with the *Ctrl* key held down to zoom in/out.
2. Click **Fit view** to refit the graph back to the default, centred state.
   Click the **Nodes** dropdown to filter the Data Lineage Graph to show *Downstream* nodes, *Upstream* nodes, or *All Nodes* in the file's lineage



Understanding the Data Lineage Graph

The data lineage graph displays file lineage information as nodes starting with file upload as the first node. If the file was processed or copied, additional nodes will be displayed. Hovering on a node displays *Node Info* containing the following information:

- **Type**: the file's metadata entity while in this state. For uploaded files this is always *nfs_file* (network file storage file)
- **Name**: the name of the file while in this state.
- **Process Time**: the end time of the processing activity.

Different icons distinguish the first and last node and any interim processing nodes.

Current File

Represents the current state of the file in its lineage. Hover over the file node to view the *Type, Name,* and *Process Time* of the current file.

Processing Node

The Processing node indicates a processing activity such as a processing, pipeline, or copy/delete actions. Hover over the Processing node with your cursor to view the processing action and the date and time it was completed.

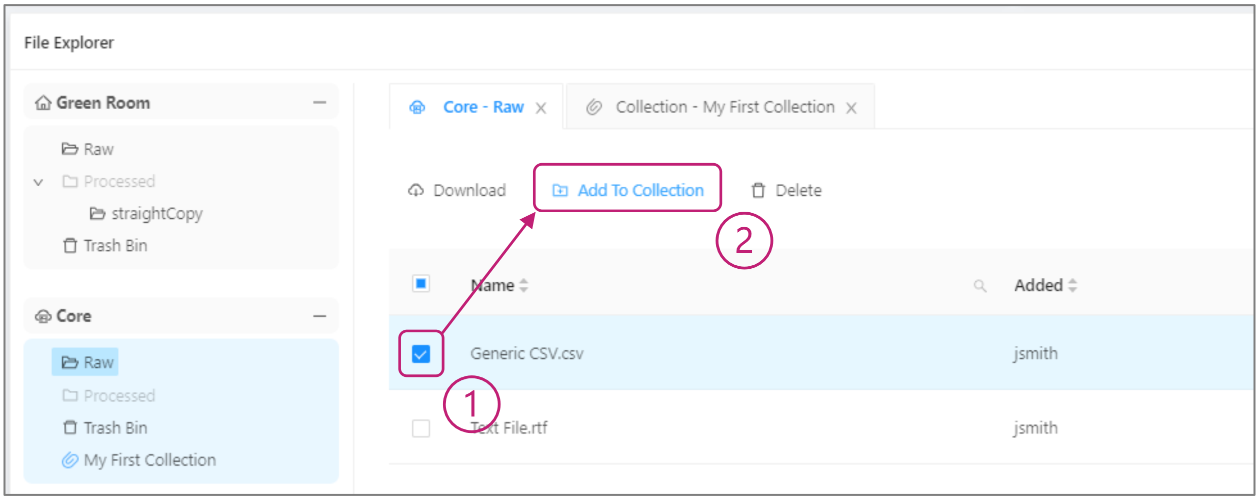
Upstream or Downstream Version of Current File
Represents either an upstream or downstream version of the current file. Hover over the file node to view the *Type, Name,* and *Upload Time* of the file.

3.3.6 File Collections

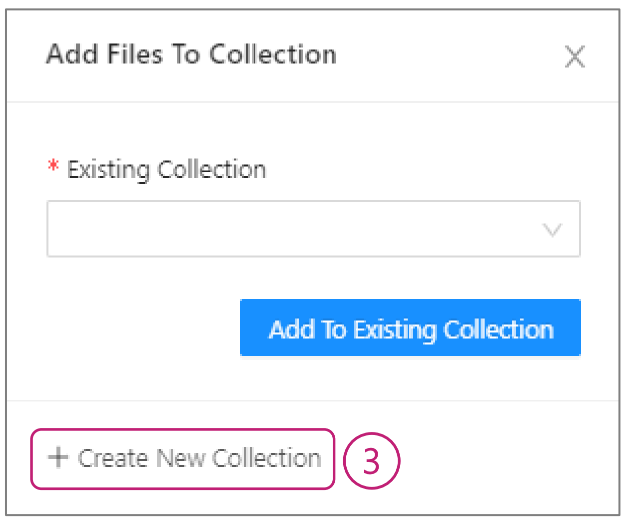
Project Collaborators and Administrators can add files stored in the VRE Core into personal Collections. These 'virtual folders' allow a user to organize and group their files without affecting the file's storage location or data lineage. Currently collections are only visible to their creator - future versions of the VRE will include the option to share Collections with other Project Members.

To create a new Collection for organizing files, follow the steps below:

1. Navigate to the *File Explorer* on your Project Landing Page, open a folder in the VRE Core and select one or more files.
2. Click **Add To Collection** – note that <u>one file can be added to multiple collections</u>.

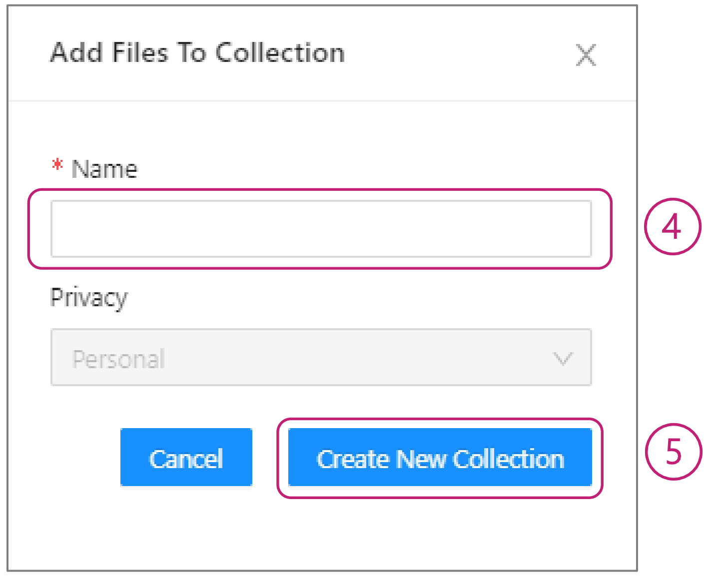


3. You may add the file to an existing Collection or click **Create a New Collection.**

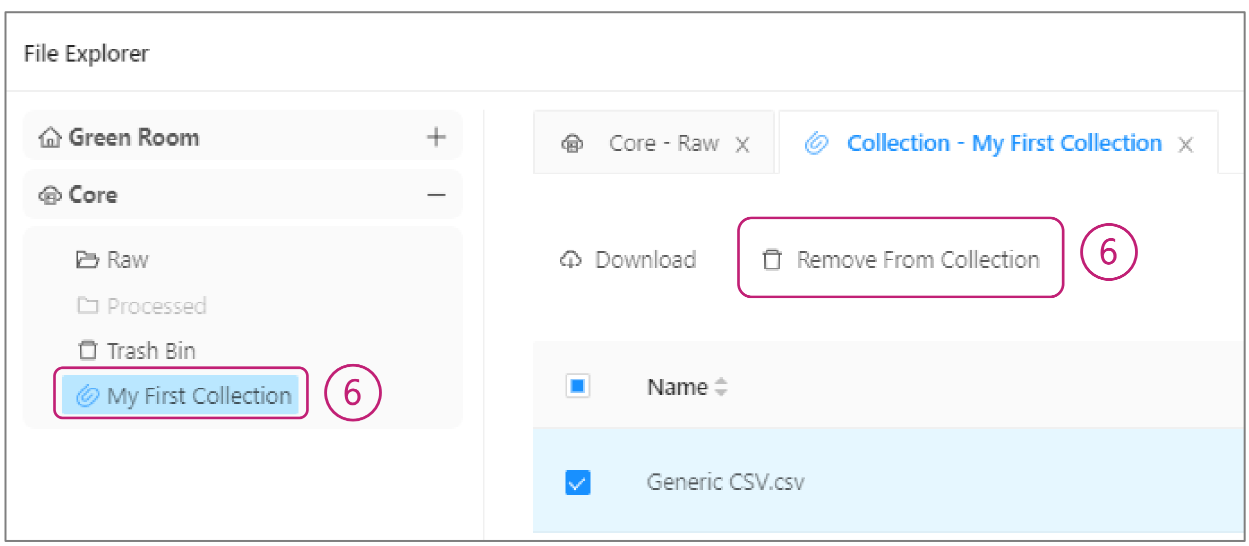


4. You will be prompted to enter a *Name* for your Collection and select a Privacy level – <u>currently only allows personal Collections can be created in the VRE</u>, future versions will provide different options for sharing your files.

5. One you have entered a name, click **Create New Collection**.



6. Your selected file(s) will be added to your new Collection automatically. To view the files in your Collection, click the Collection name in the folders in section of the File Explorer section of your Project Landing Page.
7. To *remove* files from your Collection, check the boxes next to the files you wish to remove and click **Remove From Collection**.



If you wish to delete a Collection, navigate to your Collection in the File Explorer and click the **Delete Collection** button in the File Explorer Action bar.

> **Note:** Removing data from a Collection or deleting a Collection will not affect the file, its data lineage or its storage location on the VRE.

