

T.C. Memo. 2024-113

PHOENIX DESIGN GROUP, INC., Petitioner,
v.
COMMISSIONER OF INTERNAL REVENUE, Respondent.

Docket No. 4759-22.

United States Tax Court.

Filed December 23, 2024.

Matthew S. Reddington, Russell G. Garza, Janine M. Campanaro, and Jefferson H. Read, for petitioner.

Jonathan E. Behrens, Hannah Kate Comfort, and Randall B. Childs, for respondent.

MEMORANDUM FINDINGS OF FACT AND OPINION

GREAVES, Judge.

This case involves the section 41 "Credit for Increasing Research Activities" (research credit) claimed by Phoenix Design Group (PDG or petitioner), a multidisciplinary engineering consulting firm.^[1] The Internal Revenue Service (IRS or respondent) disallowed research credits claimed for 2013 through 2016 (research years) and imposed accuracy-related penalties.

The disallowed research credits relate to over 200 projects; however, the parties agreed to try a nonbinding three-project sample. The issues for decision are (1) whether any of the three trial projects entailed qualified research and (2) whether petitioner is liable for *2 accuracy-related penalties under the parties' stipulations. We hold that none of the three projects entailed qualified research and that petitioner is liable for accuracy-related penalties as stipulated by the parties.

FINDINGS OF FACT

Some of the facts are stipulated and are so found. The parties' stipulations of facts and the attached exhibits are incorporated herein by this reference. Between 2015 and 2019 (credit years), PDG was treated as a C corporation for federal tax purposes and had a principal place of business in Tennessee.

I. PDG History

To understand PDG and the projects at issue, one must first appreciate the journey the company's principals took to become *professional* engineers. The path to becoming a professional engineer is a long and rigorous one. It begins with a four-year course of study through an accredited engineering program, focusing on principles of science and math. During this time, the student chooses a specific discipline such as civil, mechanical, electrical, or biomedical engineering. Following completion of his undergraduate studies, the student must take a two-day fundamentals of engineering exam within the chosen discipline. After passing this exam, the graduate is an "engineer" but not a "professional." Training continues with the aspiring professional engineer serving in an apprentice-like role for four years under a professional engineer. Thereafter, he may sit for the professional engineering exam over the course of two days, which again focuses on his discipline of choice. If successful, he can finally add the word "professional" to his resume.

So why does someone put in all the work to become a professional engineer? A professional engineer leads teams that design and maintain infrastructure that is vital for life and commerce. A professional engineer is the ultimate authority on building projects with the power to stamp and approve design documents. This approval signifies that all requested revisions have been made and the final design satisfies all requirements of applicable law.

3

At the beginning of his career, the professional engineer is greatly involved in the day-to-day activities of design work, using his years of training. However, as he climbs the corporate ladder, the professional engineer, who has spent countless years steeped in the intricacies of *3 engineering, assumes an unfamiliar business and marketing role. He will go from designing complex fire suppression systems that are vital for the safety of high-rise building occupants to putting out mundane human resources fires between employees. He will go from calculating the appropriate pitch of sewer pipelines to proofreading marketing pitches. This career path results in the most experienced professional engineers' having little to no involvement in the design process.

Discouraged by this rat race, professional engineer Ross T. Malloy, along with professional engineers Thomas Fisher and Clyde Searcy, sought to create an alternative engineering firm, focused on keeping those with the most experience involved in the design process. In 1997 they formed PDG, a professional engineering firm that focuses on designing mechanical, electrical, plumbing, and fire protection (MEPF) systems in laboratories and hospitals. These MEPF systems are often not visible to an occupant and are forgotten during the day-to-day use of a building. However, if one stops working, such as the boiler system heating the courtroom during the trial for this case, their importance is clear.

During the research years, PDG's principals were Ross T. Malloy, Thomas Fisher, John Wade, Jerry Young, and Brian Moore. They never sought to be the largest engineering firm; instead, they strived to distinguish PDG from the field by using senior employees' experience. This business strategy succeeded, with PDG developing a reputation that attracts clients around the country. As a result, PDG does not dedicate a lot of time to marketing. Instead, it relies on word-of-mouth endorsements from satisfied customers and architecture firms. PDG is recognized in the industry as a firm on the forefront of technology with its engineers frequently speaking at industry-wide conferences to discuss the revolutionary MEPF systems PDG engineers design.

II. PDG Disciplines and Organization Structure

It is said that engineers solve problems you did not know you had in ways you cannot understand. This saying is readily apparent in the highly complex and technical projects undertaken by PDG. PDG engineers work within three disciplines: mechanical, electrical, and plumbing.^[2]

4

*4 We start with a basic discussion of the systems designed by PDG mechanical engineers that we were able to stitch together from the discrete presentation of the various components. The mechanical discipline focuses on customizing heating, ventilation, and air conditioning (HVAC) systems to meet a client's specific needs. There are various customizable components that PDG mechanical engineers consider in designing an HVAC system, including the air volume, the components of the air handler, and the distribution of the air around the building.

One of the first decisions PDG mechanical engineers must make is whether the HVAC system will be a constant air volume system or a variable air volume system. In a constant air volume system, a constant stream of air flows through the system. The airflow in each room cannot be changed. Instead, to adjust the temperature in each room, a mechanism located near the room heats the air to raise the temperature to desired levels. In contrast, a variable air volume system adjusts the amount of airflow entering each space to control temperature. This means when an occupant wants a warmer temperature, the HVAC system will reduce the airflow to that zone.

After determining the type of system, PDG mechanical engineers begin designing the air handling unit. The air handling unit is the component of the HVAC system that heats or cools the air by blowing air across a hot or cold coil with a fan. The air handling unit also contains filters to purify the air and a mechanism to control the humidity of the air. There are multiple options for each of these components. First, PDG mechanical engineers must determine the source of energy for the coils. For cooling, the coils may be cooled with chilled water or refrigerant. As air blows over the coil, the liquid inside the coil heats up and that heat must be removed from the system. This may be done with a chiller, a cooling tower, or a condensing unit. For heating, the coils may be heated with steam, hot water, or electricity.

Fan size varies with the pressure required to distribute air around the building. To determine the appropriate fan size, PDG mechanical engineers calculate the resistance in the duct system, which is the measure of the decrease in pressure between the air handling unit and the room. This calculation is based on the characteristics of the ducts, including the size and the fittings. The result of this calculation is the required pressure to move air through the system and determines the appropriate fan size.

- 5 *5 Depending on the needs of the client, PDG mechanical engineers may add components to the HVAC system. For example, the system may use a dedicated outside air system to circulate additional fresh air in the building. There are also various energy-saving components that may be added to the system.

After the air passes through the air handling unit, the ductwork designed by PDG mechanical engineers distribute the air around the building. PDG mechanical engineers focus on the ventilation in the room and any pressure differential created by the HVAC system. Air is fed into a room via ducts and discharged from the room via return ducts or other exhaust points such as fume hoods.

PDG mechanical engineers also design fire prevention systems that are integrated into the HVAC system. Buildings with high occupancy are generally required to have fire rated walls that will prevent fire and smoke from spreading across the building. When running duct work for an HVAC system, a hole is created in the wall to allow the ductwork to pass, which compromises the fire rated wall. To prevent fire and smoke from spreading through the duct work, fire and smoke dampers are installed, which seals the duct in the event of a fire. These dampers are required by building code.

We move now to the systems designed by PDG electrical engineers. The electrical discipline focuses on lighting and electricity, emergency electricity, and communication systems. PDG electrical engineers design all electrical systems for the projects from the point at which the electricity is fed into the building to the outlet used to power lifesaving or research equipment. PDG electrical engineers work with utility companies to bring electricity to a project, if required. Once the electricity is connected to the building, PDG electrical engineers design switchboards that distribute the electricity to smaller electrical panels around the building. From the smaller electrical panels, PDG electrical engineers route wires of varying sizes to access points.

Finally, we conclude with the systems designed by PDG plumbing engineers. The plumbing discipline focuses on waste piping, fluid piping, reverse osmosis and distilled water systems, and effluent disinfecting systems for laboratories. PDG plumbing engineers also design water-based fire protection systems such as sprinklers.

- 6 Each discipline works on the building systems within its expertise. PDG engineers and support staff are assigned to a specific *6 discipline and for the most part work exclusively in that discipline. Within each discipline, there are four types of employees:^[3] principals, senior engineers, engineers, and computer aided design (CAD) designers. A principal is a professional engineer with a minimum of five years of experience that is responsible for project management and has stock ownership. A senior engineer is a professional engineer that does not have stock ownership. Principals and senior engineers have supervisory authority and are ultimately responsible for final review and approval of projects. An engineer is an employee that has an engineering degree but is ineligible to sit for the professional engineering exam. Finally, a CAD designer is an employee that has some technical education but did not complete an accredited engineering program. The CAD designers create construction drawings and sketches on computer design software. CAD designers do not design projects independently but rather do "some legwork" for engineers by entering marked-up drawings into the computer design software. In addition to the employees within each discipline, PDG has limited administrative staff. Ross T. Malloy's wife, Melanie Malloy, acts as the bookkeeper, janitor, and receptionist, among other roles within PDG.

Throughout trial, petitioner did not clearly distinguish the work performed by the various types of engineers. Therefore, we use the term "engineers" in this Opinion to refer collectively to professional engineers, senior engineers, and engineers. Petitioner likewise failed to clearly set forth the work done by the CAD designers. We use the term "PDG employees" to refer collectively to the engineers and the CAD designers.

III. PDG Design Process

- 7 Generally, an architect engages PDG to design MEPF systems for a hospital or a laboratory. PDG engineers design these systems against the backdrop of local building codes. Building codes set forth specific minimum requirements for how structures and building systems are constructed to provide a minimum standard to ensure public health, safety, and welfare. 13 Am. Jur. 2d *Buildings* § 2 (2024). Building codes provide standards for structural materials, design and construction materials, fire protection, health, sanitation, and safety that may vary with the use of a building. *Id.* For example, building codes may require 6 air changes per hour in a laboratory and 20 air changes per hour in an *7 operating room. PDG engineers must adhere to the relevant building codes from initial planning through final inspection.

Petitioner describes PDG engineers' approach to designing MEPF systems as a six-stage design process: basis of design, schematic design, design development, construction documents, bidding, and construction administration. Petitioner indicated that the design process is not linear but instead PDG engineers may loop back to previous stages if an issue is encountered in a later stage.

The first stage is the basis of design. The basis of design phase is an information gathering stage where the engineers attempt to determine the design requirements of each project, including the scope and unique characteristics of the project. The goal of this stage is to define the client's objectives and any restrictions that may affect the design.

