T.C. Memo. 2021-15

UNITED STATES TAX COURT

LITTLE SANDY COAL COMPANY, INC., Petitioner v.
COMMISSIONER OF INTERNAL REVENUE, Respondent

Docket No. 17431-17. Filed February 11, 2021.

R disallowed a research tax credit P claimed under I.R.C. secs. 38 and 41(a) for expenses incurred by its shipbuilding subsidiary, C, in developing 11 vessels. The parties agreed to treat two of those vessels as representative of the others in regard to most of the relevant issues. P argues that substantially all of the activities of C's research in developing the vessels constituted elements of a process of experimentation for purposes of I.R.C. sec. 41(d)(1)(C) and sec. 1.41-4(a)(6), Income Tax Regs., because more than 80% of the elements of each vessel differed from those of vessels C had previously developed (one of the vessels was entirely new and the other was a significantly redesigned version of a predecessor). P also argues that the work of C's production employees constructing novel elements of the redesigned vessel directly supported research and, as such, constituted elements of a process of experimentation. On the premise that the production employees' work on novel elements made up at least 87% of all of their work on the vessel, P argues that the substantially all test was met.

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[*2] Held: The requirement of I.R.C. sec. 41(d)(1)(C) and sec. 1.41-4(a)(6), Income Tax Regs., that at least 80% of a taxpayer's research must constitute elements of a process of experimentation applies to activities--not to physical components of the product being developed or improved. Consequently, the requirement is not satisfied simply because at least 80% of the product's elements differ from those of products the taxpayer previously developed.

Held, further, one who provides services in direct supervision or support of research is not "engaged in" research. See I.R.C. sec. 41(b)(2)(B). Therefore, the activities of such a person cannot "constitute elements of a process of experimentation" for purposes of I.R.C. sec. 41(d)(1)(C).

Held, further, because supplies are not activities, when the fraction described in sec. 1.41-4(a)(6), Income Tax Regs., is computed using costs as a measure of activities, the costs of supplies used in the development of the product are not taken into account.

Held, further, because P has not met its burden of proving that substantially all of C's research activities in developing the vessels in issue constituted elements of a process of experimentation, none of the expenses C incurred in that development are qualified research expenses within the meaning of I.R.C. sec. 41(b).

John H. Dies, Jefferson H. Read, Jeremy M. Fingeret, and Rosalind J. Lewis, for petitioner.

Angela B. Reynolds, Mindy Y. Chou, Naseem J. Khan, Duy P. Tran, and Christa A. Gruber, for respondent.

[*3] MEMORANDUM FINDINGS OF FACT AND OPINION

HALPERN, Judge: Respondent determined a deficiency of $324,529 in petitioner's Federal income tax for its taxable year ended June 30, 2014, and an accuracy-related penalty under section 6662 for that same year of $64,910.[1] The deficiency arose from respondent's disallowance of a claimed research credit under sections 38 and 41(a) of $1,141,713. The claimed credit relates to activities conducted by petitioner's shipbuilding subsidiary, Corn Island Shipyard, Inc. (CIS), in developing 11 vessels. As explained in more detail below, in accordance with an agreement between the parties, our trial on April 15, 2019, addressed issues related to just 4 of the 11 projects in issue. In this opinion, we address only those issues.

FINDINGS OF FACT

When petitioner filed its petition in this case, it maintained its principal office in Lamar, Indiana. For the taxable year in issue, petitioner filed a consolidated Federal income tax return on behalf of itself and affiliated corporations, including CIS.

[1]All section references are to the Internal Revenue Code in effect for the year in issue. We round all dollar amounts to the nearest dollar.

[*4] General Process of Vessel Development

The design, construction, and launch of vessels typically follows a process referred to as a "design spiral". Given the interdependence of a vessel's various elements, the design of some elements cannot be determined until the design of others is established. Conversely, the design of elements determined later in the process may require changes in designs provisionally determined earlier, causing "loops" or spirals in the process.

The design of some elements may be finally determined only during the construction process. But that possibility does not mean that the design of the vessel as a whole remains indeterminate until construction is complete. As CIS engineering technician Brian Varner explained, "a lot of" design issues "get ironed out" as the vessel is built.

Moreover, as might be expected, CIS' engineering team makes every effort to ensure the viability of each component's design before requiring CIS to incur the expense of fashioning the physical component. In Mr. Varner's words: "From an engineering perspective, you try to capture everything you can up front. You try to revise all of the drawings, hoping you caught everything." He added: "We have to feel pretty comfortable with a design before we start cutting steel. Any repairs or modifications become very costly very quickly."

[*5] Mr. Varner's testimony finds confirmation in the report of respondent's expert, Kenneth Smith, a naval architect and marine engineer. In his report, Mr. Smith opined that, while the final appropriate design of a vessel may be uncertain at the start of a project, "almost all of these uncertainties have to be resolved well before the structural steel is assembled and welded to form the hull."

The Apex Tanker

One of the projects in regard to which petitioner claimed a research credit, labeled "Project 720", involved a tank barge that CIS built under contract with Apex Oil, Inc. (Apex). CIS' agreement with Apex required it to construct a vessel of given dimensions "in accordance with the Contract Specifications, Contract Plans, and Contract Drawings" and stated that those documents, referred to as "CONTRACT DOCUMENTS", were attached to the contract and incorporated by reference.[2]

The design of the Apex tanker was based on the design of the Penn 80, a tanker that CIS had previously built for another customer. But the design of several elements of the Apex tanker that differed from those of its predecessor involved an iterative process in which proposed designs were tested through such

[2]The copy of CIS' agreement with Apex included in the record does not have the Contract Documents attached.

[*6] means as software modeling and engineering calculations and revised as necessary. For example, CIS used 3D modeling to design the stern notch that attaches the Apex tanker to the tug that pushes it. The tanker also had a towing bridle that allows a tug to pull it. The tanker's towing bridle had to be redesigned following a determination that, as originally designed, the bridle was interfering with other components of the vessel. CIS' lead engineer and naval architect, Bud Johnson, used a type of engineering calculations and analysis called "wind sail" calculations to determine the appropriate size of the vessel's anchor. Engineering calculations were also employed to test the strength of the tanker's longitudinal elements and design the tanker's vapor barrier system, which involves the application of special coatings to the top of cargo tanks to prevent corrosion. Other changes in the Apex tanker's design determined through an iterative process allowed it to handle more cargo than the Penn 80.

In an analysis of time records of CIS' production employees, Brian Meunier, an engineering technician at CIS, determined that 87% of the time those employees spent constructing the Apex tanker involved "functions that were tied directly to items" that differed from those of the Penn 80. Mr. Meunier determined that the production employees spent an additional 10% of their time on items that differed in some respect from the Penn 80 but were "very much similar".

[*7] After constructing the Apex tanker, CIS performed a deadweight survey on the finished vessel to verify its displacement--that is, the amount of water it displaces. CIS typically conducts a deadweight survey after construction of any vessel intended for certification by the American Bureau of Shipping (ABS)--even a "sister vessel" that duplicates one previously built.