3.4 File Upload

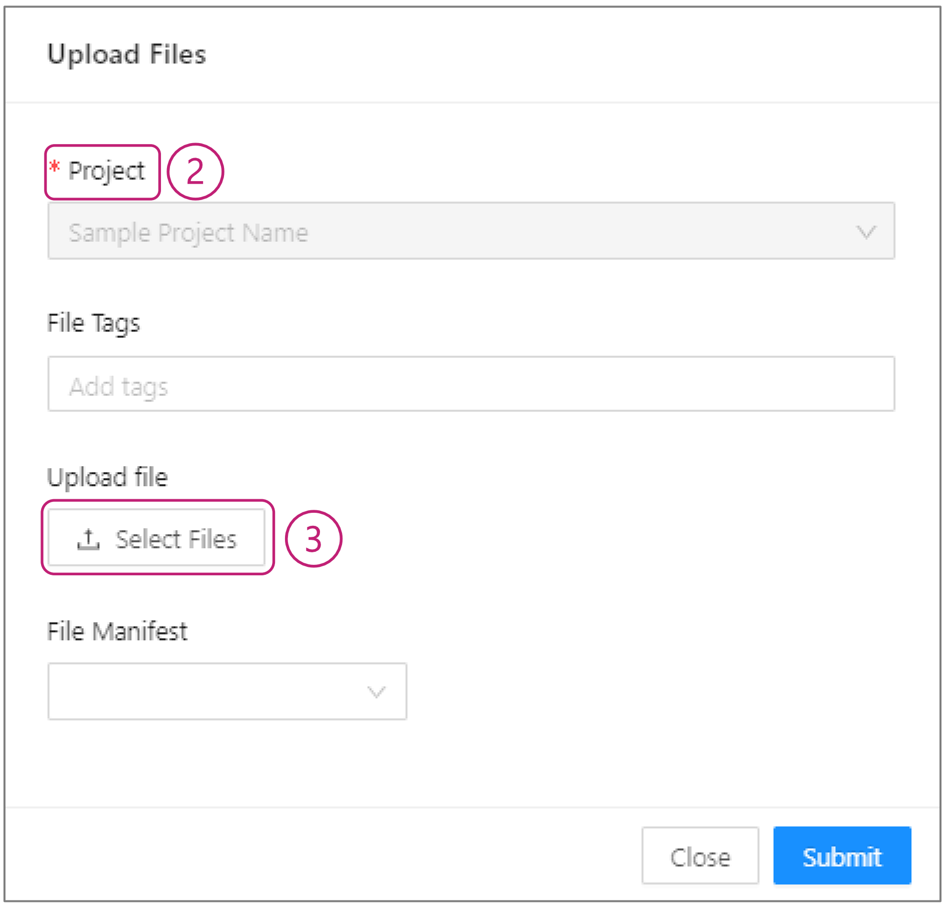
All Project Members are reminded to abide by the Platform Terms of Use, Data Sharing Agreements, and their obligations as Data Controllers when uploading files to the VRE.

All files uploaded to the VRE land in the Green Room storage. In this protected storage area Project Administrators can configure automated sanitization pipelines or other methods for pseudonymization of incoming files to ensure no sensitive personal information is transmitted to the VRE Core where broader research collaboration and analysis occurs.

3.4.1 How to Upload a File to your Project

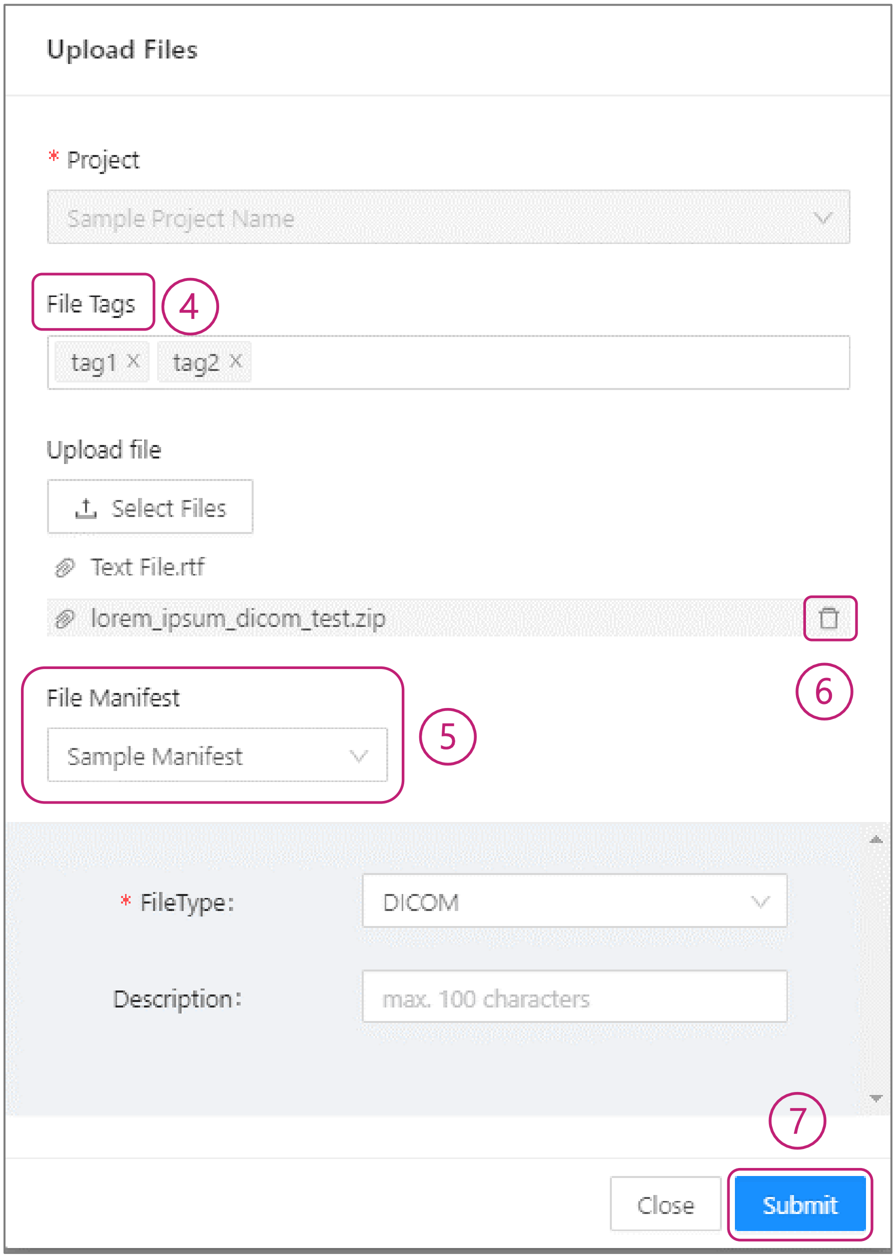
Files can be uploaded individually or in bulk from the *File Explorer*.

1. Navigate to your Project click either the **Upload icon** in the *Right Sidebar* or the **Upload button** in the *File Explorer* to open the *Upload Files* window.



2. The *Project name* is pre-filled and cannot be modified.
   - Check the entry to confirm you are about to upload data to the correct project. If not, close the window and return to the Landing Page to access the correct project

3. Click **Select Files** to add one or more files from your local computer.
   - *Optional:* Project-specific information such as a Participant ID or other information specified by the Project administrator may also be requested on upload.



4. *Optional:* Add **File Tags** by typing in the *File Tags input box* followed by pressing 'Enter'. A dropdown will appear if the entered text matches any tags that are attached to any other files in the Project. The tags will turn blue when applied to the upload and can be removed using the **x** button.
5. *Optional:* Add a **File Manifest** by selecting one from the dropdown list provided. A File Manifest can only be added during upload if the manifest has already been created in

the Project *Settings* page by a Project Administrator. For additional information on configuring a File Manifest for a Project see Section 4.3 File Manifests.

6. Review the file list to verify that you have selected the correct files. If you need to remove a selected file, click the trash can icon to **Remove file**.
7. When ready, click **Submit** to begin uploading.

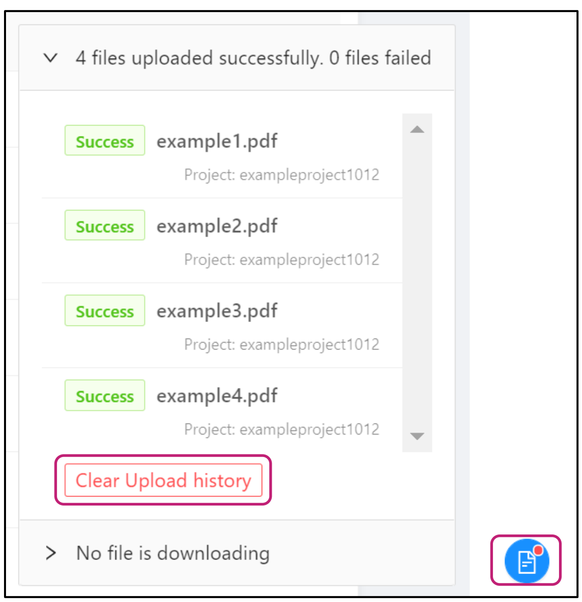
Once a file upload is initiated, the *Files Panel* will appear in the bottom right corner of the page. This panel displays the status of files that are currently uploading, downloading or being processed. It also maintains the status history of all files uploaded or downloaded during your current login session. Click on the Files Panel icon to show or hide the Files Panel. For more details See Sections 3.4.2 Checking File Upload Status and 3.5.2 Checking File Download Status.