The second stage is the schematic design phase. The architect begins determining the footprint of the building and creates gross block diagrams. PDG engineers analyze this initial information to estimate the appropriate MEPF systems and establish contact with utilities to determine how to connect the building to existing infrastructure. PDG engineers also provide the architect preliminary locations for the MEPF systems.

The third stage of the design process is the design development stage. The design development stage begins with the architect's providing PDG with plans that incorporate PDG's preliminary locations for the MEPF systems. PDG engineers use this information to determine the best route for the HVAC system and adjust the MEPF systems to accommodate any changes to the size of the building. PDG engineers also work with local zoning authorities to ensure compliance with any legal requirements. PDG engineers develop alternative systems and run calculations to ensure feasibility. PDG engineers convey the alternative systems and suggestions to the architect to incorporate in the design. The architect or owner determines which system to incorporate.

8 The fourth stage is the construction document phase. The owner determines final equipment selection, such as imaging systems, and PDG engineers ensure that the MEPF systems can support the equipment. To make these determinations, PDG engineers rely on cut sheets provided by the manufacturers, which explain the requirements *8 of the new equipment. PDG mechanical engineers run final load calculations to ensure the HVAC system can properly serve the building. PDG electrical engineers design the lighting systems in the building. At the conclusion of this phase, PDG produces the construction documents that contractors will use in construction and code officials will review for compliance. PDG professional engineers stamp these documents as a final product.

Next is the bidding stage. The owner or architect solicits bids from construction contractors to complete the work. The building owner may request that PDG revise the design plan to minimize costs.

The final stage is construction administration, in which the actual construction of the building begins. At the beginning of this stage, PDG engineers review shop drawings from contractors, which set forth the equipment they plan to use. PDG engineers review the shop drawings to ensure that the contractor complied with the construction documents and that PDG engineers made no mistakes in the construction documents. PDG engineers sometimes recorded this work as a separate stage from construction administration.

PDG engineers also make site visits to determine compliance with the construction documents. PDG engineers prepare a report on any errors they encounter. Throughout this process, contractors will send PDG requests for information. These requests for information flag conflicts in the construction documents and request PDG engineers' input on alternatives. The owner may also request changes to the design based on shifting business needs.

During the research years, PDG employees generally recorded their time by discipline and stage of the design process. PDG employees recorded their time spent in hourly increments on projects through Azero (hour sheets). The hour sheets were not used to bill clients but were instead an internal metric to measure employee performance. Each project had a unique project number assigned, and employees recorded time to the specific project number. Each time that the scope of the project expanded, PDG created a derivative project number from the main project. Employees were instructed to record time separately to the main project number and the derivative numbers.^[4] Once a particular design phase was completed,
9 an employee could not go back *9 and add time to that phase. For each increment of time, an employee included a short narrative description of his work.

IV. *alliantgroup* Study

On February 1, 2017, Melanie Malloy executed an engagement letter on petitioner's behalf with alliantgroup, a tax consulting and lobbying firm, to conduct a section 41 research credit study. Petitioner provided documentation on all projects undertaken between 2012 and 2016, and alliantgroup identified 419 possible projects that qualified for research credits. From this group, alliantgroup removed all projects known not to contain qualifying activities and de minimis projects, which reduced the total possible projects to 238. alliantgroup conducted an analysis of a sample of these projects and issued a report to petitioner.

V. Amended Returns and Audit

On the basis of the alliantgroup reports, petitioner amended its 2014 through 2016 tax returns to claim the research credits. Petitioner did not amend its 2013 tax return. Rather on its amended 2014 tax return, petitioner included the credits allocable to 2013 on line 4 of Form 3800, General Business Credit, as a carryforward of a general business credit to 2014.^[5] Petitioner claimed the following research credits per year:^[6]

10	*10	Tax Year	Research Credit Claimed
		2013	\$138,205
		2014	158,031
		2015	138,334
		2016	128,228

The research credits are attributable solely to wages paid to PDG's employees. Petitioner used the research credits during the credit years as follows:

Tax Year	Research Credit Claimed
2015	\$110,576
2016	74,488
2017	211,142
2018	68,147
2019	71,102

Respondent selected petitioner's tax returns for 2015 through 2019 for examination. On December 14, 2021, respondent issued a notice of deficiency to petitioner, disallowing the research credits and determining the following deficiencies and accuracy-related penalties:

Tax Year	Deficiency	Accuracy-Related Penalty
2015	\$55,504	\$11,101
2016	47,811	9,021
2017	219,177	43,835
2018	68,147	13,629
2019	71,102	14,220

Petitioner timely petitioned this Court for redetermination of the deficiencies and penalties.

VI. Research Projects

Given the number of projects for which petitioner claimed research credits, the parties agreed to try a sample of three research projects (trial projects). Our conclusions with respect to these trial projects are not binding as to the remaining research projects. Rather, ^{*11} it is the Court's expectation that this decision will enable the parties to mutually resolve the credits for the remaining research projects. See *Little Sandy Coal Co. v. Commissioner*, T.C. Memo. 2021-15, at *20, *aff'd*, 62 F.4th 287 (7th Cir. 2023). The parties selected the following three projects for trial: (1) Gerald Champion Military Psychiatric Unit (Gerald Champion), project No. 13008.00; (2) Baptist Memorial Health North Mississippi Oxford (BHNH Oxford), project No. 13003.00; and (3) Vanderbilt University Engineering and Science Building (VU ESB), project No. 12010.01.^[7]

The parties further narrowed the scope of trial to the determination of whether these projects entailed qualified research and not the amounts of qualified research expenses. Additionally, the parties stipulated that if we determine that none of the trial projects involved qualified research, petitioner will be liable for an accuracy-related penalty for each of the credit years in which there is a deficiency determined by the Court or by agreement of the parties. However, if we determine that one or more of the trial projects involved qualified research, respondent concedes that petitioner is not liable for accuracy-related penalties for any of the credit years.

A. Gerald Champion, Project No. 13008.00

Gerald Champion Regional Medical Center contracted architecture firm Ascension Group Architects, LLP, for two projects: (1) a geropsychiatric and military psychiatric renovation and new construction and (2) a catheterization laboratory infill.^[8] As to the first ^{*12} project, the renovations occurred in two existing wings in the hospital and included a small addition.

On July 23, 2013, PDG and Ascension Group Architects, LLP, entered a service contract related to these projects. Specifically, PDG was engaged to design and update the MEPF systems within the renovation and addition area. Gerald Champion Regional Medical Center sought to retain as much of the existing systems as possible to reduce costs. PDG agreed to a fixed compensation of \$90,000, which would be paid at the completion of specified milestones in the design and construction process. Gerald Champion initially provided PDG engineers with existing schematic design documents from previous engineering firms, a gross block diagram, and historic data that would allow sizing of equipment.

Petitioner did not identify the final construction documents it provided to Ascension Group Architects, LLP. The record contains a series of design drawings dated September 26, 2013, that appear to set forth a nearly complete plan for the MEPF systems. On the same day, PDG engineers also delivered a project manual for the renovation. PDG engineers periodically revised the designs and issued new design drawings. However, petitioner did not explain why or how the revisions were made.

PDG's employees recorded time to the Gerald Champion project under at least three distinct project numbers, including separate project numbers for the catheterization laboratory and military behavioral health wing.^[9] As established above, the scope of the trial is confined to project No. 13008.00, which is described as "Gerald Champion Military Psychiatry Unit." To act as engineers of record on the final project, PDG engineers had to ensure that any retained MEPF systems complied with relevant building codes.

1. Mechanical Systems

Gerald Champion Regional Medical Center wanted to use its existing HVAC system to support the renovations and the addition. To determine the feasibility of this request, PDG mechanical engineers reviewed the existing drawings and systems during the design ^{*13} development phase. PDG mechanical engineers determined that the existing HVAC system was installed in accordance with the original plan documents but found major flaws in the design. The original engineers failed to account for the elevation of the hospital in designing the existing HVAC system, which affects the required airflow to reach a desired temperature. After calculating the heating and cooling loads of the spaces, PDG mechanical engineers

"analyzed" the existing HVAC system and determined that it could support the renovation but not the small addition. Therefore, PDG mechanical engineers designed a new air handling system to serve the addition.

PDG mechanical engineers considered whether the system should be a constant air volume system or a variable air volume system. PDG mechanical engineers selected the variable air volume system because of the need for individual temperature control in the rooms.

As for the energy source to cool the coils, PDG mechanical engineers considered whether to use chilled water supplied from the hospital's central plant or to design a standalone refrigeration system for the unit. PDG mechanical engineers performed some calculations that determined that the existing plumbing was insufficient to serve the new air handling system, and thus they selected a local system. Relatedly, PDG mechanical engineers designed a method to reject the excess heat from the cooling system. PDG mechanical engineers determined that it was not cost efficient to connect to the hospital-wide refrigerant system that was located on the opposite side of the building. Therefore, PDG mechanical engineers selected a local condensing unit that would sit outside and reject the excess heat into the environment. As for the energy source to heat the coils, PDG mechanical engineers determined that the existing piping distribution was sufficient to serve the new air handling unit. To make this determination, PDG mechanical engineers calculated the amount by which the water pressure dropped between the central plant and the addition. PDG mechanical engineers performed static pressure calculations during the construction document phase to determine the appropriate fan size for the HVAC system.

14 After making these determinations, PDG mechanical engineers identified the addition's heating and cooling requirements, the range of possible temperatures, and the filtration requirements of the new system. Using this information, PDG mechanical engineers selected an appropriate air handling unit from a commercial producer. At this point, PDG mechanical engineers provided the architect with an *14 estimated size of the HVAC system. It was uncertain to this point whether the equipment would be housed in a mechanical room or on the roof. PDG mechanical engineers indicated their preference for a rooftop system, but the architect rejected this option because of aesthetic concerns. The architect approved placing the unit indoors but requested that the mechanical room be as small as possible. PDG mechanical engineers collaborated with the manufacturer to reduce the footprint of the unit by splitting the equipment over two levels.

In addition to the technical HVAC design, PDG mechanical engineers also had to ensure that the HVAC system complied with precautions taken for psychiatric patients. Specifically for the mechanical engineers, this included using tamper resistant fasteners that could not be unscrewed with a coin and restricting access to thermostats. These precautions also limited the choice of equipment for the system. For example, PDG considered adding a dedicated outside air system to circulate fresh air into the building that would require a portion of the system to be housed in patient rooms. This posed an additional risk to the patients, and consequently, PDG mechanical engineers rejected this idea.

