Water Engineering

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

Business Scenario

H20 Resolutions LLC is an engineering consultancy based in the U.S. that specializes in water engineering and offers a comprehensive range of high-quality engineering solutions for water management.

H20 Resolutions created a desktop software system that stimulates real-world operations of water systems. The system runs on a model that requires user-established operational rules for simulation. That is, the user inputs data that they have recorded over a period of time as operational rules or parameters for the model to work. The simulation model is used to quantify how forecast weather conditions may affect both natural and industrial/mine water resource systems, aiding technicians and managers in planning site operations.

The software had two main issues; (1) the accuracy or sensitivity of the forecast is reduced because it is based on only historical data and (2) the system requires manual collection and input of data.

In FY13, two key components were developed with purpose of enabling the system to provide more accurate and useful forecast by developing a simulation model that interfaces with external systems that collected real-time data to produce real-time analysis of that data, based on the user's requirements. These components were developed separately:

- Technology for the continuous simulation of natural streamflow
- Forecast of operational windows with real-time data

H20 Resolutions 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*. To be eligible, it had to be certain that its "qualified research" met four main criteria, known and developed by Congress as the *Four-Part Test*. H20 Resolutions' qualified R&D activities included the following.

H20 Resolutions' Eligible R&D Activities:

> Background research to evaluate current knowledge gaps and determine feasibility (background research for the development of H20 Resolutions' software system).

Background research for the software system included:

- Literature search and review of relevant, existing technology.
- 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.
- Examination of key environmental database systems to determine the factors that may inform the design of the interface/capacity required to interface with those systems.

> Design and development of a series of prototypes to achieve the technical objectives (development and testing of the system's real-time assessment capabilities).

H20 Resolutions' hypothesis for the development stage was if the system could be developed to interface with external systems that collected real-time data, it will be able to provide a more accurate and useful forecast. The activities undertaken to prove such a hypothesis included the following:

- Data acquisition testing was conducted with a test partner. The intention was test the system's ability to undertake adaptive simulation on a discrete time-step basis while keeping it aligned with the real-time data that is being fed into the system from the external database.
- The system was designed to connect to large system and process data at about 1-hour intervals. However, the test partner wanted the system to be connected to a smaller system.

> ### Trials and analysis of data to achieve results that can be reproduced to a satisfactory standard and to test the hypothesis (development of an additional trial feature).

H20 Resolutions conducted activities to find out whether the system could be enabled to extrapolate historical data to produce probabilities that are lower than those typically afforded by the available historical data. These activities included:

- Development of user interface using Windows, as this feature is enabled as part of the user interface. No current issues with user interface; however, the existing Windows software may not have enough capacity or functionality to support the system's increasing capabilities.
- Development of feature involved the testing of several methods, including:
- The annual exceed probability technique, which involved picking out the highest value in every year.
- Confidence analysis, which involved creating a time-series envelope from the available data. This gives the user the confidence that the real value will not be any more than what is encompassed by the envelope (i.e. under the curve).

> ### Ongoing analysis of customer or user feedback to improve the prototype design (feedback R&D of H20 Resolutions' software system).

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

- Ongoing analysis and testing to improve the efficiency and safety of the project:
- Development of tutorial document to assist the users in using the new system.
- 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. <u>Permitted Purpose</u>: 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. <u>Elimination of Uncertainty</u>: 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. <u>Process of Experimentation</u>: 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. <u>Technological in Nature</u>: 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 H20 Resolutions keep?

Similar to any tax credit or deduction, H20 Resolutions 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. H20 Resolutions saved the following documentation:

- Literature review
- Meeting notes
- Sketches/drawings
- Design documents for system architecture and source code
- Photographs / videos of various stages of build / assembly / testing
- Screen shots
- Test protocols
- Test results and analysis

By having these records on file, H20 Resolutions 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.