For Projects preconfigured with automated pipeline on file upload, refer to Section 3.6 File Processing.

> **Note:** Your session will remain active during file upload. You should not logout or close your browser during file upload.

3.4.2 Checking File Upload Status

The Files Panel displays a status icon for each file uploaded during the current login session. A red dot on the Files Panel icon indicates that the status of one or more files has changed. To remove all previously listed File Upload logs, click **Clear Upload history**. The Files Panel is also cleared when you logout from the current session. Click the Files Panel icon one or more times to toggle between panel show/hide.



Possible file upload status icons are as follows:

Waiting	A grey **Waiting** status means that another file is currently being uploaded and the file is waiting in the upload queue.
Uploading	A blue **Uploading** status means that the file is currently uploading. A progress bar will appear showing the upload progress.
Uploading	A yellow **Uploading** status means that the file upload is being processed.
Success	A green **Success** status means that the file has successfully been uploaded and processed.
Error	A red **Error** status means that there was a problem encountered during file upload. An error message popup will also appear at the top of your browser window.

3.5 File Download

All Project Members are reminded to abide by the Platform Terms of Use and their obligations as Data Controllers when downloading files from the VRE.

Project Administrators can access and download all Project Files, whereas Contributors can only download their own files.

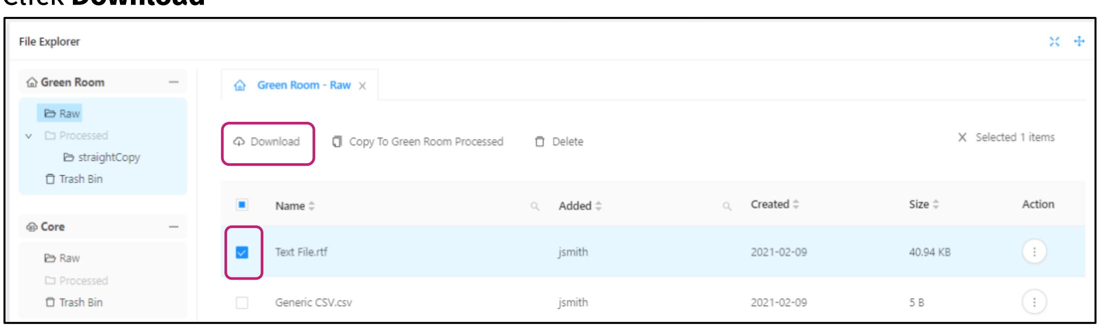
> **Note:** Before attempting to download files, check that popups are enabled and that you have disabled any popup blockers in your browser as these may prevent you from downloading files from the VRE.

3.5.1 How to Download a File from your Project

Files can be downloaded individually or in bulk directly from the *File Explorer*.

Individually:

1. Navigate to your project and locate the folder of interest in the *File Explorer.*
2. Check the box next to the file you wish to download or open the file's Action Menu
3. Click **Download**



Bulk Download:

1. Check the boxes next to the files you wish to download - to select all files on a page, check off the checkbox in the *File List* header.
2. Click **Download**.
3. *Bulk Download only:* if you have selected multiple files for download the files will be packaged in a zip file. A filename containing the *Project Code* will be automatically generated.

Once a file download is initiated the *Files Panel* will appear in the bottom right of the Project Canvas page.

3.5.2 Checking File Download Status

The Files Panel displays a status icon to indicate the status of the file during download. Click the Files Panel icon one or more times to toggle between panel show/hide.

Possible file download status icons are as follows:

Downloading	A yellow **Downloading** status means that the file is currently being downloaded to your local machine.
Success	A green **Success** status means that the files have been zipped successfully and are downloading.
Error	A red **Error** status means that there was an issue downloading the file. An error message will appear at the top of your screen if an error is encountered while downloading a file.

3.6 File Processing in the Green Room

3.6.1 Sanitizing Green Room Files

All Project files and data enter the VRE through the Green Room. The Project Administrator specifies the sanitization procedures required for all incoming Project data files to ensure sensitive personal information is removed before the data reaches the VRE Core for broader research collaboration and analysis. For example, incoming files may require no action (file is already pseudonymized and no further sanitization is required) or may be subject to the execution of a pipeline to remove sensitive personal information.

An example lifecycle of a data file in the Green Room that contains sensitive personal information and is processed with a preconfigured sanitization pipeline:

1. File stored in user's local storage
2. User uploads file to Project using VRE Portal interface
3. File lands in Green Room storage - *Raw* folder
4. VRE services detect file properties, files matching preconfigured conditions trigger pipeline execution.

5. Pipeline executes.
6. The processed output file is stored in Green Room *Processed* folder (named after the pipeline)

If the Project Administrator has configured one or more automated sanitization pipelines for your project, the files in both the Raw and Processed state will be visible in the File Explorer.

> **Note:** Project Members with the Contributor role are only permitted to view the files that they uploaded in the Raw folder. They do not have access to view any other folders.

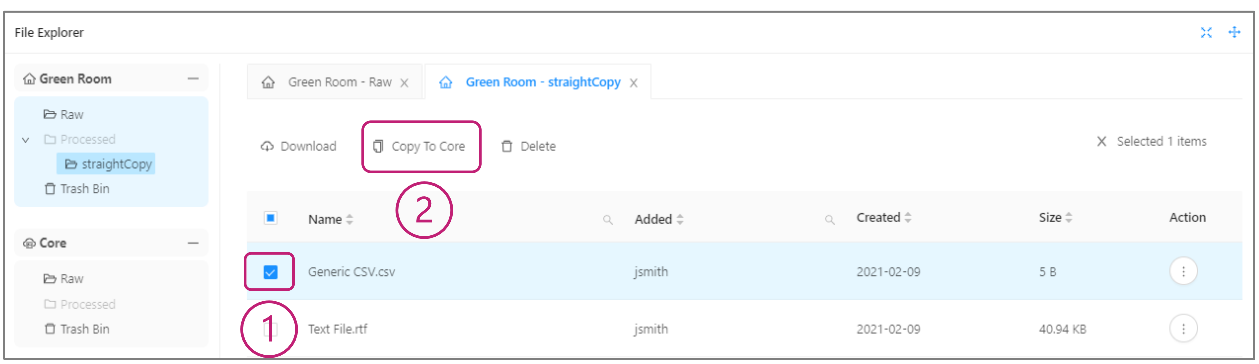
Additional tools and features for managing pipelines will be available in future releases of the VRE.

3.7 Copying Data from Green Room to the VRE Core

Project Administrators can manually approve and copy data from a Project's Green Room to the VRE Core. This feature can be accessed when files are selected in the Green Room *Processed* folder within the File Explorer. File's that are uploaded to the Green Room *Raw* folder must first undergo any necessary processing and be copied to a Green Room *Processed* before they can be copied to the VRE Core.

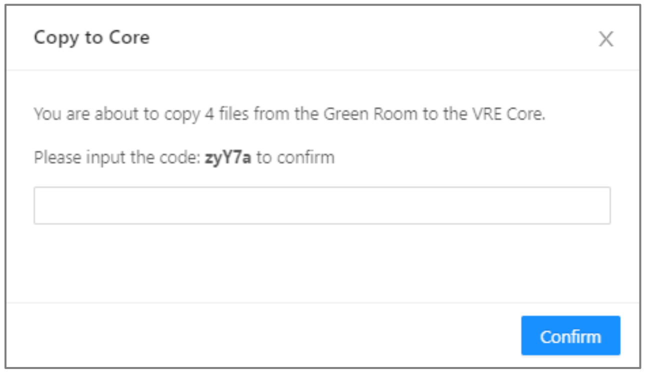
Follow the steps below to Copy Data to the VRE Core:

1. Navigate to your Green Room folder in the *File Explorer* and check the box next to the file(s) you wish to copy.



2. Click **Copy To Core** - you will be prompted to confirm.

3. Input the code displayed in the confirmation window and click **Confirm** again.



4. Your files will be begin copying to the VRE Core and the File Panel will open automatically to show the file status.

A system tag *copied-to-core* will be added to your file automatically once processing is complete - this tag cannot be removed. Files copied to the Core will be visible to all Project Administrators and Collaborators.

3.8 File Processing in the VRE Core

File processing (data analysis) in the VRE Core is performed using the available workbench tools. For additional information see Section 6 Workbench Tools.

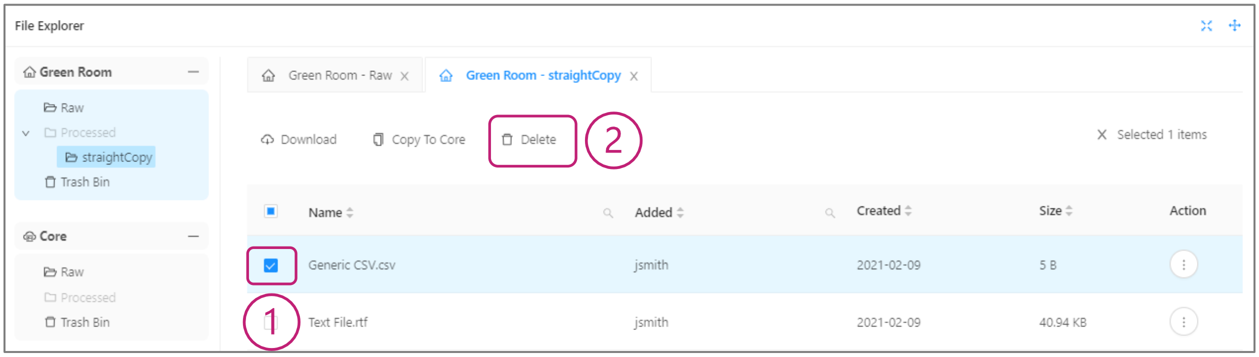
3.9 File Deletion

3.9.1 Deleting a File (Trash Bin)

If a file needs to be removed from the platform it can be deleted in a two-step process.