A deadweight survey is important to a vessel's owner because it indicates how much cargo the vessel can carry. Therefore, the contract between the owner and the builder typically includes displacement among the vessel's specifications. A sufficient variance between the displacement determined by the deadweight survey conducted after the vessel's construction and estimates made in determining the vessel's design may result in noncompliance with the agreed specifications. When asked at trial why such a variance might occur, Joseph Kelly of the ABS observed: "[V]essels are built by humans."

Nicholas Meyers, a Coast Guard inspector who professed to be very familiar with CIS from having visited the shipyard several times a year for 10 years, testified that he was unaware of any occasion on which CIS had revised a vessel's design as a result of a deadweight survey. Mr. Meyers, however, admitted the possibility of occasions he could no longer recall in which a deadweight survey had caused CIS to make design revisions.

[*8] The Dry Dock

The research credit petitioner claimed also included expenditures for "Project 730", a dry dock that CIS built for Detyens Shipyard (Detyens). A dry dock is a floating structure used for ship repair and maintenance. Before Project 730, CIS had not fully developed and designed a dry dock.

CIS also used engineering calculations and modeling to design the dry dock. For example, it used modeling software to test for spacial conflicts. In the course of the design process, CIS developed several iterations of design drawings for the dry dock. CIS performed calculations to test various iterations of the dry dock's design throughout the development process. The outboard side plate went through five design revisions.

The dry dock included a safety deck that allowed personnel to enter and access the controls and gauges for a pumping system. By filling its walls with water, the dry dock can partially submerge to allow entry by the ship to be repaired. The pumping system then expels the water, raising the dry dock (and the ship it holds) to allow the necessary repairs.

The safety deck's design also went through several iterations. In particular, the deck had to be raised 18 inches as a result of weight increases resulting from changes in other parts of the vessel.

[*9] Detyens took delivery of the dry dock at CIS' facility. Title to the vessel transferred at that time, and Detyens was obligated to make the final payment due to CIS under their contract. After Detyens transferred the dry dock to its own shipyard in Charleston, South Carolina, it conducted a final raise-and-lower test on the vessel.

Before tendering the dry dock to Detyens, CIS conducted its own tests on the vessel, including a partial raise-and-lower test. As Mr. Varner explained, CIS "couldn't take * * * [the dry dock] down as deep as it needed to go because of water level limitations."

Qualified Research Expenditures Claimed

In regard to Project 720 (the Apex tanker), petitioner reported as qualified research expenses, within the meaning of section 41(b) (QREs), $2,505,491 of wages, $17,504 of contract research expenses, and $3,892,142 of supply costs. In regard to Project 730 (the dry dock) petitioner reported $146,109 of wages and $1,943,265 of supply costs. Petitioner also reported "estimated wage expenses" not associated with any specific project of $609,276. The wages associated with specific projects were paid to production employees. The estimated wage expenses include portions of the wages paid to individuals identified as members of either CIS management or its engineering team. CIS' engineers and managers

[*10] did not track their hours by specific vessel. Petitioner estimated the wages CIS paid to those individuals for qualified services by applying to each employee's total wages an allocation percentage equal to the estimated portion of the employee's time spent on qualified research.

The highest amount paid to any one nonproduction employee that CIS included in QREs was $173,996 paid to Mr. Johnson (60% of his total wages for the year in issue). Petitioner also treated as QREs $126,734 of wages that CIS paid to members of its management team, Don Foertsch, David Foertsch, and Alan Fleischmann, and $56,895 of wages paid to three individuals it identified as "draftsmen", Dennis Gass, Kyle Harpenau, and Robert Kellems.[3]

The amount petitioner reported as contract research payments was paid to Hayes Testing Labs (Hayes) for tests Hayes performed on welds made in the tanker's construction. Mr. Meunier testified that, while the failure of a weld could be the result of a design flaw, in CIS' experience, weld failures were most often due to the welder's workmanship.

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[3]Although petitioner included Mr. Meunier, along with three others, in a list of "engineering technicians", Mr. Meunier himself testified that his involvement in Project 720 was "mostly * * * [on] the drafting end of it."

[*11] Activities of CIS' Nonproduction Employees

In describing Mr. Johnson's responsibilities, the parties stipulated:

> During the course of * * * [his] duties, Mr. Johnson worked closely with the engineering team and management to assess the manner in which the shipyard could construct the ship. Mr. Johnson conferred with management, the purchasing agent, and the production employees to evaluate specifications including those related to the criteria for vessel design and construction. Additionally, Mr. Johnson coordinated and directed projects, made detailed plans to accomplish goals, performed necessary engineering calculations, and directed the integration of technical activities. Moreover, Mr. Johnson planned and directed the installation, testing, and operation of vessels. Furthermore, Mr. Johnson directed, reviewed, and approved component and product designs, in addition to design development drawings generated from the original specifications or designs.
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> Mr. Meunier described Mr. Johnson as the "brain trust" of CIS.

Mr. Meunier elaborated:

> He * * * was the first contact with the customer. He was engaged in the project throughout, all the way to the end. He * * * would work contract negotiations, preliminary design, did a lot of the design calcs himself, managed the yard, a lot of even decisions on where things were going to be built, he was involved in the yard, whether it was built inside, outside of the shop. But he kind of controlled the whole project throughout the yard. And like I said, he would see it all the way through to completion. He was, many times, the * * * face of the company. He would get involved in everything down to the launch and deadweight to the end. I mean, he was--from start to finish, Bud was involved in it.

[*12] Although the parties stipulated descriptions of the activities of the nonproduction employees other than Don and David Foertsch, the stipulation simply describes the two Foertsches as "Petitioner's owners". While the stipulation notes that they "contributed to the wage research expenses during the 2013 tax year", it does not describe the specific activities for which those expenses were paid.

At trial, David Foertsch described his father, Don, as "oversee[ing] the management and the operations of Corn Island Shipyard." The parties stipulated a list of exhibits that "evidence" Don and David Foertsch's activities. The 13 exhibits listed as evidence of Don Foertsch's activities consist entirely of emails on which he was copied. Nine of those emails have dates outside the taxable year in issue, and at least six deal with projects other than the Apex tanker or the dry dock.

David Foertsch's name does not appear on two of the three exhibits listed as evidencing his activities. And two of the three exhibits involve projects other than the Apex tanker or the dry dock. David did testify, however, that he "helped to troubleshoot through th[e] problems with the towing bridle".

[*13] Regarding Mr. Fleischmann's activities, the parties stipulated:

> As Purchasing Agent, * * * [Mr.] Fleischmann gathered project specifications, [and] reviewed component materials required for each project. Based on project specifications, Mr. Fleischmann evaluated various material vendor alternatives for performance, quality, reliability, and functionality, in addition to cost of materials. After analyzing available alternatives, Mr. Fleischmann worked with the Engineering Team to obtain materials for projects. Mr. Fleischmann worked on the vessels.