During the construction administration phase, PDG mechanical engineers also discovered new information. For example, during a site visit, PDG mechanical engineers determined that the windows became incredibly warm during the day. PDG mechanical engineers reran heating and cooling load calculations to ensure the HVAC system could compensate for this new variable and found that it could.

2. Electrical Systems

As with the mechanical engineers, PDG electrical engineers began work on the project by evaluating the systems currently in place. PDG electrical engineers determined that the electrical panels were full and could not support the renovation. They designed new electrical panels that allowed the project to be completed in phases while patients were on site. They also had to add another electrical panel to supply a new information technology room.

3. Plumbing Systems

15 Petitioner presented little evidence to show the work PDG plumbing engineers performed for Gerald Champion. The sole issue mentioned at trial was the need to design the patient-facing systems in a way that was safe for psychiatric patients, such as slanting piping. In *15 other parts of the record, we see design drawings that appear to show revisions to the plumbing systems, equipment selection information and emails, and requests for information. Petitioner did not provide any further information regarding the design decisions or the revisions.

4. Employee Time

PDG employees recorded a total time of 487 hours on the Gerald Champion project. The mechanical discipline recorded 170 hours, the electrical discipline recorded 180 hours, and the plumbing discipline recorded 137 hours. CAD designers recorded 143 hours, broken down by discipline as follows: 60 hours for mechanical, 52 hours for electrical, and 31 hours for plumbing.

B. BHNH Oxford, Project No. 13003.00

Baptist Memorial Health Care Corp. (Baptist Memorial) contracted architecture firm Earl Swensson Associates, Inc. (Earl Swensson), to design a new hospital to replace its current hospital. On June 2, 2011, PDG and Earl Swensson entered into a service contract related to this project. Specifically, Earl Swensson engaged PDG to design the MEPF systems.

PDG agreed to a fee of 1.3% of the building's construction cost. This fee was payable at the completion of specific milestones in the design and construction process. PDG's employees recorded time to this project solely under project No. 13003.00. Having operated several hospitals, Baptist Memorial was familiar with the MEPF systems required for hospitals and had strong equipment preferences.

At the start of the project, Earl Swensson provided petitioner with floor diagrams and a preliminary master plan. Petitioner did not identify the final construction documents it provided to Earl Swensson. The record contains a series of design drawings dated December 15, 2014, that appear to set forth a nearly completed plan for the MEPF systems. PDG engineers periodically revised the designs and issued new design drawings. However, petitioner did not explain why or how the revisions were made.

1. Mechanical Systems

16 The BHNH Oxford project called for the design of a large hospital with varying climate needs for each department. For example, the *16 surgical unit had to be cooled to 62 degrees. Because of the varying needs of the hospital, the mechanical engineers determined that the HVAC system should have multiple air handling units. PDG mechanical engineers collaborated with a manufacturer that Baptist Memorial designated to design custom air handling units for critical areas: surgery, emergency, intensive care, imaging, and roof. For the remaining air handling units, PDG mechanical engineers selected conventional units designed by the manufacturer. The air handling unit for the surgical area contained a secondary coil to ensure temperature requirements could be met.

With several air handling units set to service the hospital, PDG mechanical engineers had to determine the appropriate location of each unit. PDG mechanical engineers first considered placing a mechanical room at the end of each wing to house the air handling units. However, Baptist Memorial rejected this option because it would take revenue-generating space from the hospital. PDG mechanical engineers redesigned the system to place the air handling units on the end of the roof of each wing.

As for the source to cool the coils, Baptist Memorial indicated that it wanted to use chilled water. To chill the water, Baptist Memorial selected a centrifugal chiller compressor to provide refrigerant to the air conditioning system. Baptist Memorial also set forth their preference for a specific manufacturer, required levels of redundancies, and how the chillers should be piped. PDG mechanical engineers designed the piping configuration between the centrifugal chiller compressor and the air handling units.

As for the source to heat the coils, PDG mechanical engineers selected steam because it could serve multiple purposes. In addition to heating the coils, the selected steam system could be used to sterilize surgical instruments. Next, PDG mechanical engineers considered whether the steam should be provided by local generators or at a central steam plant. They selected a central steam plant that could service both the heating and sterilization systems. They used heat exchangers on the steam plant to heat water that would be used to heat the building. They designed a complex three-boiler system to distribute heat throughout the building and provide steam for sterilization.

17 Baptist Memorial indicated that it wanted a backup fuel system to provide emergency power to the boiler system. PDG mechanical engineers designed tanks to hold the backup fuel after Baptist Memorial *17 specified that the tanks should be

above ground. PDG mechanical engineers had to ensure the tanks could withstand earthquakes and that the fuel stored inside would not become contaminated over time.

PDG mechanical engineers also had to comply with the local building code regarding airflow requirements. Airflow was particularly relevant for the hybrid operating room, which would include both imaging equipment and operating room capabilities within a sterile environment. Operating rooms, whether traditional or hybrid, require very slow air to flow that does not spiral where the table is positioned. Typically, an operating room table is in a fixed location in the room. In contrast, the hybrid operating room was designed to allow the operating staff to move the bed to several configurations, which affected the design of the diffusers needed to create the required airflow. PDG mechanical engineers designed the layout with various diffusers positioned throughout the room to create a sterile field regardless of the orientation of the bed.

2. Electrical Systems

PDG electrical engineers began work on the BHNH Oxford project by estimating the electrical needs for the various zones of the hospital. The PDG electrical engineers then met with the utility company, North East Mississippi Electric Power Co. (North Power), to determine how to supply electricity to the new building. Baptist Memorial requested that the hospital be connected to two substations in case one substation was taken offline.

PDG electrical engineers worked with North Power to run electricity from two substations to the hospital in a configuration that allowed for subsequent development. North Power provided recommendations and alternatives on how to run the electricity lines to the campus and the switch that would allow the hospital to be fed by the two substations. PDG electrical engineers communicated this information to Baptist Memorial, and Baptist Memorial made the ultimate decision.

18 Once North Power determined the route for the electric, PDG electrical engineers had to determine how to distribute it across the building. PDG electrical engineers estimated a large electric load would be required for the building. To accommodate this load, PDG electrical engineers informed the architect that they would require multiple switchboards to distribute the electricity and the estimated size of the *18 electrical rooms needed to store this equipment. PDG electrical engineers initially designed multiple electrical rooms to serve the building but reduced the number at the request of Baptist Memorial. PDG calculated the number of electrical panels required for distribution on the basis of estimated demands of the system. As the project progressed, the electrical demands often changed. For example, the hospital purchased a different piece of imaging equipment and PDG electrical engineers had to review the information provided by the manufacturer to determine whether the current design could support the new equipment.

The operating rooms provided an additional challenge in that the building code required isolated power. This required an isolated power pad, which alerts medical staff if there is a surplus of voltage that could harm the patient. PDG electrical engineers included this in the design.

Baptist Memorial also requested that PDG electrical engineers use a Powerwave Bus System to power the information technology center. PDG electrical engineers met with the vender to understand how this system worked. PDG electrical engineers then consulted with Baptist Memorial to determine the equipment that would be housed in the information technology room. Along with the mechanical engineers that were responsible for cooling the room, the electrical engineers determined the configuration of the equipment. The manufacturer then built systems to meet the expected demand.

3. Plumbing Systems

Petitioner presented little evidence to show the work PDG plumbing engineers performed for BHNH Oxford. In the record we see design drawings that appear to show revisions in the plumbing systems and equipment selection information. Petitioner did not provide any further information regarding the design decisions or the revisions.

4. Employee Time

PDG employees recorded a total time of 16,650 hours on the BHNH Oxford project. The mechanical discipline recorded 5,941 hours, the electrical discipline recorded 5,876 hours, and the plumbing discipline recorded 4,333 hours. The remaining 501 hours were recorded to specific phases of the project without a specified discipline. CAD designers recorded

- 19 2,118 hours, broken down by discipline as follows: 261 hours for mechanical, 947 hours for electrical, 909 hours for *19 plumbing, and 1 hour to construction administration without a specified discipline.

C. VU ESB, Project No. 12010.01

Vanderbilt University contracted architecture firm Wilson Architects, Inc. (Wilson Architects), to design an engineering and science building (TEAM building). Vanderbilt University intended the new building to be an interdisciplinary research building for the school of engineering and medical center that would house research laboratories, faculty offices, conference facilities, a cleanroom, imaging facilities, and a vivarium. On July 17, 2013, PDG and Wilson Architects entered a service contract for PDG to design the MEPF systems and telecommunication systems for the TEAM building. Specifically, PDG's services included (1) designing MEPF systems that meet the requirements for LEED Silver certification and (2) consulting with the cleanroom contractor to determine which utilities are needed for the cleanroom.

PDG engineers completed their work through the design development phase when the medical center pulled out of the joint venture. Vanderbilt University stopped all work on the project until it could determine how the project would continue. The university decided to continue the design and construction of the building but modified the plans to fit only its needs. Vanderbilt University decided to remove the biomedical portions of the design plan, including reducing the number of laboratories and deleting the vivarium. It also reduced the size of the building. Vanderbilt University retained the cleanroom and imaging facility.

On January 1, 2014, Vanderbilt University and Wilson Architects entered into a new contract related to the shifting scope. Under this new contract, Wilson Architects was to design and construct an engineering and science building. The new building would have five above-ground floors that would house research labs and community spaces. The building would also house a 10,000-square-foot clean room on the ground floor. Two floors below the ground level would house classrooms and imaging areas containing nanoscale and atomic-level microscopes.

- 20 PDG executed a new contract with Wilson Architects on September 29, 2015, to design the MEPF and telecommunication systems for the new project. Specifically, PDG's services included *20 (1) revising the systems for the reconfigured building and (2) reselecting the required equipment. In addition to PDG, Wilson Architects contracted a specific engineering firm that specialized in cleanroom mechanical, electrical, and plumbing systems. Because previous work had been done for the combined engineering and medical building, PDG was contracted to start at the design development phase of the project. PDG agreed to a fixed fee of \$1,758,500 for this project to be paid at specific milestones in the project.

PDG engineers submitted the stamped final construction documents to Wilson Architects. These construction documents set forth the MEPF systems designs by floor, including the exhaust systems, electricity distribution, and mechanical equipment. These documents were subsequently revised, but petitioner did not explain the revisions and we are unable to derive meaning from the design drawings.

PDG's employees recorded time to this project under at least 18 distinct project numbers, including separate project numbers for laboratory revisions, the chilled water tie-in, and the steam line relocation.^[10] As established above, the scope of the trial is confined to project No. 12010.01, which is described as "VU ESB (Olin Hall)." PDG's employees recorded time to this project in years 2013 through 2017. PDG represents that the work completed on the TEAM building with the medical center was not recorded to project No. 12010.01.