1. Select the file in the file explorer and click **Delete** from the menu at the top of the File Explorer. The file will be moved to the Trash bin and the file name will be appended with a numeric timestamp at the time of deletion. While in the Trash bin, the file will not be accessible for viewing or analysis but is not yet permanently removed from the platform.

2. From the Trash bin the file can only be permanently removed (purged) from the platform by submitting a request to the Platform Administrator.



In the Green Room, only the user who uploaded the file or a Project Administrator can delete the file (move to Trash). In the VRE Core, any user with access to the file can delete it. Once the file is deleted it cannot be used by any other users. The file's data lineage will still be maintained by the VRE.

3.9.2 Restoring Deleted Files

Coming soon in a future release of the VRE: Users will have the ability to restore a file from the trash bin.

3.9.3 Permanent File Deletion

Files deleted by Project members are moved to the Trash bin but are not permanently removed from the platform. If permanent removal is required, the Project Administrator can submit a request to the Platform Administrator to delete a Project file from the backend databases. This action is irreversible.

4 Project Management

A **Project** is a data storage container that holds all of the information, data, and pipeline configurations relating to a Principal Investigators' research project. Projects in the VRE can only be created by Platform Administrators.

4.1 Creating Projects

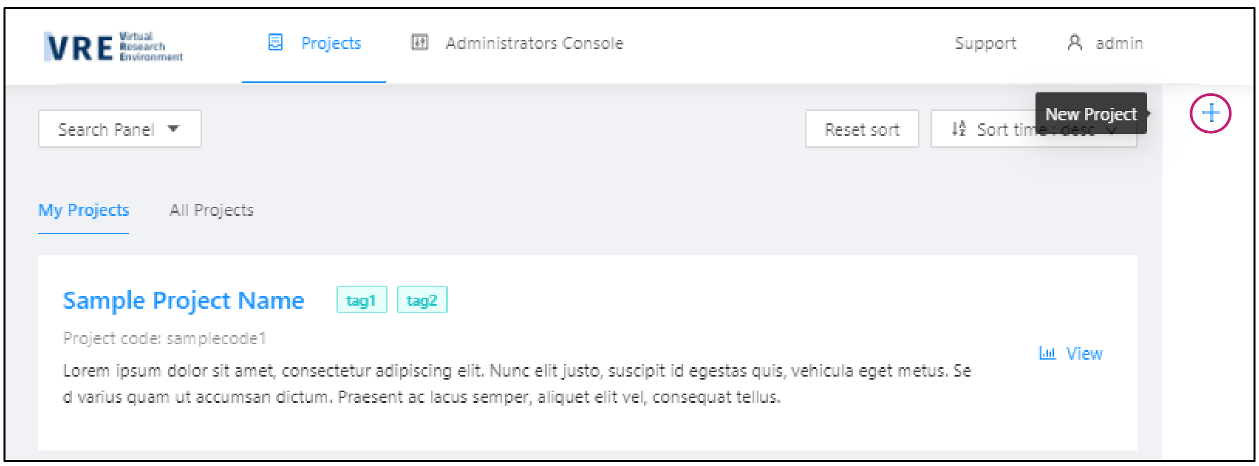
Project creation is only available to Platform Administrators.

4.1.1 Prerequisites to creating new Projects

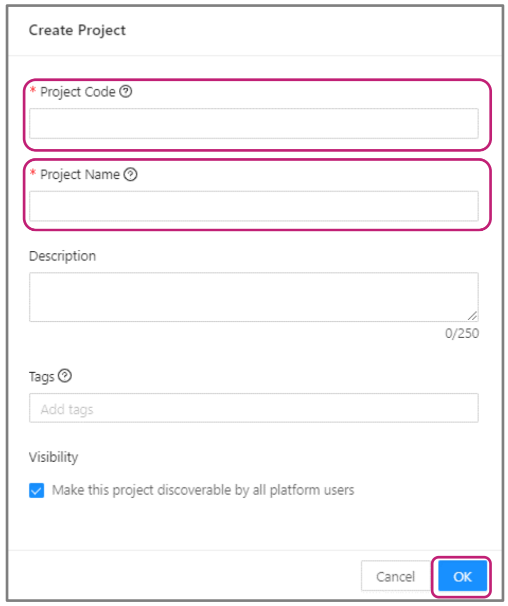
Before adding a Project in the VRE Portal, the final approval of the VRE Governance Manager must be obtained signifying that all applicable data sharing agreements, research ethics board approvals and data protection authorizations are secured.

4.1.2 Project Creation

1. Log into the VRE Portal with Platform Administrator credentials.
2. On the Landing Page, click the + New Project icon in the Right Sidebar.



3. Complete the required fields in the *Create Project* dialog box and click **OK**



4. The newly created Project will appear in the Projects list in the Landing Page.

4.1.3 Project Details

1. **Project Code** (required)
    - The *Project Code* is used by VRE backend services to uniquely identify the Project across the VRE. Project Code is mandatory for Project creation. Select a Project Code in conjunction with the Project Administrators.
    - <u>Once assigned, the *Project Code* cannot be changed</u>. *Project Codes* must follow the naming convention: maximum 32 characters, consisting of any combination of lower-case letters (a-z) and numbers (0-9).
2. **Project Name** (required)
    - A short and user-friendly title assigned to the Project to make it easier for users to identify and locate the Project. *Project Name* is mandatory for Project creation but can later be changed by a **Platform Administrator** or the **Project Administrator**.
3. **Description** (optional)
    - A longer, more informative Project field that can be used to add more context and inform users of study details. *Description* is optional for Project creation and can later be added or changed by the **Platform Administrator** or **Project Administrator**.
4. **Tags** (optional)
    - Tags are keywords that can be assigned to help organize and find information in the VRE. Tags are optional and can later be added or changed by the **Platform Administrator** or **Project Administrator.**

5. **Visibility** (optional)
    - This setting controls whether the basic Project information is discoverable by all platform users in the All Projects tab of the Landing Page.
    - By default, visibility is set at "*Make this project discoverable by all platform users*". Uncheck this box if the Project should be private, only be discoverable by Project Members. The Project Administrator can edit this setting later in the Settings page of their Project.

Note: If the *Project Visibility* is set to "Discoverable" the *Project Code, Project Name* and *Description* will be displayed to all VRE users in the Project Landing Page **All Projects** tab.

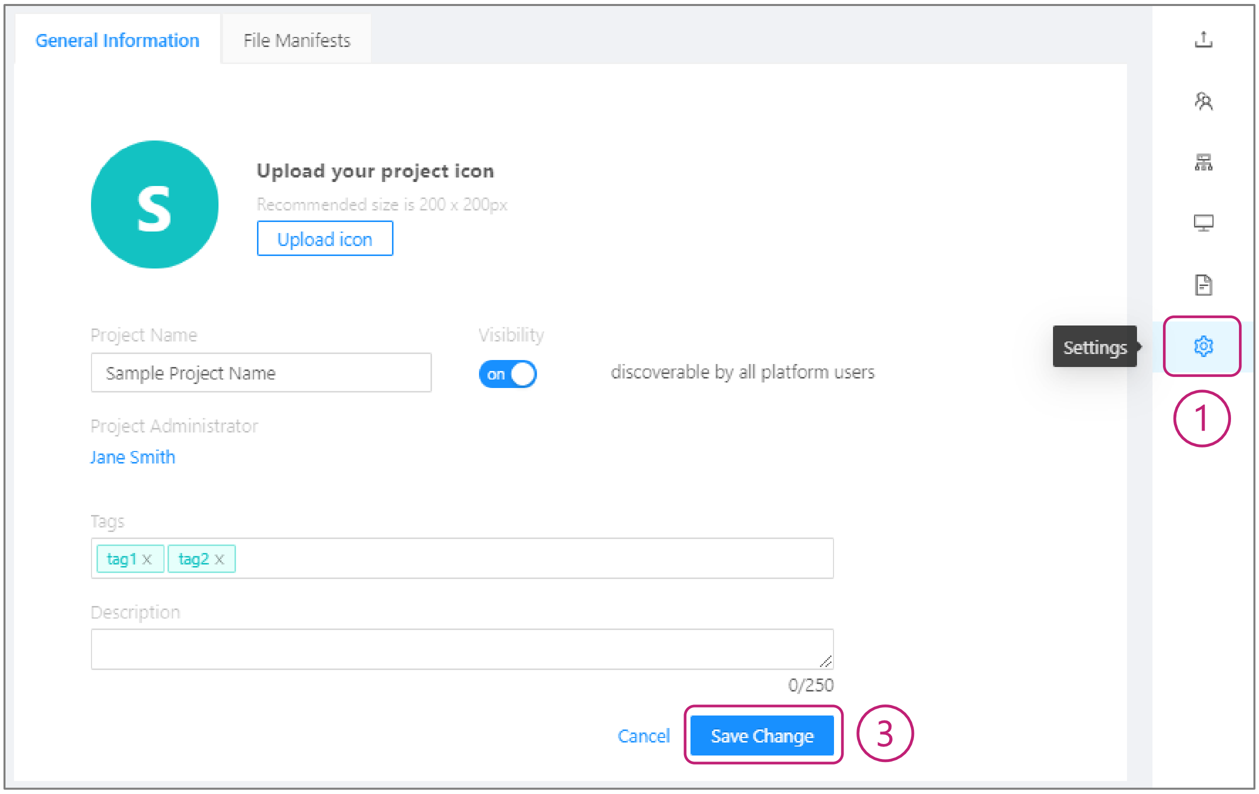
4.2 Project Settings

4.2.1 Editing Project Information

Editing Project information is a feature available to Platform Administrators and Project Administrators.

