Providing Visualizations of Air Quality Results for Arc Jet Staff

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1. Abstract

Testing the capabilities of thermal protection systems (TPS) is an integral part of a successful space exploration program. As TPS materials are tested, they are subjected to extreme levels of heat and pressure, which could potentially cause the release of gasses into the test chamber. In this project, I will be programming a database that both contains essential material outgassing information and monitors air quality levels. The objective of the project is to provide an easily referenceable graphical user interface where branch members can have access to post-test TPS material byproduct data, which will better inform them of possible atmospheric hazards in the test chamber. This requires an extensive program that documents the condition of the air over several tests, as well as incorporates a wide array of useful visual tools so that those working in the facility are able to make meaningful decisions quickly.

3. User Interface

It is essential for TSF staff to have quick access to the data using software that requires little training to use. To do this, part of this project was designing a user interface that enables the staff to utilize the results of the air sample collection. The software was written using Visual Basic and Microsoft Access.
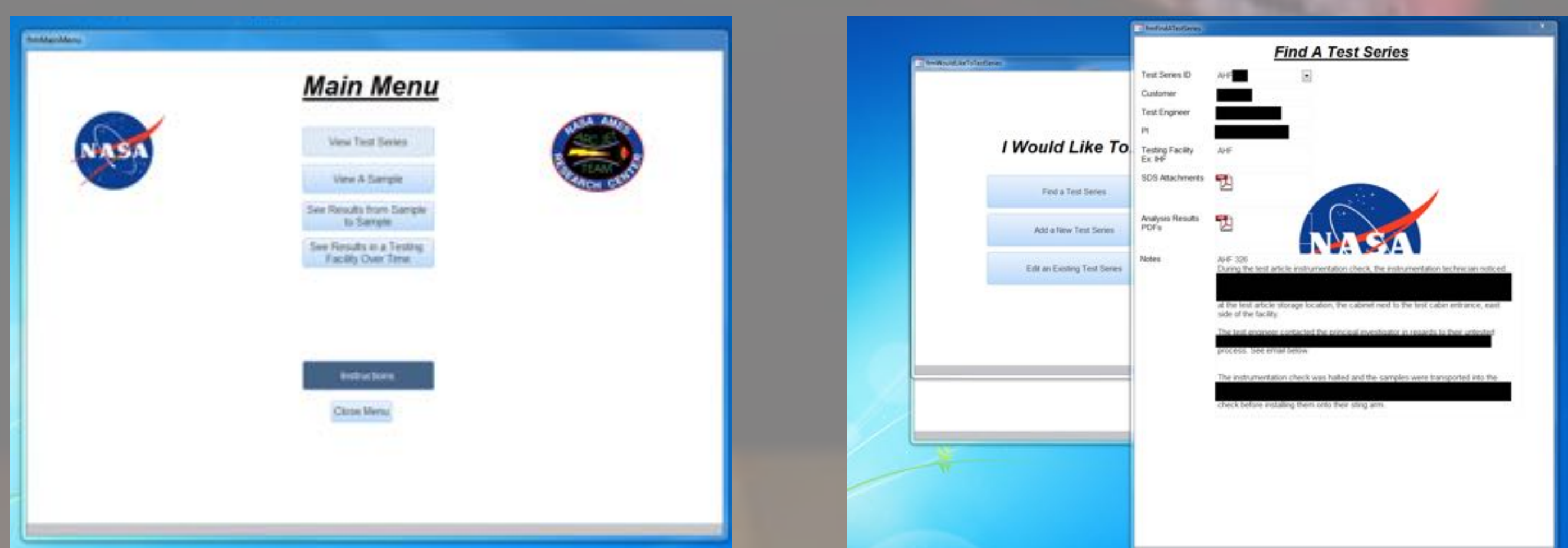
Figures 2, 3: Examples of the user interface Main Menu and Test Series screen.