The parties stipulated the following description of those individuals petitioner identified as draftsmen, Messrs. Gass, Harpenau, and Kellems: "As Draftsmen, these individuals utilized specialized computer software to produce 3D plans and 2D diagrams of vessels. Additionally, these individuals converted sketches, specifications, and engineering data into detailed 2D diagrams and 3D Computer Aided Design ('CAD') models and drawings throughout the completion of the vessels." At trial, Mr. Meunier explained the difference between drafting and design work: "Drafting's more of just the actual input into AutoCAD or our drawing it. It's * * * creating the drawings. The design work may be trying to fit different items together properly. It's kind of one step above drafting. You maybe don't have an engineering degree and can't perform the calculations, but you can receive those calculations from an engineer and be able to put that to paper in a * * * product."

[*14] Projects 749 and 750

On some of its development projects, CIS collaborates with a related corporation, Tell City Boat Works, Inc. Projects identified as 749 and 750 exemplify those collaborative projects.

OPINION

I. Background

A. Applicable Statutory and Regulatory Provisions

1. Computation of the Research Credit

Section 38(a) allows as a credit against a taxpayer's income tax the taxpayer's "current year business credit", as well as unused business credits carried from other years. A taxpayer's current year business credit includes "the research credit determined under section 41(a)". Sec. 38(b)(4). For purposes of section 38, a taxpayer's research credit includes 20% of any excess of the taxpayer's "qualified research expenses for the taxable year" over a prescribed "base amount". Sec. 41(a)(1).

2. Qualified Research Expenses

A taxpayer's QREs include any "in-house research expenses" and "contract research expenses" "paid or incurred by the taxpayer during the taxable year in carrying on any trade or business of the taxpayer". Sec. 41(b)(1).

[*15] A taxpayer's "in-house research expenses" include "(i) any wages paid or incurred to an employee for qualified services performed by such employee" and "(ii) any amount paid or incurred for supplies used in the conduct of qualified research". Sec. 41(b)(2)(A)(i) and (ii). Section 41(b)(2)(B) defines "qualified services" to mean "services consisting of--(i) engaging in qualified research, or (ii) engaging in the direct supervision or direct support of research activities which constitute qualified research."

3. Qualified Research

As indicated by the rules described above, determining whether expenses are QREs requires consideration of the relationship of those expenses to activities that meet the definition of "qualified research". Research is qualified research if it meets four requirements provided in section 41(d)(1) and is not covered by an exclusion provided in section 41(d)(4). First, expenditures with respect to the research must be eligible for "treat[ment] as expenses under section 174". Sec. 41(d)(1)(A). Second, the research must be undertaken to discover technological information. Sec. 41(d)(1)(B)(i). Third, the application of that information must be "intended to be useful in the development of a new or improved business

[*16] component of the taxpayer".[4] Sec. 41(d)(1)(B)(ii). And fourth, "substantially all of the activities of" the research must "constitute elements of a process of experimentation for a purpose" related to "a new or improved function," "performance," or "reliability or quality." Sec. 41(d)(1)(C), (3)(A). Section 41(d)(4) provides a list of activities that are specifically excluded from the definition of qualified research.

a. Section 174

As noted above, the first requirement of qualified research is that the expenses incurred in its conduct must be eligible for deduction under section 174. Section 174(a)(1) allows a taxpayer to "treat research or experimental expenditures which are paid or incurred by him during the taxable year in connection with his trade or business as expenses which are not chargeable to capital account." The taxpayer can deduct any expenditures that he treats as not chargeable to capital account. Sec. 174(a)(1). Sec. 1.174-2(a)(1), Income Tax Regs., provides:

> The term research or experimental expenditures, as used in section 174, means expenditures incurred in connection with the taxpayer's

[4]Sec. 41(d)(2)(B) defines "business component" to mean "any product, process, computer software, technique, formula, or invention which is to be--(i) held for sale, lease, or license, or (ii) used by the taxpayer in a trade or business of the taxpayer."

[*17] trade or business which represent research and development costs in the experimental or laboratory sense. The term generally includes all such costs incident to the development or improvement of a product. * * * Expenditures represent research and development costs in the experimental or laboratory sense if they are for activities intended to discover information that would eliminate uncertainty concerning the development or improvement of a product. * * *

Section 1.174-2(a)(3), Income Tax Regs., defines "product" to include "any pilot model, process, formula, invention, technique, patent, or similar property, and includes products to be used by the taxpayer in its trade or business as well as products to be held for sale, lease, or license." Section 1.174-2(a)(4), Income Tax Regs., as amended in 2014, provides: "[T]he term pilot model means any representation or model of a product that is produced to evaluate and resolve uncertainty concerning the product during the development or improvement of the product. The term includes a fully-functional representation or model of the product".

[*18] b. Process of Experimentation

The fourth, and probably most stringent,[5] requirement of qualified research is that substantially all of the activities involved in the research must "constitute elements of a process of experimentation for a purpose" related to "a new or improved function," "performance," or "reliability or quality." Sec. 41(d)(1)(C), (3)(A). Section 1.41-4(a)(5)(i), Income Tax Regs., elaborates as follows on what a process of experimentation involves:

> For purposes of section 41(d) and this section, a process of experimentation is a process designed to evaluate one or more alternatives to achieve a result where the capability or the method of achieving that result, or the appropriate design of that result, is uncertain as of the beginning of the taxpayer's research activities. A process of experimentation must fundamentally rely on the principles of the physical or biological sciences, engineering, or computer science and involves the identification of uncertainty concerning the development or improvement of a business component, the identification of one or more alternatives intended to eliminate that uncertainty, and the identification and the conduct of a process of evaluating the alternatives (through, for example, modeling,

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[5]As we observed in Union Carbide Corp. & Subs. v. Commissioner, T.C. Memo. 2009-50, 2009 WL 605161, at *80 (quoting S. Rept. No. 99-313, at 694-695 (1986), 1986-3 C.B. (Vol. 3) at 694-695), aff'd, 697 F.3d 104 (2d Cir. 2012), Congress added the process of experimentation requirement to sec. 41 because of the legislators' "concern[] that taxpayers had been claiming the credit 'for virtually any expenses relating to product development' as opposed to high technology." Although sec. 174 and the process of experimentation requirement both focus on the elimination of uncertainty, the latter "imposes a more structured method of discovering information than section 174 requires and may not include all actions a taxpayer takes to resolve uncertainty." Id.

[*19] simulation, or a systematic trial and error methodology). A process of experimentation must be an evaluative process and generally should be capable of evaluating more than one alternative. * * * Uncertainty concerning the development or improvement of the business component (e.g., its appropriate design) does not establish that all activities undertaken to achieve that new or improved business component constitute a process of experimentation.

Section 1.41-4(a)(6), Income Tax Regs., provides an arithmetic test for determining when "substantially all" of a taxpayer's otherwise qualifying research activities in regard to a business component involve a process of experimentation. According to the regulations:

> The substantially all requirement of section 41(d)(1)(C) * * * is satisfied only 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 purpose described in section 41(d)(3). Accordingly, if 80 percent (or more) of a taxpayer's research activities with respect to a business component constitute elements of a process of experimentation for a purpose described in section 41(d)(3), 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 purpose described in section 41(d)(3), so long as these remaining research activities satisfy the requirements of section 41(d)(1)(A) and are not otherwise excluded under section 41(d)(4). The substantially all requirement is applied separately to each business component.