Project information may be changed on the *Project Canvas* in the Project Information card. To edit your

1. Click the **Settings** icon in the Right Sidebar or the Project Information Card of your Project Landing Page.
2. Navigate to the *General Information* tab and click the **Edit** button.
3. *Optional:* You may upload a *Project icon* image file, recommended image size is 200 x 200 pixels
4. *Optional:* You may edit your *Project Name,* set your Project Visibility to **Discoverable** or **Hidden**, add or remove tags, or edit your *Project Description.*
5. Once you have made all required changes, click **Save Change** to update your Project Details.



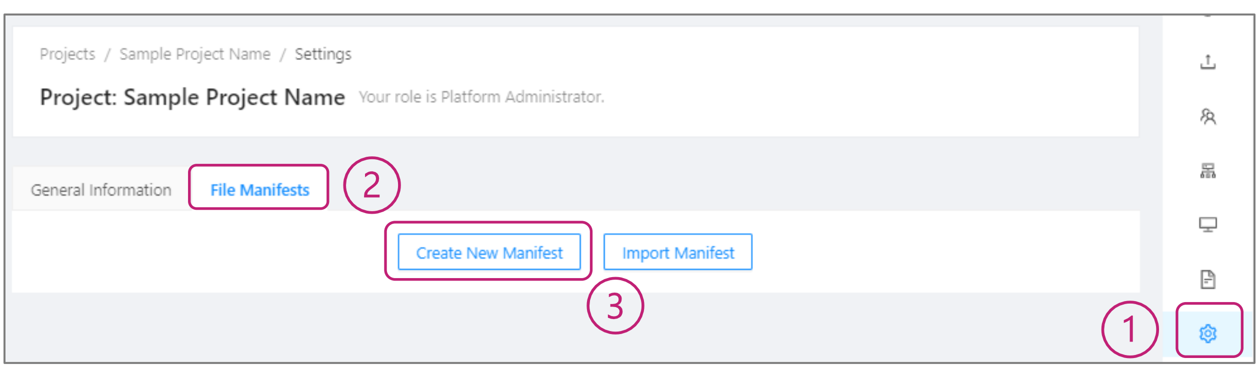
4.3 File Manifests

4.3.1 Creating File Manifests

Project Administrators can create and configure File Manifests for their projects that will be available to all Project Members to attach to their files during or after upload.

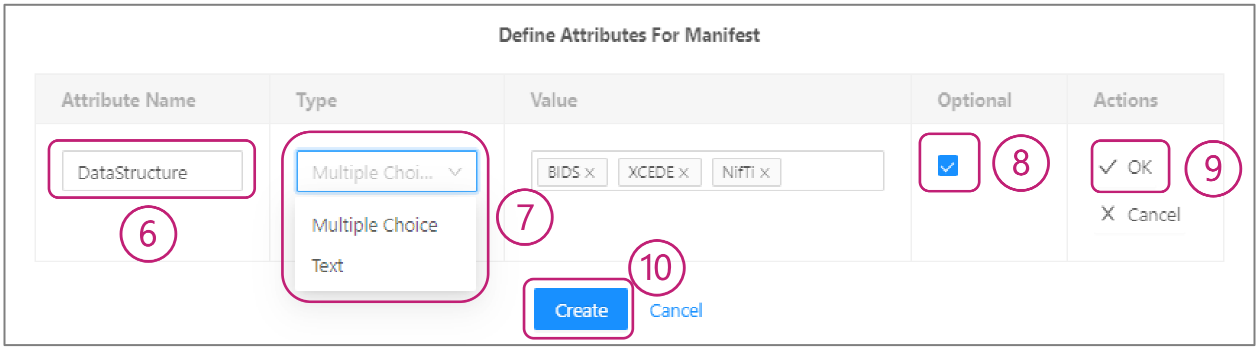
To configure a File Manifest for your project, follow the steps below:

1. Navigate to your Project Landing Page and click on the Settings icon in the Right Sidebar
2. Select the **File Manifests** tab



3. Click **Create New Manifest**
4. Enter a name for your Manifest and click **Next Step**

5. Click **Add Attribute**

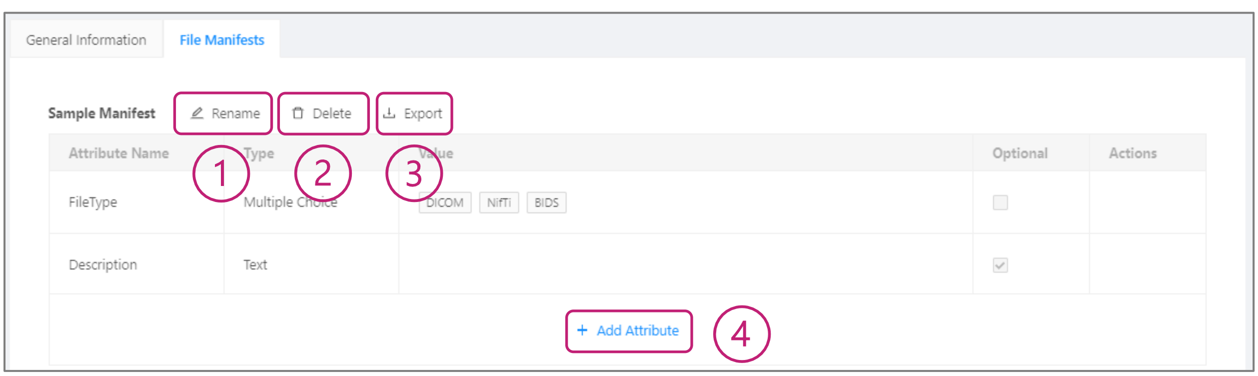


6. Enter an *Attribute Name* – note that only letters and numbers are permitted.
7. Select a *Type* from the dropdown list, current options include:
    a. **Multiple Choice** attributes can have a maximum of 10 choices
    b. **Text** attributes will have a maximum of 100 characters
8. Toggle **Optiona**l off if you want the field to be required for the user to fill out any time the manifest is attached to a file. <u>Once a File Manifest has been created, only Optional attributes can be added to the file.</u>
9. Click **OK** to save the Attribute. Repeat steps 6-9 until all of the required Attributes have been added to the file.
10. Click **Create** to save your File Manifest.

Once a File Manifest has been created, all Project Members will be able to view the File Manifest and attach it to the files they have uploaded into the Green Room *Raw* folder. For additional information see Section 3.3.4 Manifest Attributes.

4.3.2 Managing File Manifests

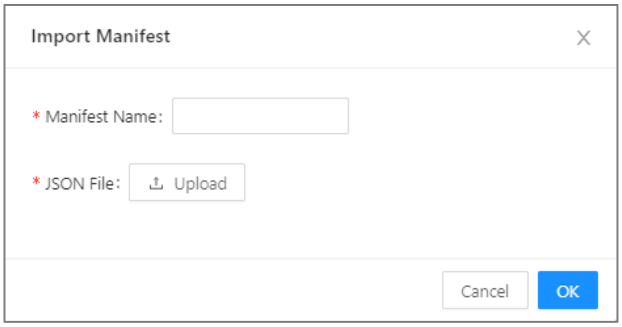
Once a File Manifest has been created a Project Administrator will be able to make additional changes to the File Manifest.



1. **Rename** button. When a File Manifest is renamed all File's with the Manifest attached will show the new Manifest name attached will not be affected by this action.

2. **Delete** button. A Project Administrator may delete the File Manifest from the Project if it has not yet been attached to a file.
3. **Export** button. Project Administrators can download a copy of the File Manifest in a JSON file format.
4. **+ Add Attribute** button. Additional optional attributes may be added to existing Manifests.

Project Administrators may also import existing File Manifests as a JSON file. To import a File Manifest, navigate to *Settings > File Manifests* and click **Import Manifest**.



Once the file has been uploaded and saved with a Manifest Name, it will be available to all Project Members.

5 User Management

5.1 User Roles

Access to the VRE is controlled by project-based and role-based permissions. The combination of Project and user role defines which data and resources a user can access in the VRE. The VRE Platform Administrator creates the first Project Administrator user account; this user becomes the first member of a Project. Thereafter, the Project Administrator can invite or remove members of their research team to their Project.

An individual person may become a member of one or more Projects in the VRE upon invitation from the Project Administrator of each project.