1. Mechanical Systems

- 21 PDG mechanical engineers were tasked with designing an HVAC system that could accommodate the varying uses of the building and achieve at least an LEED Silver certification. PDG mechanical *21 engineers ran heating and cooling loads throughout the design process to account for changes in the design plans, such as changing window sizes. In addition to calculating the heating and cooling loads, PDG mechanical engineers made recommendations to limit the demand on the heating and cooling systems, such as glazing the windows to prevent heat transfer.

In considering how to achieve the LEED Silver certification, PDG mechanical engineers contemplated whether to use water or air systems to cool and heat the building. PDG mechanical engineers selected a hybrid system, which would increase efficiency to help meet LEED Silver certification. As for the source of cooling for the coils and water system, PDG

mechanical engineers selected a building chiller.^[11] The building chiller system is a large draw on electricity that could affect the building's qualification for LEED certification. To determine the design of the building chiller system, PDG mechanical engineers modeled units from three different manufacturers to determine which unit had the lowest operating cost in peak and part load performance. PDG mechanical engineers determined that it would use two chillers with one on standby to service the building.^[12] PDG mechanical engineers created a control system to ensure the chillers functioned as one unit. PDG mechanical engineers worked on the chiller system from the design development phase to the construction document phase.

22 As for the source of heating for the coils and water system, Vanderbilt University has a campus-wide steam distribution system. The distribution system is contained in a "mole hole" 100 feet below ground. Inside the mole hole is a pipe that carries high pressure steam around campus. PDG mechanical engineers designed a piping system to connect the science building to the steam distribution system.^[13] In making this design, PDG mechanical engineers had to account for the *22 effect of the steam on the piping. The steam from the steam distribution system is over 400 degrees. In contrast, the ground temperature in the area that would house the pipes connecting the steam distribution system to the VU ESB project would be approximately 50 degrees. When the hot steam entered the pipe, it would cause the pipes to expand and contract because of the change in temperature. If PDG mechanical engineers did not account for this expansion, the pipe would rupture.

To determine the rate of expansion or stress on the system, PDG mechanical engineers initially hand drafted a design for the pipe and created computer models. They then calculated the force that would be on the pipe between the point of connection to the steam distribution system and the VU ESB project. After coming up with an initial design, PDG mechanical engineers entered the information into pipe stress analysis software. This analysis flagged the points on the pipe where the stress had to be mitigated to prevent rupture. PDG mechanical engineers then introduced elbows, expansion bellows, and different configurations to reduce stress on certain points of the pipe. After making these edits, PDG mechanical engineers ran the program again and continued this process until there were no ruptures. PDG mechanical engineers reran the program during the construction administration phase because the contractor could not build the pipe in the exact location specified in the construction documents.^[14]

PDG mechanical engineers designed a two-story penthouse to house the air handlers, chillers, pumps, and exhaust ducts. They determined the layout of the penthouse but did not specify how the components would be hung in the penthouse. The contractor came up with a solution to provide intermediate supports rather than hanging the piping from the ceiling.

23 As discussed above, once the air is chilled or heated, it is distributed around the building via duct work and return air is circulated out of the space. Because of the research performed in the laboratories, the VU ESB project had additional exhaust sources from each room. The third and fourth floors of the science building were designed as research laboratories. Laboratories are either dry or wet. A wet laboratory is one that contains biological or hazardous materials *23 that require a fume hood. At the start of the design, Vanderbilt University was not certain as to which researchers would be assigned to each laboratory. Because of this uncertainty, PDG mechanical engineers designed each laboratory with one fume hood that would allow each room to operate as either a wet or a dry laboratory. This was an additional exhaust point that had to be accounted for in the design of the HVAC system and would make the system less energy efficient.^[15] PDG mechanical engineers designed a system that captured energy from exhaust air when most of the fume hoods were not in use.

PDG mechanical engineers routed the exhausts from the laboratories to the roof of the science building. The VU ESB project was located among other university buildings, so there was concern about the fallout of particles discharged from the fume hoods on adjacent buildings. PDG mechanical engineers had to determine the proper height of the plume exhaust system that was located on the roof and the required fan strength to minimize fallout on adjacent buildings. They considered two options for the plume system: one with two stacked fans and one with a single stronger fan. They determined that the single-fan option would not propel the air high enough to get the required distribution, so the engineers selected the two-fan system.

PDG mechanical engineers were also particularly concerned with airflow and pressure relationships. The work occurring in several of the rooms was particularly sensitive to slight air disturbances. For example, the imaging facility contained a Krios microscope that could be used to examine atoms. This process was extremely sensitive to slight disturbances, which would distort the images. PDG mechanical engineers considered this sensitivity in designing the HVAC system for this area because any airflow in the room could result in distortion. They determined that the vent locations for the HVAC system

should be placed at the periphery of the space and the researchers would need the ability to turn off the system during research.

In addition to airflow concerns, the pressure relationship between the various rooms affected the design of the HVAC system. Both the imaging room and the cleanroom required particular attention to pressure differentials. To prevent disruption of the work in the imaging facility, PDG mechanical engineers designed the HVAC system such that the pressure in the imaging facility was greater than in the *24 surrounding areas. This would ensure that when the doors were open, air would blow out of the imaging facility and prevent dust from entering the room. Likewise, the HVAC system for the cleanroom had to be designed to achieve a particular pressure relationship on the account of the biohazardous materials and hazardous chemicals studied there.

In addition to designing the HVAC system, PDG mechanical engineers designed smoke and fire dampers to work with the HVAC system. One area that presented a particular challenge was the clean room. PDG determined that traditional smoke and fire dampers would be dangerous because the exhausts expelled air at a high rate to counter the harsh chemicals used in the room and could not be turned off. If a fire or smoke damper was triggered, it would cut off the makeup air supply that compensates for the high exhaust rate, which would suck the oxygen from the room. The imbalance in pressure would also result in occupants' being unable to open any outward opening doors. After determining that their initial design led to these safety concerns, PDG mechanical engineers considered alternative designs but did not find a solution. PDG mechanical engineers obtained an exception from the local authorities to not install the smoke and fire dampers in the cleanroom.

In relation to fire prevention for the HVAC system, Vanderbilt University requested that PDG design the system so that it could be tested without disturbing research. PDG mechanical engineers discovered a vendor they had not used before that offered dampers that could be tested from a centralized control panel without visual inspection. They integrated this damper system into the existing design for the fire alarm system.

2. Electrical Systems

As with the other projects, PDG electrical engineers began the project by determining the building's estimated load using software that based energy demand on square footage. Instead of using generic laboratory estimates, Vanderbilt University and PDG electrical engineers determined the average energy consumption of other laboratory buildings on campus. PDG electrical engineers then worked with Vanderbilt University to determine how to convey the electricity from the campus distribution system to the VU ESB project. PDG electrical engineers routed the electricity around the building, ensuring that the requirements of each laboratory were met. This included *25 ensuring that the system could satisfy the high electrical demand of the cleanroom.

Vanderbilt University also requested emergency electricity in the building. Because of the large electrical demands of the building and limited space, PDG electrical engineers determined that the backup generators should be located on the VU ESB's roof. Additionally, PDG electrical engineers accounted for electromagnetic interference from all of the electrical wires providing electricity to the cleanroom that would disrupt the sensitive research equipment. To prevent this interference, PDG electrical engineers insulated the wires.

3. Plumbing Systems

Petitioner presented little evidence to show the work PDG plumbing engineers performed for the VU ESB project. In the record we see design drawings that appear to show revisions to the plumbing systems and unexplained calculations. Petitioner did not provide any further information regarding the design decisions or the revisions.

4. Employee Time

PDG employees recorded a total time of 12,671 hours on the VU ESB project between 2013 and 2017.^[16] The mechanical discipline recorded 3,862 hours, the electrical discipline recorded 4,086 hours, and the plumbing discipline recorded 1,801 hours. The remaining 2,924 hours were recorded to specific phases of the project without a specified discipline. CAD designers recorded 3,515 hours, broken down by discipline as follows: 1,574 hours for mechanical, 1,466 hours for electrical, 473 hours for plumbing, and 2 hours to project management without a specified discipline.

OPINION

I. Burden of Proof

26 The Commissioner's determinations set forth in a notice of deficiency are generally presumed correct, and the taxpayer bears the burden of proving the determinations are in error. See Rule 142(a)(1); *Welch v. Helvering*, 290 U.S. 111, 115 (1933). Credits are a matter of legislative grace, and taxpayers must demonstrate their entitlement to *26 credits claimed. See *Feigh v. Commissioner*, 152 T.C. 267, 270 (2019) (citing *INDOPCO, Inc. v. Commissioner*, 503 U.S. 79, 84 (1992)). Petitioner does not contend, and the evidence does not establish, that the burden of proof shifts to respondent under section 7491(a) as to any issue of fact.

II. Section 41 Research Credit

A. Basic Structure

Section 38(a) permits a taxpayer to claim on its return a credit against tax equal to the sum of (1) business credits carried forward to the tax year, (2) current year business credits, and (3) business credits carried back to the tax year. Current year business credits include the credit under section 41 for increasing research activities. § 38(b)(4).

Section 41(a)(1) provides that the research credit is equal to 20% of the excess of the taxpayer's qualified research expenses (QREs) over the base amount.^[17] QREs are limited to the amounts "paid or incurred by the taxpayer during the taxable year in carrying on any trade or business."^[18] §§ 41(b)(1), 7701(a)(25). QREs comprise in-house research expenses and contract research expenses. § 41(b)(1). In-house research expenses are (1) "any wages paid or incurred to an employee for qualified services performed by such employee" and (2) "any amount paid or incurred for supplies used in the conduct of qualified research." § 41(b)(2)(A)(i) and (ii). Qualified services are defined as either (1) engaging in qualified research or (2) engaging in the direct supervision or direct support of qualified research. § 41(b)(2)(B). Direct support of qualified research includes direct support of either the person engaging in qualified research or the person directly supervising the qualified research. Treas. Reg. § 1.41-2(c)(3). Generally, wages are considered in-house research expenses to the extent that the wages were paid for qualified services. § 41(b)(2)(A)(i). If at least 80% of the services an employee performs are qualified services, a taxpayer may include 100% of the wages paid to the employee as in-house research expenses. Treas. Reg. § 1.41-2(d)(2).

27 *27 B. Qualified Research

To constitute qualified research, the research must satisfy a fourpart statutory test:

Sec. 41(d). Qualified research defined. . . .