Id.

[*20] B. Issues Selected for Initial Trial

Given the complexity of factual issues involved in determining a taxpayer's eligibility for the research credit, it is not unusual for the taxpayer and the Commissioner to agree, in conducting cases that involve the credit, to single out a sample of research projects to be addressed by the court in the expectation that the court's decision in regard to the sample projects will enable the parties to resolve their differences in regard to the other projects. See, e.g., Trinity Indus., Inc. v. United States, 757 F.3d 400, 404-405 (5th Cir. 2014), aff'g 691 F. Supp. 2d 688 (N.D. Tex. 2010); Suder v. Commissioner, T.C. Memo. 2014-201, at *53; Union Carbide Corp. & Subs. v. Commissioner, T.C. Memo. 2009-50, 2009 WL 605161, at *2, aff'd, 697 F.3d 104 (2d Cir. 2012). The parties before us have agreed to that approach. As noted at the outset, in accordance with their agreement (and our order reflecting it), the trial we held on April 15, 2019, addressed just four of the projects in issue. In particular, the trial considered the following issues, as described in our Order of April 2, 2019:

> (1) Whether the Petitioner conducted qualified research under I.R.C. sec. 41(d) with respect to the business components identified for Project 720 (the 87,000 bbl tanker barge sold to Apex Oil) and Project 730 (the dry dock sold to Detyen's Shipyard);

[*21] (2) Whether any exclusion found in I.R.C. sec. 41(d)(4) applies with respect to the business components identified for Projects 720 and 730;

(3) The includible amount of qualified research expenses for the business components identified for Project 720 and Project 730 * * *; and

(4) The TCBW [Tell City Boat Works] issues with respect to Projects 749 and 750. * * *

Shortly after trial, the parties executed a stipulation that describes their agreement regarding the impact of our disposition of the four issues listed above. In effect, the parties agreed to treat the Apex tanker and the dry dock as representative in regard to the general issues common to all of the development projects for which petitioner claimed QREs--that is, the definition of qualified research, the applicability of any statutory exclusions, and the determination of QREs. The parties also agreed to treat Projects 749 and 750 as representative of CIS' collaborative projects with TCBW. Therefore, we understand the fourth item listed above to encompass only those issues that arise because of that collaboration. As described below, the disposition of those issues raised by Projects 749 and 750 that are common to all projects, regardless of TCBW's involvement, will generally be governed by our conclusions regarding Projects 720 and 730.

[*22] Under the parties' stipulation, our resolution of the general issues listed in items (1) through (3) above will be binding on petitioner for purposes of determining the QREs from all 11 of the projects at issue and will also bind respondent except to the extent that we grant him leave to introduce additional evidence or make additional arguments concerning projects other than Project 720 or 730. Except to the extent that our resolution of the unique TCBW issues requires the exclusion from QREs of amounts claimed in regard to Project 749 or 750, the QREs of all projects will be determined by extrapolation from the proportion of claimed QREs that we allow for Projects 720 and 730.

With that background, we address below, in turn, each of the four issues listed in our order of April 2, 2019, and the parties' posttrial stipulation.

II. Issue (1): Whether CIS Conducted Qualified Research With Respect to the Apex Tanker and Dry Dock

Issues (1) and (2) can be viewed as preliminary steps in the determination required by Issue (3)--that is, "[t]he includible amount of qualified research expenses for the business components identified for Project 720 [the Apex tanker] and Project 730 [the dry dock]". As described above, to be a QRE, an expense must bear a relationship specified in section 41(b) to an activity that satisfies the four elements of the definition of qualified research listed in section 41(d).

[*23] Therefore, it is appropriate to begin the determination of which reported expenses are QREs by determining the extent to which the activities involved in the development of the tanker and dry dock meet the definition of qualified research (Issue (1)). But activities that meet the four tests listed in section 41(d)(1) are not qualified research if they are covered by one of the exclusions provided in section 41(d)(4) (Issue (2)). Determining those activities that meet the definition of qualified research and are not covered by a statutory exclusion allows for the ultimate determination of the amount of those expenses that bear the requisite relationship to qualified research to be included in QREs (Issue (3)).

The activities that CIS conducted in developing the Apex tanker or the dry dock will be "qualified research", as defined by section 41(d)(1), only if those activities meet each of the four tests specified in that section. As explained below, petitioner has not established that substantially all of the development activities CIS conducted in regard to either the tanker or the dry dock "constitute[d] elements of a process of experimentation for a purpose described in * * * [section 41(d)(3)(A)]". See sec. 41(d)(1)(C). Consequently, we need not decide whether any research CIS conducted as part of those projects met any of the other three tests specified in section 41(d). In regard to the first issue covered by our April 15, 2019, trial, we conclude that CIS did not conduct qualified research, within

[*24] the meaning of section 41(d), with respect to either the tanker or the dry dock.

We have no doubt that CIS' efforts to design the tanker and dry dock involved activities that "constitute[d] elements of a process of experimentation" for a purpose related to "a new or improved function," "performance," or "reliability or quality." See sec. 41(d)(1)(C), (3)(A). As indicated in our Findings of Fact, the design of elements of each vessel involved iterative processes in which proposed designs were tested through such means as software modeling and engineering calculations and revised as necessary.

That the design of each vessel involved iterative processes of the type described in section 1.41-4(a)(5)(i), Income Tax Regs., should not be surprising: CIS had never designed and built a dry dock before and, while the Apex tanker was based on the Penn 80, there were, as respondent admits, "many differences between the two vessels". As noted above, however, petitioner has not demonstrated that substantially all of CIS' research activities in developing either the Apex tanker or the dry dock constituted elements of a process of experimentation for one of the purposes specified in section 41(d)(3)(A).

[*25] A. The Apex Tanker

1. Petitioner's Primary Argument

In claiming that CIS' development of the tanker meets the substantially all test of section 41(d)(1)(C), petitioner lists various elements of the vessel, including the hull, that, in comparison to the Penn 80, "were redesigned and re-engineered * * * during the development process". Petitioner alleges that the tanker's hull "alone makes up 90% of the vessel." Petitioner then claims: "Demonstrating that the vast majority of the vessel, including every major system on the vessel, was re-engineered and redesigned meets the substantially all requirement."