A Platform Administrator may invite general members to the platform with no Project membership.

Member roles and functions available to Researchers are described **Table 1**.

Table 1. Platform User Roles

Actions	Registered Platform Member	Project Contributor	Project Collaborator	Project Administrator	Platform Administrator
View list of projects in portal Landing Page	✓	✓	✓	✓	✓
Access a Project in the portal		✓	✓	✓	✓
Modify Project information				✓	✓
Create and modify Project file manifests				✓	✓
Upload, view, download my files (Green Room)		✓	✓	✓	✓
Upload, view, download any files (Green Room)				✓	✓
Copy files from Green Room to Core				✓	✓
Analyse data in VRE Core			✓	✓	✓
Add users to a Project				✓	✓
Modify project information				✓	✓
Create projects					✓

5.1.1 Project Administrator

The **Project Administrator** is the Principal Investigator (or their delegate) who has overall responsibility under GDPR as the Data Controller for the Research Project. They are responsible for all Project data stored in the VRE. They have the authority to invite other research members to the Project and assign their member roles within their project. Project Administrators can access all data related to their project, can register pseudonymization pipelines, view activity logs for all Project Files and Members, and manage users for their Project. A project may have more than one individual person assigned to the role of Project Administrator. This ensures role redundancy in case of absence.

5.1.2 Project Collaborator

The **Project Collaborator** is a member of the Project whose primary role is data analyst. Members with this role can contribute, or upload, data to the Project, view the list of files they uploaded to the Project using the *File Explorer*, and download the files they originally uploaded. Project Collaborators cannot browse or download data contributed by any other member of the Project in the VRE Green Room but can view and download all data in their Project that has been added to the VRE Core.

5.1.3 Project Contributor

The **Project Contributor** is a member of the Project whose primary role is to contribute data only. Members with this role can contribute, or upload, data to the Project Green Room, view the list of files they uploaded to the Project using the *File Explorer*, and download the files they originally uploaded. Project Contributors cannot browse or download data contributed by any other member of the Project and cannot view or access any data in the VRE Core.

5.1.4 General User

The **Registered Platform Member** has access to the public list of projects on the Project Landing page but is not a member of any Project. They must be invited by a Platform Administrator. Users with this role can view the list of public Projects but cannot access or upload data to any projects until they are invited to a project by a Project Administrator.

5.1.5 Platform Administrator

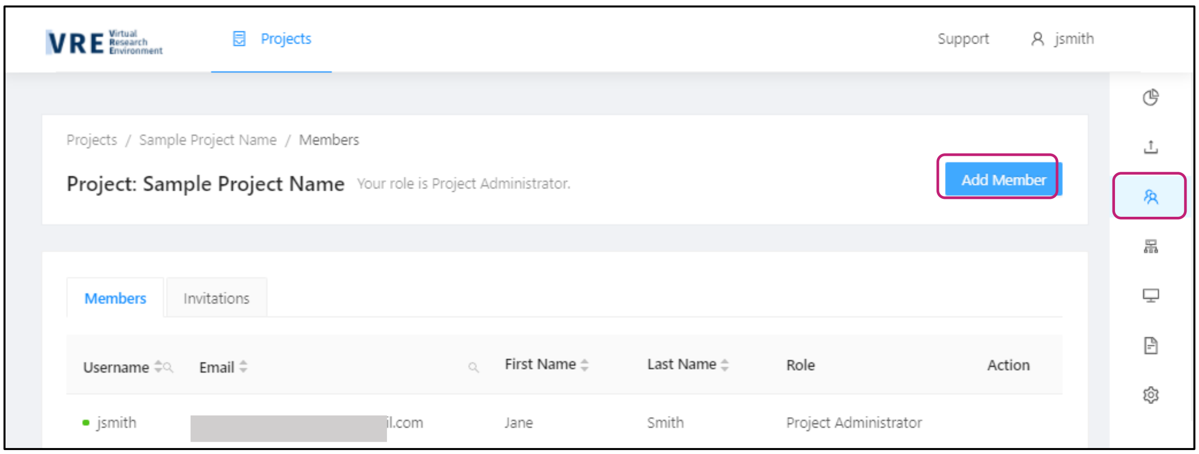
The **Platform Administrator** is a member of the VRE administrative team. The Platform Administrator maintains the Portal and creates Projects in the VRE upon request from a Principal Investigator (PI) and after all appropriate data protection authorizations and data sharing agreements have been secured. The Platform Administrator can perform other administrative functions to assist the Project Administrator with support issues related to their Project.

5.2 User Management for Project Administrators

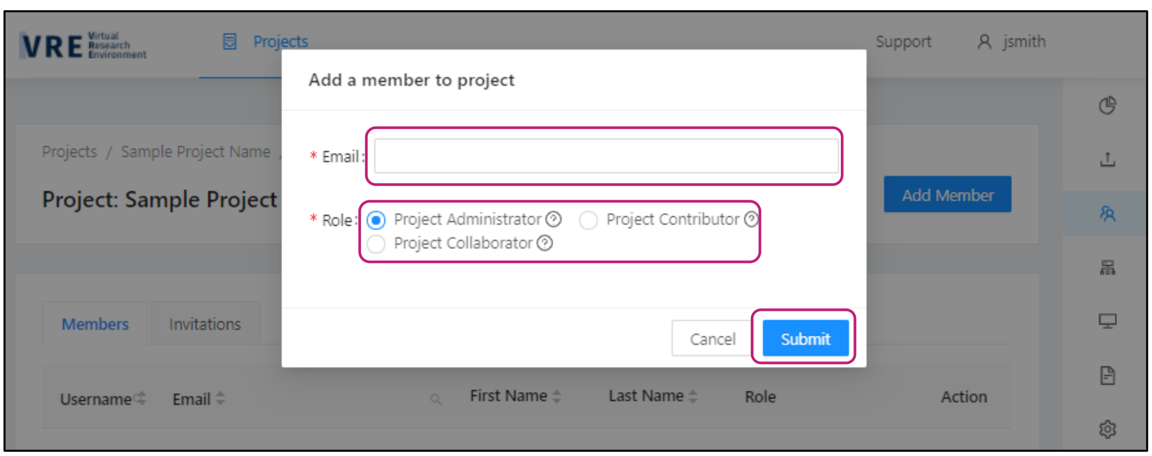
5.2.1 Adding Project Members

Project Administrators may invite members of their research team to collaborate on their Project and may assign their role.

1. Log into the VRE Portal. You must be a Project Administrator in the Project
2. Select your Project from the Landing Page
3. Click the **Members** icon located in the Right Sidebar
4. Click **Add Member** to open the *Add a member to project* dialogue box



5. Enter the user's institutional email address, select the role for the new user, and click **OK.**



- If the user has already been registered as Member of the VRE platform in one or more other Projects, they will be added to the Project immediately and will be notified by email that their new Project access has been granted.

- If the user has not previously been registered as a Member of a VRE Project, an email will be sent to the Member with instructions on setting up their VRE Account (see Section 5.2.2 Completing the Member Registration Process).

5.2.2 Completing the Member Registration Process

All new users of the VRE will receive a registration email containing information on the name of the Project to which they have been invited, and a registration link. Clicking the link directs the user to a registration page prompting them to provide their user information and to accept the Platform Terms of Use (See Section 2.2 User Account Registration).

Dear VRE member,

John Smith has invited you to the following project:

Project Name: Example Project

Role: Contributor

In order to access the project please visit the link below:

Project Link

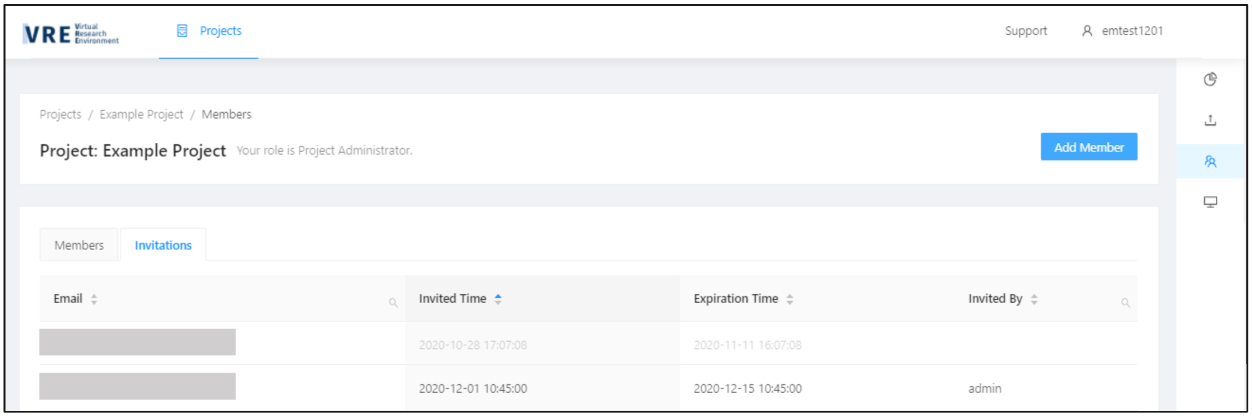
After completing this process, the user can now log in and access the project resources according to their role.

The link is valid for 14 days, or until the registration process is successfully completed, whichever comes first.