(1) In general.—The term "qualified research" means research—

(A) with respect to which expenditures may be treated as expenses under section 174,

(B) which is undertaken for the purpose of discovering information—

(i) which is technological in nature, and

(ii) the application of which is intended to be useful in the development of a new or improved business component of the taxpayer, and

(C) substantially all of the activities of which constitute elements of a process of experimentation for a purpose described in paragraph (3).

The four-part statutory test is applied separately to each business component. § 41(d)(2)(A). A business component is defined in relevant part as a product that the taxpayer either (1) holds for sale, lease, or license or (2) uses in its trade or

business. § 41(d)(2)(B). For each trial project, petitioner claims that the mechanical, electrical, and plumbing systems together—the MEPF systems as a whole—represent the business component. Respondent concedes the technological information test and the business component test. We now examine the remaining portions of the four-part statutory test: the section 174 test and the process of experimentation test.^[19]

1. The Section 174 Test

28 The first requirement is that the research must be research "with respect to which expenditures may be treated as expenses under *28 section 174." § 41(d)(1)(A).^[20] We refer to this as the "section 174 test," whereby the taxpayer must show (1) that the claimed research expenditures would be eligible for a deduction under section 174 and (2) that the claimed research activities constituted research and development within the meaning of section 174. See *Norwest Corp. & Subs.*, 110 T.C. at 491. For tax years ending after July 21, 2014, if we conclude that the taxpayer fails the section 174 test at "the level of a product" as a whole, the taxpayer may still satisfy the test "at the level of the component or subcomponent." Treas. Reg. § 1.174-2(a)(5).^[21]

For background, section 174 operates as a narrow, elective exception to the general capitalization rules. §§ 174(a), 263(a)(1), 263A(c)(2). Section 174(a) allows a taxpayer to elect a current deduction for research and expenditures which are paid by the taxpayer during the taxable year in connection with the taxpayer's trade or business.^[22] See also Treas. Reg. § 1.174-1. Research and experimental expenditures are research and development costs in the experimental or laboratory sense and generally include all costs incident to the development or improvement of a product. Treas. Reg. § 1.174-2(a)(1).

29 We apply a two-step test to determine whether a taxpayer's activities constituted research and development within the meaning of section 174. In the first step the taxpayer must show that the information objectively available to it did not establish the appropriate design of the product. See Treas. Reg. § 1.174-2(a)(1); see also *Max v. Commissioner*, T.C. Memo. 2021-37, at *29. If such information was not available to the taxpayer with respect to establishing either the capability, method, or appropriate design, then uncertainty existed. See *Union Carbide Corp. & Subs.*, T.C. Memo. 2009-50, slip op. at 195; *29 Treas. Reg. § 1.174-2(a)(1). In determining whether uncertainty existed, we examine the information objectively available to the taxpayer, rather than the taxpayer's subjective understanding of that information. *Union Carbide Corp. & Subs.*, T.C. Memo. 2009-50, slip op. at 195-96 ("Whether an uncertainty exists is an objective test that depends on the information available to the taxpayer." (citing *Mayrath v. Commissioner*, 41 T.C. 582, 590-91 (1964), *aff'd*, 357 F.2d 209 (5th Cir. 1966))); see also *Max*, T.C. Memo. 2021-37, at *30 (finding no uncertainty where appropriate design may have been subjectively unknown to the taxpayer but the taxpayer "already ha[d] the information necessary to address that unknown"). Expenditures that are paid after the elimination of uncertainty are not research and development expenditures. Treas. Reg. § 1.174-2(a)(2). Furthermore, it bears emphasis that uncertainty related to a subcomponent does not necessarily render the appropriate design of the product as a whole uncertain. *Betz v. Commissioner*, T.C. Memo. 2023-84, at *76 (determining that a taxpayer failed to show objective uncertainty as to the design of the product as a whole because the taxpayer would not have to scrap the entire product if it did not work); *Little Sandy Coal Co.*, T.C. Memo. 2021-15, at *53.

30 In the second step, if uncertainty existed, the taxpayer must show that it undertook investigative activities that were "intended to discover information that would eliminate uncertainty." Treas. Reg. § 1.174-2(a)(1); see *Max*, T.C. Memo. 2021-37, at *30-31 (citing *Mayrath*, 41 T.C. at 590) (requiring the taxpayer to show it undertook investigative activities because the purpose of section 174 was to limit deductions to expenditures of an investigative nature). The resolution of this uncertainty does not necessarily require experimentation. See *Little Sandy Coal Co.*, T.C. Memo. 2021-15, at *36. We have previously held that a meeting or email soliciting further information and specifications is an investigative activity within the meaning of section 174. See *Betz*, T.C. Memo. 2023-84, at *80, *89. However, performing basic calculations on available data is not an investigative activity because the taxpayer already has all the information necessary to address that unknown. *Id.* at *84, *87 (finding that performing calculations to determine duct size based on airflow was not an investigative activity); *Max*, T.C. Memo. 2021-37, at *30 (finding that while information was subjectively unknown to the taxpayer with respect to the appropriate design of a component, the taxpayer "already ha[d] the information necessary to address that unknown"). A taxpayer may not carry its burden to show it engaged in investigative activities merely by presenting an issue and eventual solution. See *Betz*, T.C. Memo. *30 2023-84, at *86. Instead, the taxpayer must show it actually conducted investigatory activities. See *id.*

Petitioner argues that the second step of the section 174 analysis—whether PDG engineers undertook investigative activities—is not before the Court. Petitioner argues that respondent's stipulation that he would not contest the technological information prong of the four-part statutory test binds respondent as a concession that PDG engineers undertook investigative activities. Petitioner cites no authority for extending this concession, and we will not do so in this case. See *Betz*, T.C. Memo. 2023-84, at *68, *86 (considering whether a taxpayer satisfied the investigative activities portion of the section 174 test even when the IRS conceded the technological information test).

2. The Process of Experimentation Test

Finally, section 41 requires that (1) substantially all the research activities (2) constitute elements of a process of experimentation (3) for a qualified purpose. § 41(d)(1)(C). We refer to this as the process of experimentation test. A process of experimentation is a "process designed to evaluate one or more alternatives to achieve a result where . . . the appropriate design of that result, is uncertain as of the beginning of the taxpayer's research activities." Treas. Reg. § 1.41-4(a)(5)(i). The requisite uncertainty under this test is essentially identical to the uncertainty required by the section 174 test. *Union Carbide Corp. & Subs.*, T.C. Memo. 2009-50, slip op. at 199. Unlike the section 174 test, however, this evaluative process must follow the scientific method. *Id.* at 201.

The substantially all requirement is satisfied if "80 percent or more of a taxpayer's research activities, measured on a cost or other consistently applied reasonable basis . . . , constitute elements of a process of experimentation for a [qualified purpose]." Treas. Reg. § 1.41-4(a)(6). The substantially all requirement is satisfied even "if the remaining 20 percent (or less) of a taxpayer's research activities with respect to the business component do not constitute elements of a process of experimentation for a [qualified purpose], so long as these remaining research activities satisfy the [section 174 test] and are not otherwise excluded under section 41(d)(4)." *Id.* Therefore, the numerator of the relevant fraction is all research activities that constitute an element of a process of experimentation for a qualified purpose. *Little Sandy Coal Co.*, T.C. Memo. 2021-15, at *40; Treas. Reg. § 1.41-4(a)(6). The denominator is all research activities that meet the section 174 test that are not covered by one of the statutory exclusions. *Little Sandy Coal Co.*, T.C. Memo. 2021-15, at *40; Treas. Reg. § 1.41-4(a)(6). Petitioner bears the burden of providing sufficient information to demonstrate that the substantially all fraction equals or exceeds 80%. *Little Sandy Coal Co.*, T.C. Memo. 2021-15, at *43-44. Petitioner indicated only the number of hours worked by each employee on each project; therefore, we will apply the substantially all test on this basis.

The final part of the process of experimentation test requires that the activities be for a qualified purpose as defined in section 41(d)(3). Qualified research includes research that is related to (1) a new or improved function, (2) performance, or (3) reliability or quality. § 41(d)(3). Research related to style, taste, cosmetic, or seasonal factors is not for a qualified purpose. *Id.*

C. Shrinking-Back Rule

If a business component fails any part of the four-part statutory test, we may apply the test to a subset of the product (shrinking-back rule). Treas. Reg. § 1.41-4(b)(2). The shrinking-back rule instructs us to reapply the four-part statutory test to the business component at its most significant subset of elements. *Id.* If that subset of elements again fails, we generally drill down to a more granular subset of the business component until either (1) a subcomponent satisfies the test or (2) the most basic level of the component fails to satisfy the test. *Id.* When a component fails, we have previously applied this rule to an issue that a taxpayer encounters in the design process when the issue relates to an identifiable subcomponent. See, e.g., *Betz*, T.C. Memo. 2023-84, at *81. As noted above, an identical test applies if a business component fails the section 174 test. See Treas. Reg. § 1.174-2(a)(5).

If we determine that the MEPF systems for any trial project fails, petitioner contends that we can apply the shrinking-back rule by relying on the hour tracking information. Petitioner presents several options to shrink back including by (1) discipline, (2) particular design phase, or (3) individual employee. Petitioner's first suggestion to apply the shrinking-back rule by discipline aligns with the regulatory text. That is, if the MEPF systems as a whole fail to qualify, we will narrow the scope of our review separately to the mechanical systems, electrical systems, and plumbing systems. If this secondary level fails, the shrinking-back rule directs us to determine the next most significant subset of the business component.

32 *32 We reject petitioner's other shrinking-back methods. We must apply the shrinking-back rule to the next most significant subset of elements of the business component. Looking at the design stages, we cannot identify subsets of the MEPF systems. Instead, PDG engineers worked on various subsets of the MEPF systems in each design stage and subsets of the systems were not neatly resolved in one design stage. For example, during the project design stage of the BHNM Oxford project, PDG engineers worked on the roof units and the fire alarm system. Additionally, work on the lighting systems extended over several design stages.

As for applying the shrinking-back rule to focus on the activities of one employee, we likewise run into the issue of ignoring the most significant subset rule. No one employee exclusively focused on one subset, nor was any one subset worked on by only one employee. For example, in the VU ESB project mechanical engineer Thomas Fisher worked on the chiller issue and the steam distribution issue. Mechanical engineer Ross T. Malloy also worked on the steam distribution issue. Therefore, applying the shrinking-back rule by employee would not identify the most significant subset of the MEPF systems. Thus, we will apply the shrinking-back rule, if required, to examine the mechanical system, electrical system, and plumbing system. If these systems also fail, we then will have to determine whether there is sufficient information to apply the shrinking-back rule to a further subset of the systems.