We disagree. Section 1.41-4(a)(6), Income Tax Regs., requires that the substantially all test be applied in reference to activities--not physical elements of the business component being developed or improved. We cannot accept--indeed, petitioner does not even argue--that a business component's proportion of novel elements is a "reasonable basis", see sec. 1.41-4(a)(6), Income Tax Regs., for measuring the proportion of research activities undertaken in the product's development that constitute elements of a process of experimentation for a purpose described in section 41(d)(3). For starters, the design of some, or even all, of the elements whose design was uncertain at the outset could have been

[*26] determined by means other than a process of experimentation. As noted above, section 1.41-4(a)(5)(i), Income Tax Regs., provides: "Uncertainty concerning the development or improvement of the business component (e.g., its appropriate design) does not establish that all activities undertaken to achieve that new or improved business component constitute a process of experimentation." Moreover, even if determining the design of every new element required a process of experimentation, we would not anticipate that the extent of that experimentation would vary in proportion to the size of each element. Determining the design of smaller, more complex elements might require more experimentation than determining the design of larger but simpler elements.

To the extent that the opinion of the District Court for the Northern District of Texas in Trinity Indus., 691 F. Supp. 2d 688, can be read to support petitioner's position, we decline to follow that court's analysis. The taxpayer in Trinity Indus. was, like CIS, in the business of shipbuilding. The court considered the extent to which the expenses the taxpayer incurred in developing six vessels were QREs within the meaning of section 41(b). The court concluded that the taxpayer's research in developing only two of those vessels met the process of experimentation requirement.

[*27] Although the court in Trinity Indus. found that 80% of the costs the taxpayer incurred in developing two of the six vessels in issue were part of a process of experimentation, its opinion does not explain how it made that calculation. The court simply described some of the aspects of those vessels that were novel in comparison to vessels previously developed by the taxpayer. See, e.g., id. at 694 ("The court does not intend to enumerate everything about the Mark V [special operations deployment craft] that was new and required research expenditures, but rather to give a flavor of the effort required."). It is not at all clear from the court's analysis that it conducted the quantitative analysis section 1.41-4(a)(6), Income Tax Regs., requires. In fact, the court's response to the Government's complaint that the taxpayer treated insurance costs as QREs suggests that the court did not engage in the required analysis. Addressing the Government's complaint, the court wrote:

> The implication is that the Court should scour the records and determine which line items are for matters not properly considered QRE. The Court believes that this is an issue the 80% rule of Treas. Reg. 1.41-4(a)(6) is intended to address. The Court finds that the additional expenses the government cites are properly considered research expenditures in that the business component--the ship--could not have been developed without them. Under the 80% rule, the Court finds that those costs are properly included in QRE * * *

Id. at 697.

[*28] If the court did not make a line-by-line determination of those otherwise qualifying research expenditures that involved a process of experimentation, we do not understand how the court concluded that the 80% test was met. Moreover, the proposition that the court's finding in regard to the 80% test meant that all costs necessary in the development of the ship were QREs conflicts with the governing regulation. Section 1.41-4(a)(6), Income Tax Regs., makes it clear that "the remaining 20 percent (or less) of a taxpayer's research activities with respect to the business component [that] do not constitute elements of a process of experimentation for a purpose described in section 41(d)(3)" must "satisfy the requirements of section 41(d)(1)(A)"--that is, the cost of the activities must be eligible for deduction under section 174. Not all costs necessary in the development of a business component are research or experimental expenditures within the meaning of section 174. (We are hard pressed to see, for example, how the purchase of insurance is an activity "intended to discover information that would eliminate uncertainty concerning the development or improvement of a product." Sec. 1.174-2(a)(1), Income Tax Regs.)

Because the District Court in Trinity Indus. did not explain how it arrived at its finding that the taxpayer's research on two of the vessels in issue satisfied the substantially all test of section 41(d)(1)(C), and because, in each case, the court

[*29] stated its finding after a recitation of those aspects of the vessels that were new or redesigned, we can understand how petitioner might have interpreted the court's substantially all analysis to have turned on an assessment of the proportion of novel elements in each vessel. If that understanding of the court's analysis is correct, however, we judge the analysis unsupported by the governing regulations and thus decline to follow it.

2. Petitioner's Alternative Argument

As an alternative argument, petitioner claims to have "demonstrated that substantially all of the time spent by * * * [CIS'] employees also went toward elements of a process of experimentation." Relying on Mr. Meunier's determination that at least 87% of the time CIS production employees spent working on the Apex tanker involved elements of that vessel that differed from the Penn 80, petitioner concludes that CIS "has far exceeded the substantially all requirement."[6]

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[6]Mr. Meunier's analysis did not take into account the activities of CIS' nonproduction employees--that is, members of the engineering group and management personnel. We might reasonably expect that members of CIS' engineering group, at least, spent a higher proportion of their time on activities that were part of a process of experimentation than did production employees. But we cannot take that as a foregone conclusion. Therefore, even if Mr. Meunier's analysis were otherwise valid in assessing the satisfaction of the process of experimentation requirement of sec. 41(d)(1)(C), it would be incomplete.

[*30] Again, the novelty of an element of a business component does not establish that the work involved in developing that element involves a process of experimentation. Moreover, the regulation on which petitioner relies in claiming that the activities its production employees performed in building the tanker were qualified services within the meaning of section 41(b)(2)(B) demonstrates that their services did not "constitute elements of a process of experimentation" for one of the purposes specified in section 41(d)(3)(A).

As noted above, section 41(b)(2)(B) defines "qualified services" to mean "services consisting of--(i) engaging in qualified research, or (ii) engaging in the direct supervision or direct support of research activities which constitute qualified research." Section 1.41-2(c)(3)(ii), Income Tax Regs., provides that "direct support of research includes the services of * * * a machinist for machining a part of an experimental model used in qualified research."

We understand petitioner to rely on section 1.41-2(c)(3)(ii), Income Tax Regs., for the proposition that the activities performed by CIS' production employees on the Apex tanker were qualified services under section 41(b)(2)(B)(ii). Petitioner observes that a "fully-functional representation or model of * * * [a] product" can be a "pilot model", as defined by section

[*31] 1.174-2(a)(4), Income Tax Regs.[7] Therefore, petitioner concludes, the Apex tanker was a pilot model. And, apparently presuming that the term "pilot model", as defined by section 1.174-2(a)(4), Income Tax Regs., has the same meaning as the term "experimental model", as used in section 1.41-2(c)(3)(ii), Income Tax Regs., petitioner posits: "[I]ndividuals who are making parts for said pilot models can have their time allocated toward the R&D credit as qualified direct support (i.e. a machinist making parts for an experimental model)."

We agree with petitioner that, if the efficacy of the proposed design of a component of the Apex tanker could be determined only by testing the physical component after its fabrication, the component could be viewed as an experimental model and the work of the production employees could be viewed as directly supporting the research involved in testing the component. If that research were qualified research (which would depend, among other things, on satisfaction of the substantially all test of section 41(d)(1)(C)), the wages paid to the production employees for the construction of that element of the tanker would

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[7]The amendments to sec. 1.174-2, Income Tax Regs., adopted in 2014 "apply to taxable years ending on or after July 21, 2014." Id. para. (d). The regulations, however, allow taxpayers to apply the amended provisions "to taxable years for which the limitations for assessment of tax ha[ve] not expired." Id. We take petitioner's invocation of the definition of "pilot model" provided in sec. 1.174-2(a)(4), Income Tax Regs., as amended in 2014, as an indication that it has chosen to apply the amended provisions to its taxable year ended June 30, 2014.