5.2.3 Viewing and Re-sending invitations

A Project Administrator may need to re-send an invitation to a user who has lost or deleted the original email invitation or if the invitation link has expired. To re-send an invitation to a user, a new invitation must be created following the steps in Section 5.2.1 Adding Project Members.

To view invitations that have already been sent, navigate to your Project, click the **Members** icon and select the *Invitations* tab. The list of all invitations can be sorted by using the column headers. Invitations with black text are pending (sent but not yet accepted), while invitations displayed in grey text are no longer valid either because the new member successfully registered or because the link has expired.

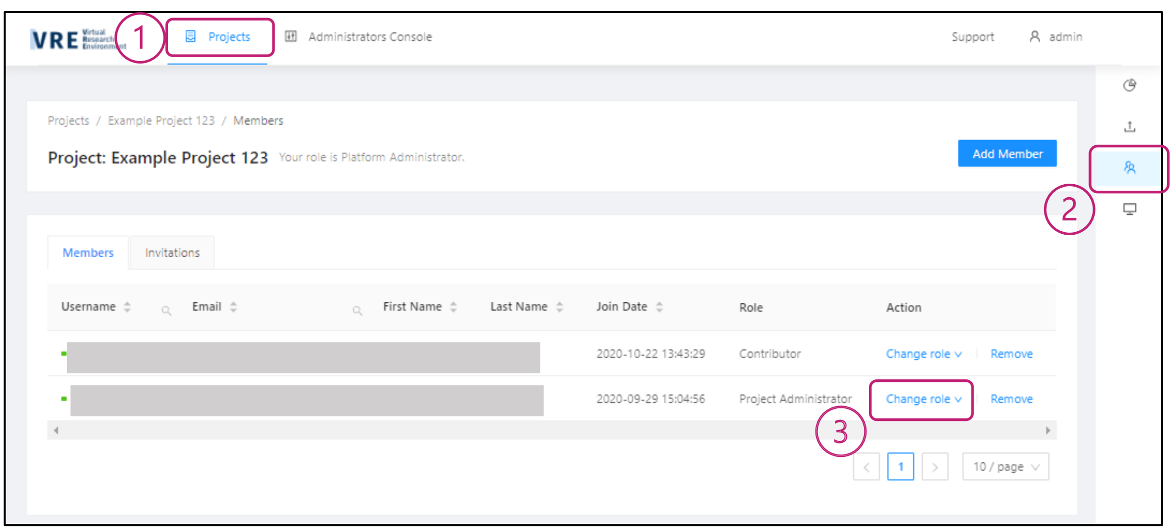


Note: Resending an invitation to a Project will automatically deactivate any previous invitation links sent to a new user.

5.2.4 Updating Member Roles or Removing Members from a Project

Project Administrators may modify a Member's role in their project or remove them from the Project. Start by logging into the VRE Portal as Project Administrator.

1. Select the Project from the Landing Page.
2. Click the **Members** icon located in the Right Sidebar.
3. Locate the member's user account
4. In the *Action* column select **Change role** and choose one of the following options:
    a. Select the new role from the dropdown menu.
    b. Select *delete* to remove the user from the project.

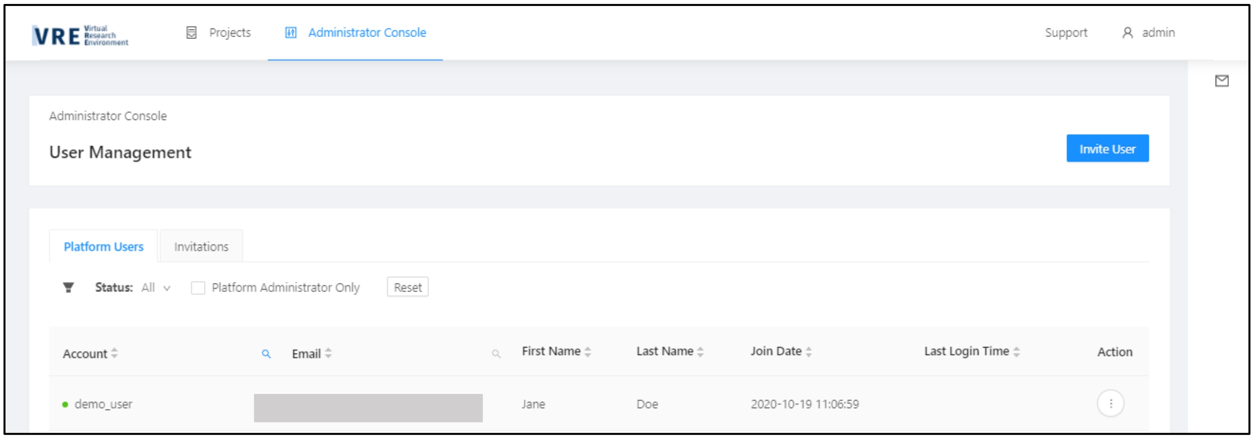


Note: Removing a Member from a Project removes access to all the Project data and resources but does not affect their membership in any other Project. Only a Platform Administrator can remove a user from all Projects.

5.3 Administrator Console

For Platform Administrators only.

The Administrator Console provides Platform Administrators with tools for managing users across the Platform. It is accessed from the main menu of any VRE portal page.



5.3.1 Viewing All User Accounts

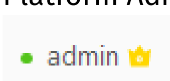
The **Platform Users** tab displays all platform user accounts.

- A coloured circle icon to the left of the username denotes the user's account status:

  ● Active (Green with black text)

  ● Disabled (Red with grey text)

- A yellow crown icon to the right of a username indicates that the user is a Platform Administrator.

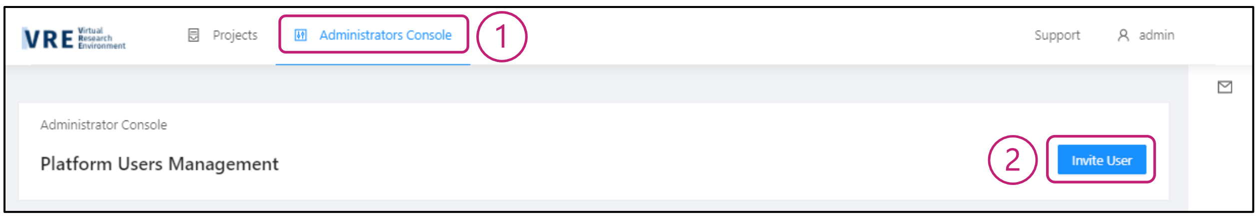
- Use the filters to limit the entries displayed by Status (All, Active or Disabled) or filter to view Platform Administrators only.
- To view more information about a user, click the **Action** menu icon and select **Profile**. To send an email to all users click the **Email** icon in the right sidebar.

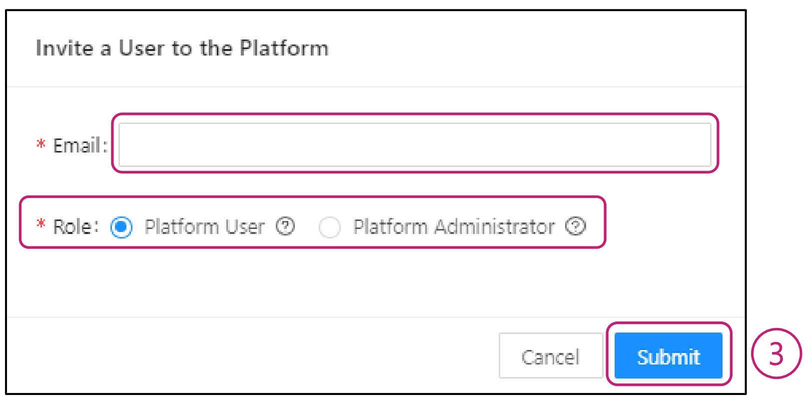
The **Invitations** tab displays all invitations sent, including expired invitations.

5.3.2 Adding Platform Members

A Platform Administrator may invite a new Member to the VRE without assigning them to a specific project.

1. Navigate to the Administrators console in the Main Menu
2. Click the **Invite User** button.
3. Enter the user's institutional email address, select the role for the new user, and click **Submit.**
4. An email will be sent to the user with instructions to register their account on the VRE.





5.3.3 Adding a Project Administrator to a Project

The Platform Administrator invites the first Project Administrator for each Project. This step must be carried out from within an existing Project by following the steps outlined in Section 5.2.1 Adding Project Members.

Once the Project Administrator has registered their account and accessed their project, they can invite additional members to their project.

Note: Uploading real study data is prohibited until the lawful requirements for data processing have been established and approved by applicable data protection authorities, ethics boards and data sharing agreements have been secured for the Project.

5.3.4 Viewing and Re-sending Invitations

To view invitations that have been sent to all users across the platform, click the **Members** icon and select the *Invitations* tab. The list of all invitations can be sorted by using the column headers. Invitations with black text are pending (sent but not yet accepted), while invitations displayed in grey text have expired.

A Platform Administrator may need to re-send an invitation to a user who has lost or deleted the original email invitation or if the invitation link has expired. To re-send an invitation to a user, follow the steps outlined in Section 5.2.1 Adding Project Members to invite users directly into a Project, or Section 5.3.2 Adding Platform Members to invite general members without any specific Project access.