4. Data Entry

The data is received from the third party testing site in PDFs and must be inputted into the database for analysis. One of the goals of this project was to enable any staff member to add results to the database with as few steps as possible. To enable this, additional user interface features were developed which automate the data input process. Through the use of scripting, a user can simply copy and paste data from the PDF into an excel file, hit a macro which will format the data, and then import that data into the interface. Minimizing the the steps needed will ensure that data retains formatting homogeneity.
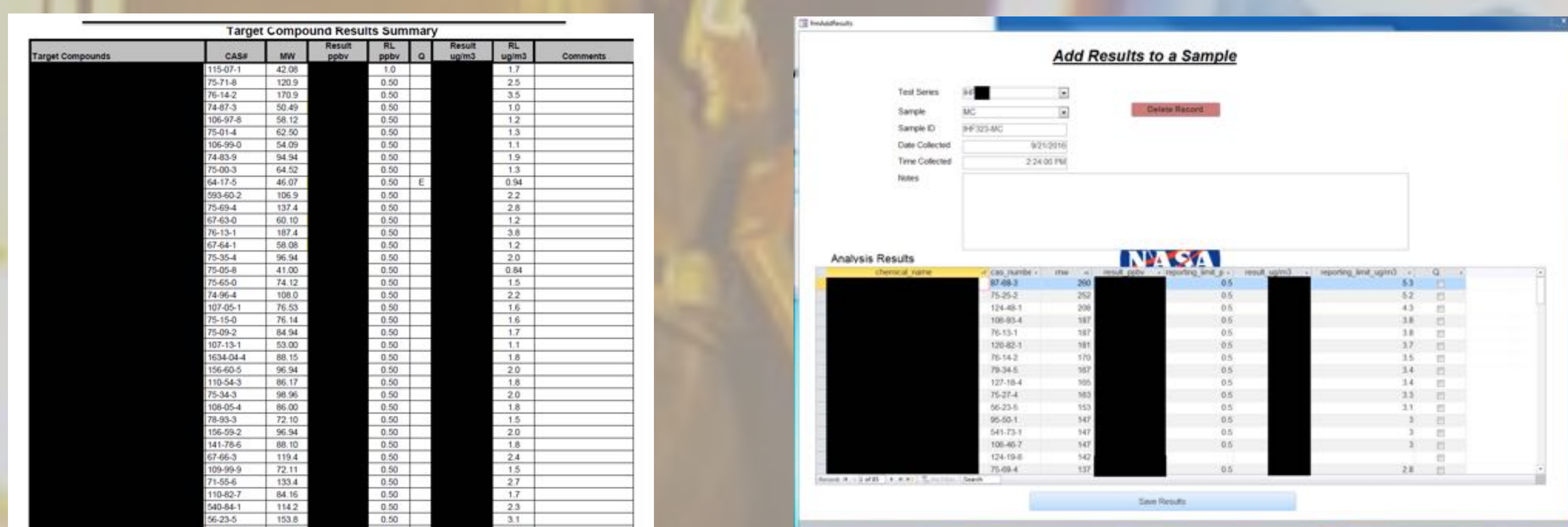
Figures 6,7: Showing the data as received from the laboratory (left) and the format in which it is inserted into the database (right).