[*32] be QREs. But it does not follow that, if the testing of that component of the tanker involved a process of experimentation, the work of the production employees in fabricating the physical component was part of that process of experimentation. In fact, section 1.41-2(c)(3)(ii), Income Tax Regs., tells us that the work of the production employees would not be considered part of that process of experimentation. The work of the production employees directly supports the research involved in testing the model, but the production work does not have a close enough nexus to the testing to be considered qualified research in its own right. The fabrication of an experimental model and the use of that model in qualified research (e.g., testing the model's design as part of a process of experimentation) are, by definition, two different things. The latter is qualified research; the former is not. The qualified research in which the physical component is used--which may include testing as part of a process of experimentation--does not encompass the fashioning of the component. The distinction that section 41(b)(2)(B) draws between "engaging in qualified research" and "engaging in the * * * direct support of research activities which constitute qualified research" allows no other conclusion.

We agree with petitioner that "[t]he fact that personnel would have performed tasks that, standing alone, do not appear to constitute a process of

[*33] experimentation, does not mean supporting activities are not qualified." Wages paid to production employees can be for qualified services, as defined by section 41(b)(2)(B), even if those employees do not engage in a process of experimentation. But we do not agree that, "[i]f the activities are in direct support, they are considered an element of the process of experimentation and are claimable." Petitioner cites no statutory basis for its notion of "experimentation by association". Indeed, petitioner's argument ignores the distinction drawn by the plain terms of section 41(b)(2)(B) between engaging in qualified research and directly supporting qualified research. A production worker who directly supports qualified research is not himself engaged in qualified research and thus cannot be engaged in any process of experimentation the research might involve.

Even if we were to accept that activities provided in direct support of experimentation could be viewed as elements of the process of experimentation--despite the fact that the provider of those supporting activities is, by definition, not himself "engaged" in the experimentation--it would not follow that all of the efforts of CIS' production employees fabricating novel components of the Apex tanker were elements of that process of experimentation. Petitioner asserts that "CIS's uncertainty as to the appropriate design of the Apex 720 Tanker was not resolved until the deadweight survey was conducted confirming that the vessel

[*34] met the functional and economic requirements as laid out in the specifications". If valid, that assertion might suggest that the tanker's various elements were uniquely interdependent, so that the construction of the entire vessel--or at least its novel elements--was part of a process of experimentation. See Trinity Indus., 691 F. Supp. 2d at 692 ("[T]he systems [of a vessel] do not exist in a vacuum * * * [but instead] interact with each other, sometimes in complex and nonintuitive ways."). In other words, the argument might run, even accepting that novelty does not, by definition, require experimentation, in the case of the Apex tanker, it did. Respondent, however, reasons that, because CIS typically conducts a deadweight survey after construction of any vessel intended for ABS certification, the deadweight survey must be a quality control test that assesses whether the subject vessel has been constructed in accordance with its design rather than a test of the validity of the design itself.

Respondent overstates the case. The routine conduct of deadweight surveys on "first-in-class" and sister vessels alike demonstrates that assessing the validity of a vessel's design cannot be the only purpose of the survey. But assessment of design could nonetheless be one of the purposes served by a deadweight survey when the subject vessel is first-in-class. Although we understand Mr. Kelly to have attributed unfavorable results of a deadweight survey to errors in

[*35] construction rather than design flaws, and Mr. Meyers' testimony can be taken as support of that view, we nonetheless cannot rule out the possibility that an unfavorable result from a deadweight survey performed on a first-in-class vessel could be due to an error in the calculations made during the vessel's design rather than a construction error. Engineers, after all, are human, too.

Even accepting that the deadweight survey conducted after CIS finished construction of the Apex tanker could have led to design revisions, we do not view that possibility as establishing that the design of the tanker as a whole remained materially in doubt pending the completion of that procedure. If the displacement determined in the deadweight survey failed to comply with the contract specifications, we expect CIS would have refashioned or redesigned elements of the tanker only to the extent necessary to bring it into compliance. It would not have scrapped the entire vessel and started afresh.

We also accept the possibility of more limited testing of physical components after their fabrication--but before completion of the entire vessel--to validate the design of those components. But petitioner has not established that postfabrication testing was required to determine the design of every component

[*36] of the Apex tanker that differed from its predecessor.[8] As one might expect, CIS' engineers made every effort to ensure the viability of a component's design before requiring their employer to incur the expense of fashioning the physical component. They may not always have achieved that goal: Evaluation of further design iterations might have been required in some cases after testing of the physical component proved the initial design defective. But that prospect does not establish that all novel components of the tanker were, by definition, used in a process of experimentation. Again, novelty may create uncertainty, but resolution of that uncertainty need not require experimentation. See sec. 1.41-4(a)(5)(i), Income Tax Regs.; see also Siemer Milling Co. v. Commissioner, T.C. Memo. 2019-37, at *36 ("Although Siemer faced uncertainty with respect to whether the wheat hybrids that it tested would be sufficient for current or new products, it did

[8]Petitioner makes much of a purported "concession" at trial by one of respondent's attorneys, Mr. Tran, "that uncertainties were happening throughout construction." The exchange to which petitioner refers occurred when the Court asked about the purpose of a line of Mr. Tran's inquiry during his cross-examination of Mr. Varner. In response, Mr. Tran referred to petitioner's claim that "there were design uncertainties throughout the construction of the project" and advised the Court that the purpose of his inquiry was "to show what some of those design uncertainties were". At most, we understand Mr. Tran only to have accepted, as we have, that the design of some of the tanker's elements were resolved only during construction--not that the design of the vessel as a whole remained materially uncertain until construction was complete.

[*37] not establish that it engaged in a process of experimentation with respect to the wheat hybrids.").

In sum, petitioner has not provided us with grounds to include in the numerator of the fraction described in section 1.41-4(a)(6), Income Tax Regs., any of the activities of CIS' production employees. Those who directly support research are, by definition, not engaged in research. See sec. 41(b)(2)(B). Consequently, their activities cannot be viewed as elements of any process of experimentation that research might entail. Even if, contrary to the plain terms of section 41(b)(2)(B), we were to accept the possibility that the work of production employees could be part of a process of experimentation, petitioner has not established the portion of their time those employees engaged in experimentation.

3. Calculation of Relevant Fraction

a. Production Activities Included in Denominator--The Apex Tanker as a Pilot Model

If the activities of CIS' production employees--though perhaps directly supporting research--are nonetheless not part of a process of experimentation, the activities those employees undertook working on the Apex tanker could not be included in the numerator of the fraction described in section 1.41-4(a)(6), Income Tax Regs. But if petitioner is correct that the tanker is a "pilot model", as defined

[*38] by section 1.174-2(a)(4), Income Tax Regs., and if, as a consequence, the activities of the production employees were included in the denominator of the relevant fraction, it would be arithmetically impossible for CIS' research in developing the tanker to satisfy the substantially all test of section 41(d)(1)(C).