III. The Qualification of the Trial Projects as Qualified Research

Now we turn to the issue of whether any trial project entailed qualified research within the meaning of section 41. Petitioner contends that it faced uncertainty as to the appropriate design of each of the MEPF systems even beyond the delivery of stamped construction documents because the appropriate design of the MEPF systems could not be established until construction was complete. Petitioner claims this uncertainty continued because PDG engineers would have to revise and alter the design through construction. For how PDG engineers resolved this uncertainty, petitioner directs the Court to its six-stage design process. Petitioner alleges that when faced with an issue in a later design stage, its engineers would revert to earlier stages to resolve the issue, creating an iterative process that mirrors the scientific method.

33 *33 At the outset, we reject petitioner's theory that uncertainty existed because of the possibility of revising the design of the MEPF systems before construction was complete. The regulations and our caselaw recognize a distinction between objective uncertainty as to the design of the whole system (its basic design specifications) and objective uncertainty as to the design of a particular component. Treas. Reg. § 1.174-2(a)(5); *see also Betz*, T.C. Memo. 2023-84, at *76. The mere possibility of altering the design in later stages does not itself establish that the appropriate design remained uncertain. *See Betz*, T.C. Memo. 2023-84, at *76; *Little Sandy Coal Co.*, T.C. Memo. 2021-15, at *53. These subsequent revisions may introduce some uncertainty, but the scope of the uncertainty is a question based on the particular facts and does not necessarily translate to the entire system. *See Betz*, T.C. Memo. 2023-84, at *76; *Little Sandy Coal Co.*, T.C. Memo. 2021-15, at *53.

We similarly reject petitioner's argument that it satisfied the process of experimentation test simply by directing the Court to the six-stage design process. Merely connecting an activity to a larger plan that may resemble the scientific method does not satisfy the process of experimentation test. While the design process as framed by petitioner may appear similar to the scientific method, the assertion alone is not sufficient for us to find that PDG employees engaged in the process of experimentation. Instead, we focus on the activities of PDG employees. *See Union Carbide Corp. & Subs.*, T.C. Memo. 2009-50, slip op. at 200-01.

We are also skeptical of whether PDG employees followed petitioner's description of the six-stage design process because of the way the hour sheets are filled out. PDG employees did not categorize any of their hours on the basis of design phase. Additionally, the descriptions do not appear to line up with the work completed in each stage. For example, petitioner described the construction document stage as ending with the delivery of stamped construction documents. However, for the VU ESB project, mechanical engineer Ross T. Malloy labeled time in the design development stage as "finishing up construction documents." Related to the BHNM Oxford project, mechanical engineer John Wade labeled time in the design development stage "schematic design," which according to petitioner's description of the six-stage design process is an independent stage. Given these inconsistencies between the description of the six-stage design process and the narrative descriptions on the hour sheets, we cannot determine that petitioner followed a process of experimentation by merely

34 relying on the description. Instead, we must apply a more granular approach *34 to determine whether the activities of these employees were part of a process of experimentation for the trial projects. We must focus on the uncertainty and the steps taken to resolve that uncertainty. *See id.* Below, we will address only the relevant portions of the four-step statutory test.

A. Gerald Champion

1. MEPF Systems as a Whole

The MEPF systems designed for Gerald Champion fail the section 174 test. Petitioner alleges uncertainty as to the appropriate design of the MEPF systems because PDG engineers had to integrate new MEPF systems within the existing systems. Petitioner argues that the uncertainty continued until all mechanical and appliance components of the systems were selected.

Petitioner failed to identify the specific information that was not available to PDG engineers at the start of the project. Instead, petitioner points to the limited information provided to it at the start of the project, including a simple gross-block diagram that only generally showed the location of the buildings. PDG engineers also received historic data from the hospital that could be used to determine the necessary size of the equipment. Testimony at trial also revealed that PDG engineers were provided existing schematic design diagrams although petitioner did not identify these documents to the Court.^[23] Therefore, we do not know what information was shown on this diagram or whether it provided sufficient evidence to determine the appropriate design. Petitioner failed to show that the information set forth on the gross-block diagram and the schematic design diagram did not establish the appropriate basic design of the systems. Therefore, petitioner has failed to establish that there was objective uncertainty as to the appropriate design of the MEPF systems.

Petitioner further failed to demonstrate how uncertainty in one element of the MEPF systems created uncertainty throughout the entire MEPF systems. As we reiterated recently in *Betz*, T.C. Memo. 2023-84, at *76, uncertainty regarding a subset of the business component does not make the design of the entire business component uncertain. PDG engineers provided sparse, conclusory testimony that a change in one subcomponent affected the basic design of the entire MEPF systems.

35 *35 However, petitioner failed to develop this interconnection to any meaningful extent. Instead, petitioner presented evidence at trial and on brief focused around discrete issues.^[24] Petitioner fails to satisfy the section 174 test as to the entirety of the MEPF systems designed for Gerald Champion.

2. Shrinking-Back Rule

We look next to the shrinking-back rule to determine whether any of the activities related to a component or a subcomponent were qualified research. The next most significant components of the MEPF systems are the mechanical, electrical, and plumbing systems. This level of review likewise does not involve qualified research. Petitioner makes the same general argument about uncertainty as discussed above and highlights a few additional uncertainties for specific systems. We reject the general argument for the same reasons as above.

As it relates to the mechanical system, petitioner's claimed uncertainty relates to where the HVAC system would be located in the hospital. Petitioner argues that this uncertainty was not resolved until its engineers determine the required size for the system. Regardless of whether this uncertainty existed, petitioner failed the process of experimentation test related to the design of the mechanical systems. PDG mechanical engineers calculated the approximate size of the systems by referencing the historic data they were provided by Gerald Champion at the start of the project and reported the required size of the system to the architect. The architect ultimately decided that the system would be placed in a mechanical room. Performing calculations and communicating the results to the architect is not an evaluative process that mirrors the scientific method. Instead, PDG mechanical engineers provided the architect with the information that the architect used to base the decision on aesthetics.

36 PDG mechanical engineers' other decisions regarding the mechanical systems likewise fail the process of experimentation test. PDG mechanical engineers encountered several decision points in the design, and rather than engage in experimentation, they selected an option. This decision-making process was presented as decisions PDG *36 mechanical engineers made using their expertise rather than a course of study as demanded by the scientific method.

As for the electrical systems and plumbing systems, petitioner did not allege any additional uncertainty other than that it was "uncertain as to the appropriate design" of each system. We reject this argument for the same reason we rejected it with regard to the MEPF systems: petitioner failed to set forth (1) what information was unavailable to PDG electrical and

plumbing engineers and (2) what investigative activities PDG electrical and plumbing engineers undertook with respect to the uncertainty. See *Betz*, T.C. Memo. 2023-84, at *76.

Having determined that the activities related to the mechanical, electrical, and plumbing systems individually are not qualified research, we shrink back to the next most significant subset of each of the systems. While we have information to identify discrete issues faced by PDG engineers, it would be futile. To demonstrate that its engineers conducted qualified research, petitioner relies heavily on the hour sheets. While these hour sheets are broken down by discipline, they are not consistently broken down by subset or issue confronted by PDG engineers. For example, mechanical engineer John Wade recorded time to "HVAC," electrical engineer Joseph Barnes recorded time to "ltg, pwr, sys design," and plumbing engineer Richard Miller recorded time to "work on plumbing fixtures." We cannot connect these time entries to the discrete issues identified in testimony. Therefore, we are unable to verify whether these activities were (1) investigative activities, (2) part of a process of experimentation, or (3) for a permitted purpose.

Finally, to the extent we have the capability to apply the shrinking-back rule, petitioner fails to carry its burden. Petitioner failed to present any evidence that its engineers engaged in a process of experimentation with respect to any subcomponent. Instead, petitioner presented issues its engineers encountered and the decisions they made. On occasion, petitioner indicated that its engineers did some preliminary calculations or considered some factors. However, these activities fall short of the process of experimentation test that must mirror the scientific method. Instead, PDG engineers made determinations as to the design using their expertise. Likewise the numerous design drawings in evidence do not demonstrate the activities performed to get the solutions. As aptly summarized by petitioner's counsel, the unexplained design drawings "tell[] me nothing."

37 *37 **B. BHNM Oxford**

1. MEPF Systems as a Whole

The MEPF systems designed for BHNM Oxford fail the section 174 test. Petitioner alleges that it was uncertain as to the design for the MEPF systems because it was new construction and the PDG engineers did not know the footprint of the hospital. Petitioner also argues that the hybrid operating room, the lack of knowledge regarding the final equipment, and the building code created uncertainty regarding the entire system.

At the start of the project, the architect provided PDG engineers a schematic block diagram and a preliminary master plan. The schematic block diagram showed a preliminary layout of each floor of the hospital and identified the location of each department. The preliminary master plan appears to lay out the configuration of the hospital and outbuildings, which would indicate where the MEPF systems would be needed. PDG engineers were experts in their field that had years of experience designing MEPF systems for hospitals. Because petitioner claimed the general uncertainty was the lack of information regarding the construction, these documents appear to resolve such uncertainty and serve as a basis for the basic design of the MEPF systems. Therefore, petitioner failed to establish that there was objective uncertainty as to the appropriate design of the MEPF systems.

Even if there was uncertainty stemming from the hybrid operating room, equipment selection, and building codes, petitioner failed to show how this uncertainty would lead to uncertainty regarding the whole MEPF systems. Uncertainty as to a component of the system does not mean there is uncertainty related to the entire business component. See *Betz*, T.C. Memo. 2023-84, at *76. Other than some conclusory statements at trial about the interconnected nature of the various pieces of the MEPF systems, petitioner failed to explain why the inclusion of the hybrid operating room would render the entirety of the MEPF systems uncertain. Drilling down further, the bulk of the uncertainty regarding the hybrid operating room appears to stem from the placement of the vents in the room to ensure a sterile field regardless of the position of the table. Petitioner failed to introduce evidence that this uncertainty would affect the basic design of the MEPF systems. For example, how the ventilation would affect the electrical switch directing electricity into the hospital is not clear. See *Betz*, T.C. Memo. 2023-84, at *76; Treas. Reg. § 1.174-2(a)(5) (distinguishing between objective *38 uncertainty as to the design of a product as a whole (i.e., its basic design specification) and objective uncertainty as to the design of a particular subcomponent).

As for the equipment selection uncertainty, there may have been objective uncertainty as even Baptist Memorial did not know the ultimate selection of equipment. However, PDG engineers did not engage in the process of experimentation to

resolve this uncertainty. Instead, they waited for the final selection to come from Baptist Memorial. After receiving this information PDG electrical engineers verified that their design could support the equipment. There is no evidence these engineers relied on the scientific method to make this determination. Instead, they reran load calculations, which gave them an answer one way or another. This is not a process of experimentation.

