

Water Technology

This case study shows the application of key legislative requirements for qualifying R&D activities as they apply to relevant activities in the water industry.

Business Scenario

Re-Water Corporation provides consultation, design, construction, and process optimization to the water and waste-water industry. The organization now provides recycled-water validation services for new and existing water-reuse schemes across America.

In 2013, Re-Water began a project with the main objective being to design and develop a water-quality system to detect contaminated storm water and prevent spillage and flow offsite. Specific technical objectives of developing the water-quality system included:

- Design and develop analytical sensors to monitor, detect and extract data related to the chemical properties of contaminations in waste-water streams—the focus will be mainly on storm water.
- Develop a human machine interface (HMI) and control parameters to control the hardware components of the system—this needed to also allow users to switch between various screens related to equipment setup and the various accessing of data logging.
- Design and develop programmable logic controller (PLC) as part of control parameters.
- Develop the programmable coding for the PLC, which can be manipulated by users depending on site requirements and water data—monitoring requirements.
- Design and develop hydraulics.
- Design and develop electrical components—to be low voltage across various circuit boards.

Re-Water needed to determine the eligibility of its proposed R&D activities in order to know if they qualified for the *Research and Experimentation Tax Credit*. It had to be certain that its “qualified research” met four main criteria, known and developed by Congress as the *Four-Part Test*. Re-Water’s qualified R&D activities included the following.

Re-Water’s Eligible R&D Activities:

Background research to evaluate current knowledge gaps and determine feasibility
(background research of the water-quality plant system).

Background research for Re-Water’s R&D project included the following:

- Literature search and review.
- Market analysis and review, including competing products, bench marking of best available solutions.
- Consultation with industry professionals and potential customers to determine the level of interest and commercial feasibility of such a project.
- Preliminary equipment and resources review with respect to capacity, performance and suitability for the project.
- Consultation with key component/part/assembly suppliers to determine the factors they consider important in the design, and to gain an understanding of how the design needs to be structured accordingly.

Design and development of a series of prototypes to achieve the technical objectives
(design of the water-quality plant system).

The hypothesis for the design phase of Re-Water’s project was designing a water-quality system with improved hydraulics, user-friendly PLC, and seven analytical sensors will produce a system that more accurately detects the contamination substances (type and chemical properties) in storm water and, therefore, allow operators to prevent spillage and flow offsite.

Major changes to the design of the plant/system and its components resulted from the finding that the organization could use the information generated in the water samples taken to conduct various other activities. Re-Water designed many versions of components and the overall system as a whole to avoid potential technical issues in the development phase; however, to prove that its theoretical concepts can operate in the intended application, it needed to develop and construct prototypes for chemical testing.

Trials and analysis of data to achieve results that can be reproduced to a satisfactory standard and to test the hypothesis (prototype development and testing of the water-quality plant system).

The hypothesis for this stage of the R&D project was the same as the design phase. The following activities were conducted to prove the hypothesis:

- Development of a prototype and manufacturing was conducted by an external manufacturer
- Development of the HMI and control parameters
- The sensors on the prototype were found to have made more sense (regarding the data obtained) when combined as opposed to when they were operating independent of each other. That is, they provide clearer indication about contamination physical properties and chemical values, which therefore allows Re-Water to more accurately identify the type of contamination within the storm water.

Ongoing analysis of customer or user feedback to improve the prototype design (feedback R&D of the water-quality system).

The feedback was necessary to evaluate the performance capabilities of the new design in the field and to improve any flaws in the design. The feedback activities included:

- Ongoing analysis and testing to improve the efficiency and safety of the project.
- Ongoing development and modification to interpret the experimental results, and draw conclusions that serve as starting points for the development of new hypotheses.
- Commercial analysis and functionality review.

Commentary

Qualified Research Defined

Qualified research consists of research for the intent of developing new or improved business components. A business component is defined as any product, process, technique, invention, formula, or computer software that the taxpayer

intends to hold for sale, lease, license, or actual use in the taxpayer's trade or business.

The Four-Part Test

Activities that are eligible for the R&D Credit are described in the "Four-Part Test" which must be met for the activity to qualify as R&D.

1. Permitted Purpose: The purpose of the activity or project must be to create new (or improve existing) functionality, performance, reliability, or quality of a business component.
2. Elimination of Uncertainty: The taxpayer must intend to discover information that would eliminate uncertainty concerning the development or improvement of the business component. Uncertainty exists if the information available to the taxpayer does not establish the capability of development or improvement, method of development or improvement, or the appropriateness of the business component's design.
3. Process of Experimentation: The taxpayer must undergo a systematic process designed to evaluate one or more alternatives to achieve a result where the capability or the method of achieving that result, or the appropriate design of that result, is uncertain at the beginning of the taxpayer's research activities.
4. Technological in Nature: The process of experimentation used to discover information must fundamentally rely on principles of hard science such as physical or biological sciences, chemistry, engineering or computer science.

What records and specific documentation did Re-Water keep?

Similar to any tax credit or deduction, Re-Water had to save business records that outlined what it did in its R&D activities, including experimental activities and documents to prove that the work took place in a systematic manner. Re-Water saved the following documentation:

- Project records/ lab notes
- Conceptual sketches
- Design drawings
- Literature review
- Background research
- Design documents for system architecture and source code
- Testing protocols
- Results of records of analysis from testing/trial runs
- Records of resource allocation/usage logs
- Staff time sheets
- Tax invoices
- Patent application number

By having these records on file, Re-Water confirmed that it was "compliance ready" — meaning if it was audited by the IRS, it could present documentation to show the progression of its R&D work, ultimately proving its R&D eligibility.