2. Sample Collection Method

In order to determine the composition of the air of interest, TSF utilized a third party air-testing facility. The air was collected at Ames using Summa canisters, as pictured below. Summa canisters are small stainless steel containers that can be connected to a testing area via Swagelok. The Summa canisters being used in this project come under vacuum directly from the third party testing facility and are allowed to equilibrate with the testing air over a pre-specified time period. Each canister is then sent back to the facility to be analyzed. Results are sent back to TSF two weeks later.
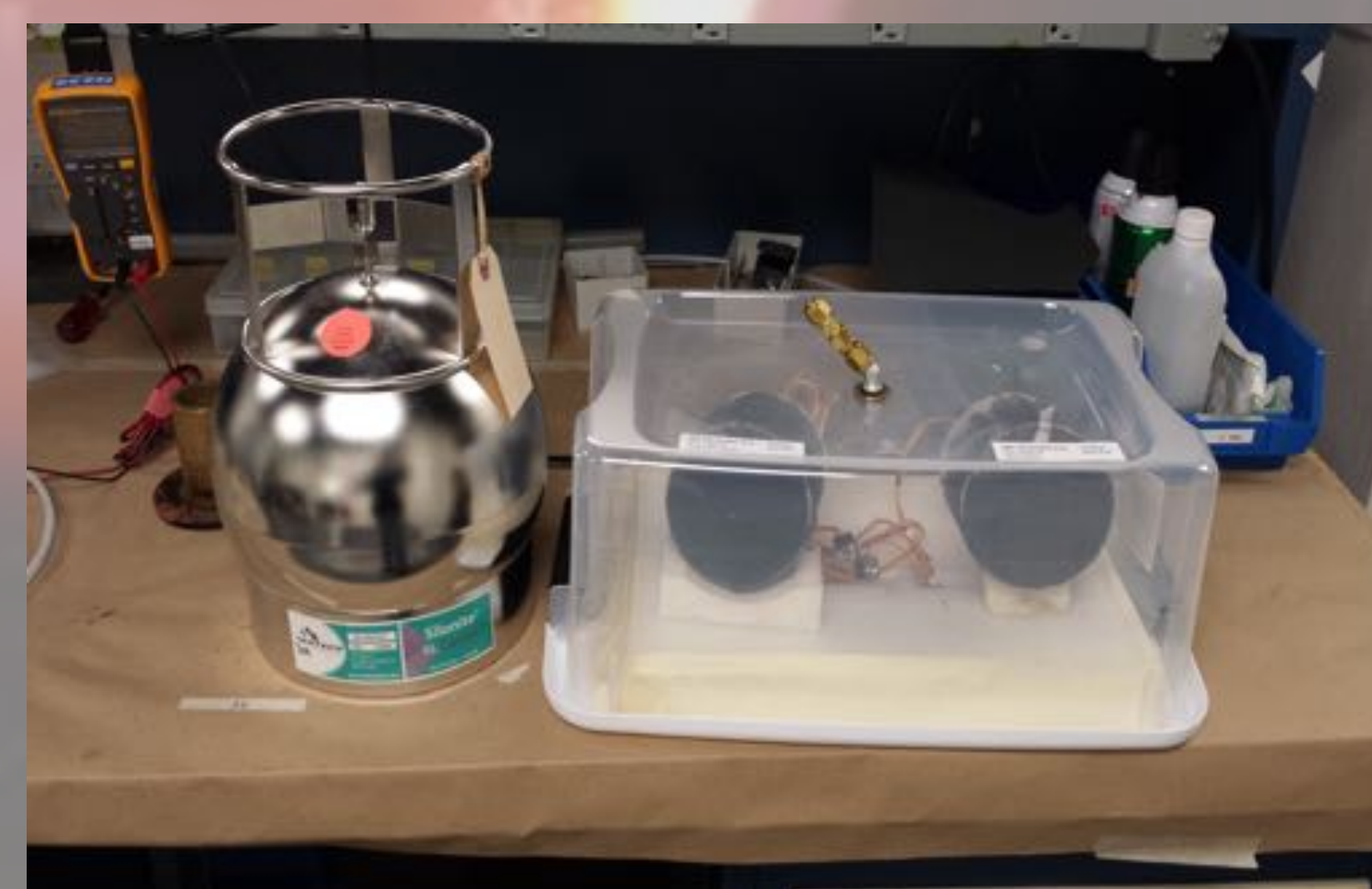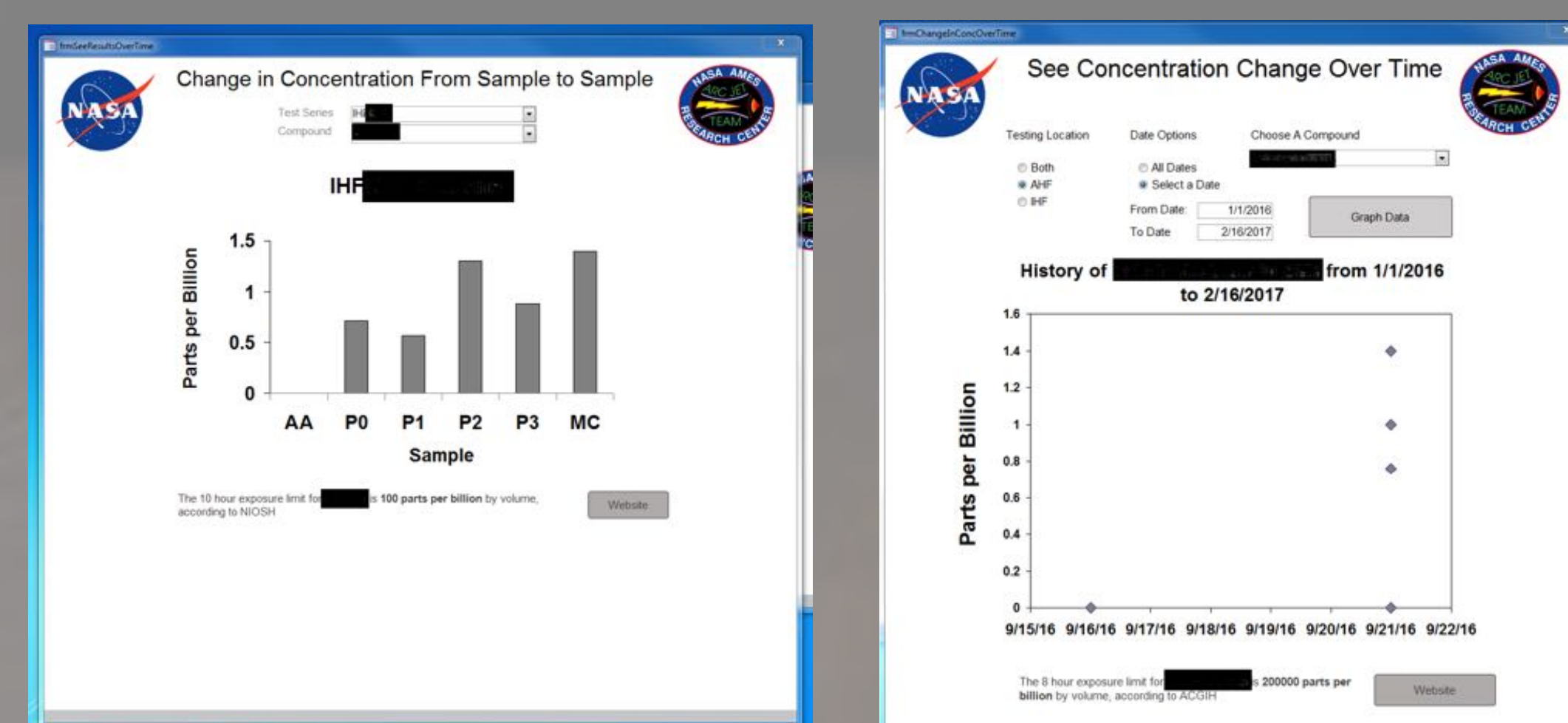

Figure 1: Summa Canister setup for collecting a sample

Figures 4,5: Graphs automatically generated by user parameters

5. Analyzing the Data

The software will allow for two main forms of accessing the data: queries and automatically generated graphs. Queries allow the user to systematically build a set of parameters that specify particular conditions, which are then used to filter results and generate a report. Graphs will have preset filters that would commonly be used that can be adjusted by the user

6. Future Work

The end goal of this project is to have the software available on all computers in the TSF branch. To do this, the database will be redone in FileMaker Pro, as this software is currently accessible to all TSF staff. In addition, the branch will be looking into bringing in a gas chromatography-mass spectroscopy instrument in order to bring the air analysis in-house.

References

Hart-Davis, G. (2005). *Mastering Microsoft® VBA*.: Hoboken, NJ: Wiley.

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