As for the building code, petitioner did not develop this argument to any significant extent. We note, however, that all systems designed by PDG engineers are subject to a building code, with the majority being the stricter hospital building codes encountered here.

To the extent any uncertainty existed before the architect provided PDG engineers with the schematic block diagram and the preliminary master plan, petitioner failed to show that PDG engineers engaged in investigative activities to resolve the uncertainty. Petitioner did not provide any information as to the activities that its engineers conducted to determine the scope of the project before receipt of the documents. The hour sheets do not disclose the precise activities PDG engineers undertook to resolve the uncertainty. Instead, it appears as though the uncertainty was resolved by the actions of Baptist Memorial and the other contractors on the project. Again, the unexplained design drawings tell us nothing. Petitioner failed to carry its burden that the design of the entirety of the BHN Oxford MEPF systems constituted qualified research.

2. Shrinking-Back Rule

We look next to the shrinking-back rule to determine whether any of the activities related to a component or a subcomponent were qualified research. The next most significant components of the MEPF systems are the mechanical, electrical, and plumbing systems. The activities related to these systems likewise were not qualified research. Petitioner
39 makes the same general argument about uncertainty as explored above and points to additional elements that introduced
*39 uncertainty as to the design of each system. We reject the general arguments for the same reasons as above.

As it relates to the mechanical systems, petitioner claimed uncertainty stemming from the chiller plant, the unknown size of the hospital, the boiler plant, and the air handling systems. Petitioner failed to demonstrate how uncertainty related to one of these subcomponents would cause uncertainty as to the entire design of the systems. Rather, petitioner presented these issues as discrete challenges its engineers encountered and did not connect the issues. *See Betz*, T.C. Memo. 2023-84, at *76; Treas. Reg. § 1.174-2(a)(5).

Petitioner failed to show that its engineers conducted investigative activities to resolve the uncertainties. Instead, the record shows that the bulk of the claimed uncertainties, such as the chiller system, were resolved by Baptist Memorial. As for decisions left to PDG mechanical engineers, petitioner failed to show any investigative activities. *See Betz*, T.C. Memo. 2023-84, at *86 ("Merely identifying a project difficulty and the eventual design solution, without bridging the gap with evidence as to what investigative activities were performed, does not satisfy petitioners' burden.").

As for the electrical system, petitioner claimed an additional uncertainty related to how to route the electricity from the substations to the vacant lot. At a minimum, the record establishes that PDG electrical engineers did not engage in a process of experimentation to resolve this uncertainty. Instead, they met with the electricity company and Baptist Memorial to resolve the uncertainties. While this could be an investigative activity, there is no evidence that PDG electrical engineers used a process of experimentation to determine how to route the electric. *See id.* at *80, *89. PDG electrical engineers merely passed the recommendation and options from North Power to Baptist Memorial. Baptist Memorial then selected its preferred option. Meeting with North Power and presenting the options to Baptist Memorial is a far cry from the evaluative process mirroring the scientific method demanded by the process of experimentation test. As for the other decisions encountered by PDG electrical engineers, petitioner failed to show any investigative activities. *See id.* at *86.

As for the plumbing system, petitioner spent no time at trial explaining the uncertainties encountered by PDG plumbing engineers. The hour sheets likewise do not disclose this information in any meaningful manner. Petitioner failed to set forth
40 (1) what information *40 was unavailable to PDG plumbing engineers and (2) what investigative activities they undertook with respect to the uncertainty. *See id.* at *76.

Having determined that the mechanical, electrical, and plumbing systems individually did not involve qualified research, we shrink back to the next most significant subset of each system. Again, petitioner identified issues its engineers confronted in the design of the systems and offered testimony at trial regarding the solutions to the issues and appears to rely on the hour sheets to fill in the gaps.

However, like the hour sheets from the Gerald Champion project, the hour sheets for the BHNM Oxford project lack sufficient detail to allow us to make the necessary determinations. For example, mechanical engineers John Wade and John Beard recorded significant time to "design," electrical engineer Brian Moore recorded time to "mark-ups," and plumbing engineer James Hobbs recorded significant time to "SD." Petitioner provided us with no metric to allocate this generic time to each issue encountered by its engineers. We cannot determine, nor did petitioner explain, what subset of the systems these engineers worked on. Therefore, we are unable to determine whether these activities were (1) investigative activities, (2) part of a process of experimentation, or (3) for a permitted purpose. Therefore, shrinking back would be futile.

Even if we could apply the shrinking-back rule to the issues petitioner confronted using solely the general descriptions provided, the activities were not qualified research. Petitioner often identified an issue and the solution without bridging the evidentiary gap as to the activities its engineers conducted. Therefore, petitioner failed to carry its burden to show its engineers conducted investigative activities. *See id.* at *86. Additionally, for the vast majority of the uncertainties petitioner claims with respect to the issues, PDG engineers did not perform activities related to a process of experimentation. For example, Baptist Memorial, not PDG engineers, selected the chiller that would be used for the building. The activities and ultimate solutions were attributable primarily to third parties.

C. VU ESB

1. MEPF Systems as a Whole

41 The MEPF systems for the VU ESB project fail the section 174 test. Petitioner alleges general uncertainty as to the appropriate design *41 of the MEPF systems because the building was new construction and the specific use of each portion of the building was not determined. Petitioner also alleges uncertainty related to the strict requirements of each room.

Petitioner failed to identify specific information that was not available to the PDG engineers at the start of the project that caused the uncertainty. We are unable to determine this information from the record because petitioner failed to identify the initial information provided by the architect, the design documents completed for the TEAM building project before the hospital pulled out of the project, and the date it ended work on the TEAM building project. While the building size was reduced and some portions of the building were designated for different purposes, other portions of the building were retained, such as the cleanroom and imaging suite. Additionally, PDG engineers recorded considerable time before PDG was formally engaged on the VU ESB project. While petitioner alleges none of the hours overlapped, we hesitate to accept this as fact when there are other errors on the hour sheets^[25] and petitioner failed to provide even the most basic timeline of the projects. Without presenting the information objectively available to them at the start of the project, petitioner failed to show objective uncertainty as to the design of the entire MEPF systems.

Petitioner further failed to set forth the interrelated nature of the various components of the MEPF systems such that uncertainty as to one portion renders the entire design of the MEPF systems uncertain. Uncertainty as to one subcomponent does not necessarily render the entire business component uncertain. *See id.* at *76. Petitioner argues that the strict requirements of each room caused uncertainty as to the appropriate design of the whole MEPF systems. Other than conclusory statements that all the systems affected LEED Silver certification, petitioner provided no evidence of the interdependence of the systems. For example, petitioner did not explain how strict airflow requirements in the imaging suite affected the electrical design of the building. Therefore, even if there was uncertainty as to specific subcomponents, petitioner failed to carry its burden to show that there was uncertainty as to the whole design. *See id.*; Treas. Reg. § 1.174-2(a)(5).

42 *42 To the extent there was uncertainty because the specific use of each portion of the building was not known, PDG engineers did not engage in investigatory activities to resolve this uncertainty. There is no evidence PDG engineers had any involvement in this decision making. Instead, the evidence shows Vanderbilt University resolved this uncertainty by indicating to PDG engineers the specific use of each portion of the building. There is no evidence that PDG engineers were involved in this decision-making process. Instead, PDG engineers began designing the MEPF systems with the knowledge that the information would come from Vanderbilt University. Again, the numerous versions of the design drawings in evidence tell us nothing.^[26] Petitioner has failed to carry its burden to show that the design of the entirety of the MEPF systems meets the section 174 test.

2. Shrinking-Back Rule

We look next to the shrinking-back rule to determine whether the activities related to any particular component or subcomponent were qualified research. The next most significant component of the MEPF systems are the mechanical, electrical, and plumbing systems. The activities related to these systems likewise were not qualified research. Petitioner makes the same general argument about uncertainty as advanced for the whole MEPF systems. Again, petitioner failed to identify the specific information unavailable to the PDG engineers at the start of the project that resulted in the design uncertainty. Therefore, we reject this argument.

As for the mechanical system, petitioner alleges that the appropriate design of the entire system was uncertain because Vanderbilt University had not assigned researchers to each laboratory and thus PDG mechanical engineers did not know the ventilation requirements of each laboratory. Because the ventilation in each laboratory would require adjustments to the airflow to compensate for the extracted air, petitioner contends that this caused system-wide uncertainty as to the basic design of the mechanical system. This is the first time in this case that petitioner coherently tied uncertainty in one subcomponent to another. However, there are several other components of the mechanical system that do not appear dependent on the ventilation. Petitioner did not provide information on how the ⁴³ ventilation would, for example, affect the steam pipe connection. Therefore, petitioner failed to demonstrate that even if there was uncertainty regarding ventilation, the basic design specifications were uncertain. See *Betz*, T.C. Memo. 2023-84, at *76; Treas. Reg. § 1.174-2(a)(5).

Additionally, petitioner failed to show its employees engaged in investigative activities related to this uncertainty. Instead, Vanderbilt University resolved the uncertainty by selecting researchers as discussed above, which would dictate the proper configuration for the laboratory. As for the other decisions PDG electrical engineers encountered, petitioner failed to show any investigative activities. See *Betz*, T.C. Memo. 2023-84, at *86.

As for the electrical systems, petitioner alleges there was uncertainty regarding the appropriate design of the electrical systems due to the unknown demand from each laboratory. Even if the activities of PDG electrical engineers met the section 174 test, petitioner failed to show PDG electrical engineers undertook a process of experimentation. Electric engineer Brian Moore testified at trial that PDG electrical engineers entered the estimated square footage of the building into software that estimated the load of the building. PDG electrical engineers then increased this figure to account for the higher demands of the laboratories in the building. This increase was based on a "study with Vanderbilt University" of the other laboratories on campus. Petitioner provided no additional information on the study or the division of work between PDG engineers and Vanderbilt University.

Entering previously available information into software does not show that PDG electrical engineers engaged in a process of experimentation. Although the study with Vanderbilt University may have mirrored the scientific method, petitioner did not provide sufficient information for us to make this determination. Instead, petitioner asserts simply that a "study" was conducted. Without knowing the activities involved in the study and PDG electrical engineers' involvement, we cannot find that petitioner engaged in a process of experimentation.

As for the plumbing system, petitioner did not mention any additional uncertainty. Petitioner failed to set forth (1) what information was unavailable to PDG plumbing engineers and (2) what investigative activities were undertaken by PDG plumbing engineers with respect to the uncertainty. See *Betz*, T.C. Memo. 2023-84, at *76.