As a general rule, section 174 applies to the costs of developing the concept of a product but not to the costs of building the product itself. See Mayrath v. Commissioner, 41 T.C. 582, 590 (1964), aff'd, 357 F.2d 209 (5th Cir. 1966); Union Carbide Corp. & Subs. v. Commissioner, 2009 WL 605161, at *79 (citing, inter alia, Mayrath v. Commissioner, 41 T.C. at 590). But when a taxpayer constructs a physical product for the purpose of assessing the viability of its concept, the construction costs can be considered costs of developing the concept of the product and thus can be deducted under section 174. The 2014 amendments to section 1.174-2, Income Tax Regs., clarified that point by adopting, for the first time, a definition of "pilot model" and providing examples of the treatment of pilot models under section 174. Section 1.174-2(a)(11), Example (7), Income Tax Regs., confirms that the costs of producing a pilot model can qualify as research or experimental expenditures under section 174. The example involves an aircraft manufacturer who sought to develop an experimental aircraft capable of taking off and landing vertically. The taxpayer "produce[d] a working aircraft at a cost of

[*39] $5,000,000" for the purpose of "evaluat[ing] and resolv[ing] uncertainty during the development or improvement of the product and test[ing] the appropriate design" of the aircraft. Sec. 1.174-2(a)(11), Example (7), Income Tax Regs. The example concludes that the aircraft the taxpayer built was a pilot model, as defined by section 1.174-2(a)(4), Income Tax Regs., and that "the $5,000,000 of costs that * * * [the taxpayer] incurred in producing the aircraft qualifie[d] as research or experimental expenditures under section 174." Id. That was true even though the taxpayer sold the aircraft "[i]n a later year". Id.

If CIS' purpose in producing the Apex tanker was to "evaluate and resolve uncertainty" concerning the product, it would qualify as a pilot model for purposes of section 174. See sec. 1.174-2(a)(4), Income Tax Regs. It would follow that the costs CIS incurred in producing the tanker, including the wages it paid to its production employees, would qualify as research or experimental expenditures under section 174, like the costs of producing the experimental aircraft in section 1.174-2(a)(11), Example (7), Income Tax Regs.

If the activities engaged in by CIS' production employees working on the Apex tanker are included in the denominator of the fraction described in section 1.41-4(a)(6), Income Tax Regs., but not the numerator, the relevant fraction could not equal or exceed 80%. The prescribed fraction measures the proportion of

[*40] (i) research activities conducted in regard to a business component that constitute elements of a process of experimentation for a qualified purpose to (ii) all research activities in regard to the business component that satisfy the requirements of section 41(d)(1)(A) (i.e., the costs of which can be deducted under section 174) that are not covered by one of the statutory exclusions from qualified research. (Clause (i) describes the numerator of the fraction described in section 1.41-4(a)(6), Income Tax Regs., and clause (ii) its denominator.) Because the fraction described in section 1.41-4(a)(6), Income Tax Regs., considers activities, the supply costs petitioner claims as QREs for Project 720 are not taken into account in computing the fraction. Instead, we must consider the activities of CIS' employees.[9] The record provides no means of measuring the activities of CIS'

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[9]For purposes of applying the substantially all test of sec. 41(d)(1)(C), we do not take into account Hayes' activities testing welds made in the tanker's construction. Respondent claims that the testing Hayes performed was for quality control and, as such, was covered by exclusions provided in sec. 41(d)(4)(D)(v) and sec. 1.174-2(a)(6)(i), Income Tax Regs. (as amended in 2014). Petitioner attempts to distinguish quality assurance testing from quality control testing but does not apply that distinction to the specific work performed by Hayes or otherwise explain why Hayes engaged in qualified research. Moreover, petitioner's own witness, Mr. Meunier, testified that weld failures were most often due to the welder's workmanship. We therefore accept respondent's argument. Because the amounts CIS paid to Hayes were not research or experimental expenditures, within the meaning of sec. 174(a), Hayes' activities are excluded from both the numerator and the denominator of the fraction described in sec. 1.41-4(a)(6), Income Tax Regs.

[*41] nonproduction employees other than the wages paid to those employees. Therefore, if the relevant fraction includes activities of both groups of employees, those activities would have to be measured by their cost--that is, the wages CIS paid the employees for their conduct of the activities. If the $2,505,491 of wages CIS paid to its production employees is included in the denominator of the relevant fraction but not its numerator, the fraction could not equal or exceed 80%. Even if all $609,276 of wages paid to nonproduction employees that petitioner claimed as QREs was for qualified research on the Apex tanker that involved a process of experimentation, the relevant fraction would be only about 19.6% ($609,276 ÷ ($609,276 + $2,505,491)).

It is far from clear, however, that the Apex tanker qualifies as a "pilot model", as defined by section 1.174-2(a)(4), Income Tax Regs. As explained above, the classification of a product as a pilot model turns on the taxpayer's purpose in producing it. In that respect, the Apex tanker can be distinguished from the experimental aircraft described in section 1.174-2(a)(11), Example (7), Income Tax Regs. Although the taxpayer in the example ended up selling the aircraft, the example is careful to note that the taxpayer's purpose in building the aircraft was to "evaluate and resolve uncertainty during development or

[*42] improvement of the product and test the appropriate design". Petitioner has made no such showing with respect to the Apex tanker.

The Apex tanker can also be distinguished from other examples of pilot models provided in the regulations. Section 1.174-2(a)(11), Example (5), Income Tax Regs., involves a taxpayer that spent $5,000 producing several models of a product to "test[] the appropriate design" before mass-producing the product. The example concludes that the $5,000 the taxpayer spent producing the models was covered by section 174. Although the taxpayer ultimately "enter[ed] into a contract to sell one of the models to a customer", the example is careful to note that that occurred only "[u]pon completion of several years of testing". Section 1.174-2(a)(11), Example (3), Income Tax Regs., involves a taxpayer who, like CIS, entered into a contract to design and build a custom product (in that case, a machine) to a customer's specifications. The taxpayer spent $10,000 to produce a model of the machine to evaluate and resolve design uncertainty and spent an additional $1,000 to test the model. Once it had determined the appropriate design, the taxpayer spent $20,000 to build the machine itself. The example concludes that the $11,000 the taxpayer spent to build and test the model was covered by section 174, but the $20,000 the taxpayer spent to build the machine itself was not. Section 1.174-2(a)(11), Example (3), Income Tax Regs., thus draws

[*43] a distinction between a model of a product and the product itself. The example accepts that the taxpayer's purpose in building the model was to evaluate and resolve design uncertainty. By contrast, the taxpayer built the machine itself to fulfill its contractual obligations to its customer.

b. Production Activities Excluded From Both Numerator and Denominator

Under the circumstances, however, we need not decide whether the Apex tanker is a pilot model, within the meaning of section 1.174-2(a)(4), Income Tax Regs. If the tanker does not qualify as a pilot model, it would not be clear that any of the wages CIS paid to its production employees for the construction of the tanker would be research or experimental expenditures, within the meaning of section 174.[10] But petitioner has not established that the fraction described in section 1.41-4(a)(6), Income Tax Regs., would equal or exceed 80% in regard to the Apex tanker even if the activities of CIS' production employees were excluded

[10]Some of the wages CIS paid to its production employees for construction of the Apex tanker might be eligible for deduction under sec. 174 regardless of whether the tanker qualifies as a pilot model. Sec. 1.174-2(a)(1), Income Tax Regs., as amended in 2014, provides: "Costs may be eligible under section 174 if paid or incurred after production begins but before uncertainty concerning the development or improvement of the product is eliminated." It does not follow, however, that the costs of producing each and every component of a product are deductible under sec. 174 as long as the design of any one component remains uncertain.