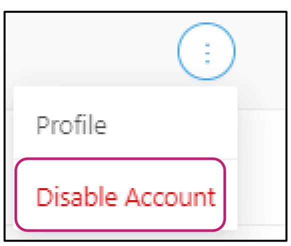
5.3.5 Disabling Platform User Accounts

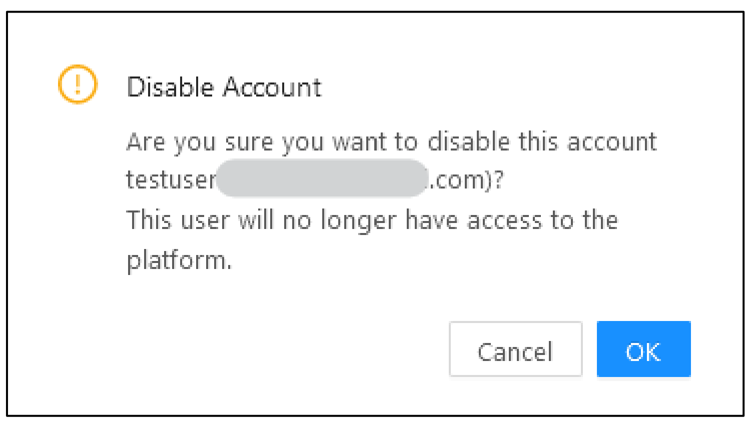
If a VRE user no longer requires access to the VRE or their account has been compromised, a Platform Administrator can use the Administrators Console to disable the User's account. The user whose account has been disabled will be blocked from logging into the VRE and will lose access to all of their projects. Disabling a user account does not delete the user from the platform - all of their platform history and lineage will be retained for audit trail purposes.

Disabled accounts are visually distinguished in the *Platform Users* list by grey text with a red circle icon to the left of the username.

To disable a user's account:

1. Navigate to the Administrators console in the Main Menu
2. Click the *Action Menu* ⋮ icon next to the user's name and select **Disable Account**
3. A warning message will appear to confirm the action. Review and confirm the username and email address and click OK to complete the action.

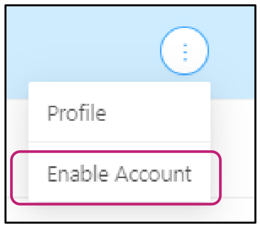




5.3.6 Re-enabling Platform User Accounts

Platform Administrators can re-enable a user's disabled account in the Platform Administration Console. Note that this only restores the user's access to the platform without any project membership; a Project Administrator or Platform Administrator will need to add the user into each of their previously affiliated projects after their account is restored. To re-enable a user's account:

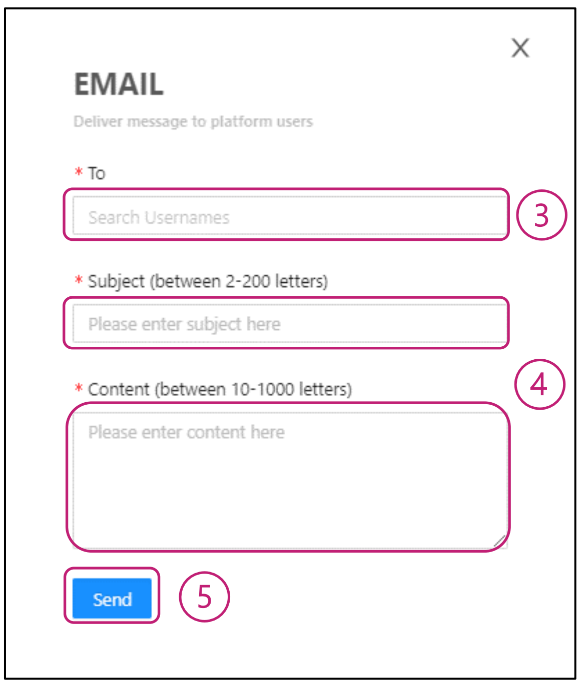
1. Navigate to the Administrators console in the Main Menu
2. Click the *Action Menu* ⋮ icon next to the user's name and select *Profile*
3. Click **Enable Account** and confirm.



5.3.7 Platform Member Communication

Platform Administrators can send bulk emails to VRE members from the Administrators Console. To send an email to all platform members:

1. Navigate to the Administrators console in the Main Menu
2. Click the **Email** ✉ icon in the right sidebar
3. Enter the usernames of the recipients or select *All Users* from the dropdown menu
4. Enter the email *Subject* and *Content*
5. Click **Send**



6 Workbench Tools

6.1 XWiki

XWiki is an open source, structured wiki platform designed for knowledge sharing and collaboration that has been integrated into the VRE with a Single Sign-On Protocol. XWiki pages are created on a per-project basis by Platform Administrators. Once a Project's XWiki has been set up, the Project Administrator may customize the Project Page(s) and their access permissions, to allow Project members to view, comment, and edit content as needed. More information can be found through the application documentation: https://xwiki.org.

1. Navigate to your Project Landing Page and click the XWiki icon in the Right Sidebar, a new browser tab will open.
2. Click the action Menu (vertical ellipsis) in the top right-corner and click login.
3. You may view, comment and edit XWiki pages in your Project's folder depending on the access rights configured by the Project Administrator.

For additional information on setting up and configuring your Project's XWiki please see the VRE XWiki User Guide or contact the Platform Administrator at vre-support@charite.de.

Users are reminded that the VRE Platform Terms Use prohibits any code or files containing personal information of data subjects from entering the VRE, including workbench tools, unless it has first been uploaded to the Green Room and approved by the Project Administrator for use in the VRE Core.

6.2 JupyterHub

JupyterHub is an open source, multi-user version of Jupyter Notebook for performing analysis of data in the VRE Core. More information can be found through the application documentation https://jupyter.org/.

JupyterHub must be configured on a project basis by the Platform Administrator. If JupyterHub has been configured for your project, the data available in the VRE Core will be accessible to you for analysis. Users may import Jupyter Notebooks for use in this environment but are reminded that the VRE Platform Terms Use prohibits any code or files containing personal information of data subjects from entering the VRE, including workbench tools, unless it has first been uploaded to the Green Room and approved by the Project Administrator for use in the VRE Core.

Jupyterhub is integrated with your VRE user account with Single sign-on; no separate user account is required. To launch JupyterHub from the VRE Portal,

1. Navigate to your Project Landing Page and click the Jupyterhub icon in the right sidebar, a new browser tab will open.
2. Click **Sign in with Keycloak** to initiate your single sign-on session.
3. From the JupyterHub home page you can now perform various actions such as opening a Python notebook, import an existing Jupyter Notebook.

4. When finished using JupyterHub, click **Logout** to end your session.

For more information on using JupyterHub please contact the Platform Administrator at vre-support@charite.de.

6.3 Apache Guacamole

Apache Guacamole is a clientless remote desktop gateway that supports standard protocols like VNC, RDP, and SSH. Guacamole has been integrated into the VRE using a Single Sign-On Protocol and is configured on per-project basis by a Platform Administrator, so that each project has its own deployment of Guacamole and an assigned Guacamole Administrator.

Project Administrators may contact the Platform Administrator at vre-support@charite.de to set up Guacamole for their project. Additional information can be found at https://guacamole.apache.org/doc/gug/administration.html.

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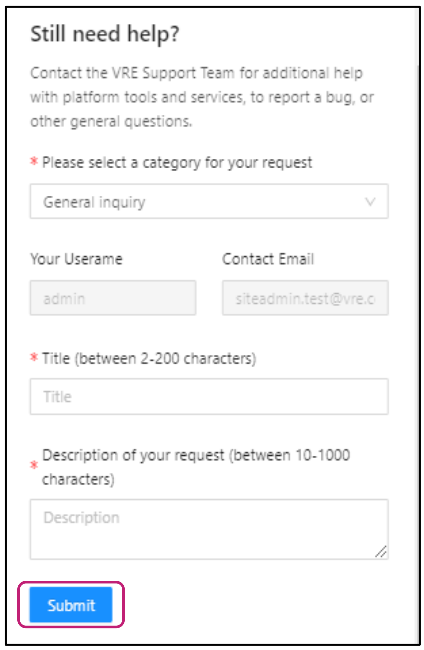
7 Support

Support resources can be accessed from any page of the VRE Portal, regardless of whether you are logged into a Project.

1. From the Main Menu, click **Support**, to open a sidebar with support resources.
2. Download the User Guide to review detailed information about the VRE.
3. Review **Frequently asked questions** to see if information is already available on the issue you are experiencing.
4. If you cannot find a solution, scroll down to the **Still need help?** to initiate a support inquiry.



5. Complete the required fields to provide details on your support inquiry and click **Submit**. A member of the VRE Support Team will connect with you to resolve your issue.

> **Note:** If you are unable to log into your account or access the Support page, you can contact a Service Desk agent directly by sending email to: vre-support@charite.de

8 Change Log

Version	Date	Updates
0.1.0	October 20, 2020	Initial Version
0.1.1	October 28, 2020	Updated features for Release 0.1.1; Updated text and screenshots for clarity; Added Change Log.
0.2.0	November 30, 2020	Updated features for Release 0.2.0: Enhanced file tagging & annotation; Data lineage graph; Search project attributes; Platform Administrators user management console, Search Panel and Properties Side Panel. Updated URL to include "/vre" extension. Revised content for clarity and flow.
1.0.0	February 12, 2021	Updated features for Releases 0.3.0 and 1.0.0. Updates to Definitions section. Modified existing content to reflect updated user interface.