⁴⁴ Having determined that the mechanical, electrical, and plumbing systems individually are not qualified research, we apply the shrinking-back rule to the next most significant subset of each system. We confront the exact difficulties in shrinking back as discussed above. As an initial note, we are particularly skeptical of the hour sheets related to the VU ESB project. To start, PDG engineers recorded significant time before the execution of the new contract with the architect in 2013 and 2014. Petitioner did not provide the exact date that the TEAM building was put on hold. Petitioner represents that all the time recorded to this project was for the VU ESB project and not the TEAM building project, but we are unable to verify this. Additionally, petitioner's other representations regarding the hour sheets, namely that no subproject was recorded to the project number at issue, are directly contradicted by entries on the hour sheets. Finally, the hour sheets contain entries for 2017, which is beyond the scope of the credits claimed in this case.

The hour sheets also fail to provide sufficient information to conduct the qualified research analysis. As with the other projects, the narrative descriptions do not consistently relate to the issues petitioner identifies. Mechanical engineer John Beard recorded significant time to "design," electrical engineer Brian Moore recorded time to "project coordination," and

plumbing engineer Raymond Parham recorded time to "ABP." Petitioner provided us with no metric to allocate this generic time to each issue discussed in testimony. We cannot determine, nor did petitioner explain, what subset of the systems these engineers worked on. Therefore, we are unable to determine whether these activities were (1) investigative activities, (2) part of a process of experimentation, or (3) for a permitted purpose. Therefore, shrinking back would be futile.

One particular issue petitioner encountered deserves a closer look: connecting to the steam distribution system. At trial, Ross T. Malloy testified that he, Thomas Fisher, and Ryan Malloy were the only employees involved in this process. The three men indicated when they worked on the steam line project in their time sheets, but the hours sheets tell a different story. The hour sheets show CAD designer Barry Septer recorded time with a description referencing the steam line. This directly refutes the testimony, and we cannot accurately determine whether other employees worked on the steam line and recorded time under the generic terms noted above.

45 Even if we could apply the shrinking-back rule to the issues petitioner confronted solely on the basis of the general descriptions *45 provided, they would not qualify as qualified research. Petitioner often identified an issue and the solution without bridging the evidentiary gap as to the activities conducted by its engineers. Again, the unexplained design drawings tell us nothing. Therefore, petitioner failed to carry its burden to show its engineers conducted investigative activities. *See id.* at *86.

IV. Accuracy-Related Penalties

The parties stipulated that if we determine that none of the trial projects entails qualified research, petitioner is liable for the accuracy-related penalties for the credit years in which there are deficiencies, as determined by the Court or agreement of the parties. Because we determined that none of the trial projects involved qualified research, petitioner is liable for accuracy-related penalties as specified by the parties.^[27]

CONCLUSION

As said before, engineers solve problems you did not know you had in ways you cannot understand. Without an explanation of the work or process of the engineers, we cannot understand how PDG engineers came to the ultimate solutions and determine whether the activities qualify as research within the meaning of section 41. None of the trial projects as a whole or at the shrinking-back level involved qualified research. Petitioner is liable for the accuracy-related penalties as stipulated by the parties.

To reflect the foregoing,

An appropriate order will be issued.

[1] Unless otherwise indicated, statutory references are to the Internal Revenue Code, Title 26 U.S.C., in effect at all relevant times, regulation references are to the *Code of Federal Regulations*, Title 26 (Treas. Reg.), in effect at all relevant times, and Rule references are to the Tax Court Rules of Practice and Procedure.

[2] Plumbing engineers are typically engineers with formal training in mechanical engineering that subsequently specialize in plumbing systems.

[3] This Opinion will use the term "employee" in the colloquial sense and not as defined in section 3401(c).

[4] It appears that employees generally followed this instruction. However, the hour sheets that petitioner provided for the main project numbers contain some entries associated with the derivative project numbers.

[5] It appears petitioner did not properly claim the credit for the 2013 tax year on its 2014 tax return. However, petitioner raised this issue in its petition, and we have jurisdiction over this claimed credit because it relates to the determination of the correct tax liability for the credit years. *See* § 6214(b) (allowing us to "consider such facts with relation to the taxes for other years or calendar quarters as may be necessary correctly to redetermine the amount of such deficiency"); *Brock v. Commissioner*, T.C. Memo. 1982-335, 1982 WL 10645 (holding that the Court had jurisdiction to consider facts related to prior years to determine the proper amount of credit carryforward); *see also Noell v. Commissioner*, 66 T.C. 718, 727 (1976) (considering a tax credit raised for the first time at trial); *Norwest Corp. & Affiliated Cos. v. Commissioner*, T.C. Memo. 1992-282 (considering a tax credit first raised in a petition), *aff'd*, 69 F.3d 1404 (8th Cir. 1995).

[6] All numbers are rounded to the nearest whole number.

[7] Petitioner contends in its posttrial brief that the Court should expand the scope of the stipulation to all projects at a given location. For example, Gerald Champion is project No. 13008.00. The related catheterization laboratory is assigned project No. 13008.01. Petitioner contends both of those projects should be considered part of the trial; whereas respondent argues the parties tried only project No. 13008.00. Because the parties agreed to the specific project numbers in both stipulations related to the scope of trial, we will limit our review to the project numbers specified in the stipulations as listed above. Petitioner's argument to expand the scope of trial directly conflicts with the representation that employees billed times to the appropriate project number. Petitioner did not provide hour sheets related to the derivative project numbers.

Petitioner did not provide a project description for each project number and derivative project number. Therefore, we have used the titles of the projects and the hour sheets related to the primary project number to discern the scope of the projects at issue.

[8] The catheterization laboratory is beyond the scope of this trial.

[9] The projects include Gerald Champion Military Psychiatry Unit, project No. 13008.00; Gerald Champion Cath Lab, project No. 13008.01; and Gerald Champion Cath Lab Revisions, project No. 13008.02. We have disregarded all evidence to the extent it does not relate to Gerald Champion Military Psychiatry Unit.

[10] The projects include: VU ESB (Olin Hall), project No. 12010.01; VU ESB — Central Plant Chilled Water, project No. 12010.02; VU ESB 3rd & 4th Floor Redesign, project No. 12010.03; VU ESB — Olin Steam Line — Relocation, project No. 12010.04; VU ESB — LEED Forms Additional Service, project No. 12010.05; VU — ESB — RFP #25 Innov Ct Changes, project No. 12010.06; VU ESB — Add Third Chiller & Olin Hall, project No. 12010.07; VU ESB — AV Revisions, project No. 12010.09; VU ESB — Roof Terrace Revision, project No. 12010.10; VU ESB Campus Chilled Water Tie-ins, project No. 12010.11; VU ESB 2nd FI Server Room/IT RFP 53, project No. 12010.12; VU ESB — CNC Laser Cutter Fitout, project No. 12010.13; VU ESB — Animal Holding, project No. 12010.14; VU ESB — 4th Floor Revisions 2016, project No. 12010.15; VU ESB Bus Stop Duct Bank/Light Pole, project No. 12010.16; VU ESB Bardham Lab Olin Hall, project No. 12010.17; VU ESB — Lab 343 Buildout for Pint, project No. 12010.18; and VU ESB — Art Work Additional Lighting, project No. 12010.19. We have disregarded all evidence to the extent it does not relate to project No. 12010.01.

[11] In its posttrial brief petitioner categorizes this design as falling under the plumbing discipline. However, the referenced exhibit is a mechanical engineering diagram, and time spent on this project was billed to the mechanical discipline. Therefore, we will treat this design challenge as falling under the mechanical discipline.

[12] PDG engineers also designed a backup system using the campus chilled water system, but that is beyond the scope of the current trial.

[13] In its posttrial brief petitioner categorizes this design as falling under the plumbing discipline. However, the referenced exhibit is a mechanical engineering diagram, and time spent on this project was billed to the mechanical discipline. Therefore, we will treat this design challenge as falling under the mechanical discipline.

[14] PDG mechanical engineers also designed a mechanism to connect the old engineering building to the VU ESB with a valve that allowed steam to travel in two directions. This project is beyond the scope of this trial.

[15] The laboratories were then further customized as the university assigned researchers to each space, but the redesign exceeds the scope of the trial project.

[16] The hour sheets contained entries from 2017; however, petitioner claimed research credits only between 2013 and 2016.

[17] Respondent conceded the issue of petitioner's base amount; therefore, we need not address it further.

[18] Petitioner is a cash method taxpayer. A cash method taxpayer takes liability into account when the expenditure is actually paid. § 446; Treas. Reg. § 1.446-1(c)(1)(i).

[19] In addition to the four-part statutory test, section 41(d)(4) excludes certain activities from the definition of qualified research. We need not consider these excluded activities for purposes of deciding this case.

[20] We have previously interpreted this requirement as incorporating section 174 requirements on both the nature of the activities and the nature of the expenditures. See *Norwest Corp. & Subs. v. Commissioner*, 110 T.C. 454, 491 (1998) (requiring "the taxpayer to satisfy all the elements for a deduction under section 174"); *Union Carbide Corp. & Subs. v. Commissioner*, T.C. Memo. 2009-50, slip op. at 197 (analyzing whether a taxpayer's activities constituted research and development within the meaning of section 174 and whether the costs associated with these activities may be treated as expenses under section 174), *aff'd*, 697 F.3d 104 (2d Cir. 2012).

[21] For tax year 2013, Treasury Regulation § 1.41-4(b)(2) provided an identical shrinking-back rule.

[22] Section 174 was later amended to eliminate the current deduction and instead requires amortization of research and development expenditures for tax years starting after December 31, 2021. See Tax Cuts and Jobs Act of 2017, Pub. L. No. 115-97, § 13206, 131 Stat. 2054, 2111-13.

[23] Instead, petitioner identified internal communications that discuss the existing schematic design drawing.

[24] Even if petitioner satisfied the section 174 test, petitioner failed to provide sufficient information to allow us to determine whether substantially all activities of the PDG employees were part of a process of experimentation. See Little Sandy Coal Co., T.C. Memo. 2021-15, at *40.

[25] For example, time that petitioner admits should have been recorded to the VU ESB — Olin Steam Line — Relocation, project No. 12010.04, was recorded to the project number at issue.

[26] Even if petitioner satisfied the section 174 test, it again failed to provide sufficient information to allow us to determine whether substantially all activities of the PDG employees were part of a process of experimentation. See Little Sandy Coal Co., T.C. Memo. 2021-15, at *40.

[27] Nothing in this Opinion should be construed as determining the amounts of the deficiencies in petitioner's federal income tax for the credit years. Instead, this Opinion solely determined that the three trial projects do not constitute qualified research.

Save trees - read court opinions online on Google Scholar.