[*44] from the fraction's denominator. If production employees' activities were excluded from both the numerator and denominator, the fraction would take into account only the activities of the engineering group and CIS management. In that case, the research CIS conducted in developing the tanker would satisfy the substantially all test of section 41(d)(1)(C) if at least 80% of the research activities engaged in by members of engineering group and CIS management as part of that project constituted elements of a process of experimentation. But petitioner has not provided a breakdown of the activities of those nonproduction employees by project, much less provided evidence of the portions of the time they spent on each project that did or did not involve elements of a process of experimentation.

i. Mr. Johnson

Given Mr. Johnson's role in the development of the vessels in issue, we are not surprised that petitioner included more of his wages in QREs than those of any other employee. While we accept that Mr. Johnson's activities included some that would qualify as elements of a process of experimentation, the record demonstrates that his responsibilities were very much broader.

We doubt that the customer relations and management activities Mr. Johnson engaged in involved a process of experimentation. Even the "direct supervision" of experimentation is not itself experimentation. As noted above,

[*45] section 41(b)(2)(B)(ii) includes in the definition of "qualified services" "engaging in the direct supervision or direct support of research activities which constitute qualified research." And section 1.41-2(c)(2), Income Tax Regs., provides: "The term 'direct supervision' as used in section 41(b)(2)(B) means the immediate supervision (first-line management) of qualified research (as in the case of a research scientist who directly supervises laboratory experiments, but who may not actually perform experiments)." Just as direct support of qualified research is not itself qualified research, direct supervision of such research is not qualified research. See sec. 41(b)(2)(B) (contrasting in clauses (i) and (ii) the direct engagement in qualified research and the direct supervision or support of qualified research). Thus, while a person who directly supervises research may perform qualified services, he is not himself engaged in qualified research and cannot be treated as conducting himself any experimentation that research involves. The descriptions of Mr. Johnson's activities included in the record indicate that, even if he spent 60% of his time on services that would meet the definition of "qualified services" (if the research involved in the various projects he directed were qualified research), a considerable portion of his activities did not constitute elements of a process of experimentation, within the meaning of section 1.41-4(a)(5), Income Tax Regs.

[*46] ii. Management Team

The $126,734 of wages paid to Don Foertsch, David Foertsch, and Mr. Fleischmann that petitioner treated as QREs itself constitutes more than 20% of the total $609,276 nonproduction employee wages that petitioner treated as QREs. The record provides little detail of the nature of any research activities Don Foertsch might have conducted. In particular, we do not understand how the emails on which Don was copied but may not even have read provide evidence of activities--involving experimentation or otherwise--that he may have engaged in. On brief, petitioner justifies its inclusion of a portion of Don's wages in QREs on the ground that he "directly supervised" qualified research performed by Mr. Johnson. Again, activities constituting the direct supervision of research that might involve a process of experimentation are not themselves elements of a process of experimentation.

David Foertsch's testimony regarding his efforts to "troubleshoot" the problems with the tanker's towing bridle indicates that, in addition to his management responsibilities, he may have engaged in at least some activities that constituted elements of a process of experimentation. But the record allows us no means of determining the extent of his time David spent on experimentation.

[*47] At least some of the activities Mr. Fleischmann engaged in as part of the development of the vessels in question--and perhaps a considerable portion--did not involve a process of experimentation. As we have previously observed, "the 'evaluation of products available from vendors is not a process of experimentation.'" Siemer Milling Co. v. Commissioner, at *24 (quoting section 1.41-4(a)(8), Example (5), Income Tax Regs.). On brief, petitioner refers to Mr. Fleischmann as having "directly supported" research it claims to be qualified research by "determining the supplies required to complete the vessel." Again, activities that directly support research that might involve a process of experimentation do not themselves constitute elements of a process of experimentation. See sec. 41(b)(2)(B).

iii. Draftsmen

The distinction Mr. Meunier drew between drafting and design calls into question the extent to which Messrs. Gass, Harpenau, and Kellems--as well as Mr. Meunier himself in regard to Project 720--were involved in processes of experimentation. Simply drawing a design provided by an engineer (or other designer) need not involve an evaluation of design alternatives. The choice between alternatives, and any experimentation involved in that choice, may well have been made by the designer before asking the draftsman to draw up the chosen

[*48] design. It is also not clear that drafting "fundamentally rel[ies] on the principles of the physical or biological sciences, engineering, or computer science". See sec. 1.41-4(a)(5)(i), Income Tax Regs. Mr. Meunier acknowledged that a draftsman does not need an engineering degree. And the drafters' use of computers in preparing their drawings does not qualify their work as experimentation. See sec. 1.41-4(a)(7), Income Tax Regs. ("The employment of computers or information technology * * * does not itself establish that qualified research has been undertaken."). Finally, petitioner effectively concedes that the draftsmen's work was not itself experimentation by describing those employees, along with CIS' purchasing agent and production workers, as providing "direct support" services--in the case of the draftsmen, "by aiding in the computer aided design of drawings".

iv. Conclusion

For the reasons explained above, the record does not allow us to determine the percentage of research activities conducted by CIS' nonproduction employees that constituted elements of a process of experimentation. We cannot make that determination even in the aggregate--for all 11 projects petitioner took into account in computing its claimed research credit--much less for those employees' work on the Apex tanker in particular. But we need not arrive at a specific

[*49] percentage. Nor do we need to establish that the percentage was less than 80%.[11] It suffices to say that petitioner has not given us grounds to conclude, on the basis of the record before us, that substantially all of the research CIS conducted in developing the Apex tanker constituted elements of a process of experimentation.

c. Substantiation Rules

We recognize that petitioner might have been handicapped in its ability to demonstrate satisfaction of the substantially all test provided in section 41(d)(1)(C) by the absence of any nontax reason for CIS to track in detail the work performed by members of its management and engineering teams. The governing regulations, however, require taxpayers claiming research credits to "retain records in sufficiently usable form and detail to substantiate that the expenditures claimed are eligible for the credit." Sec. 1.41-4(d), Income Tax Regs. In connection with amendments to that section of the regulations proposed in 2001 and adopted in 2004, Treasury and the Internal Revenue Service (IRS) acknowledged that the need for taxpayers to keep records that they would not otherwise keep "ha[d] made

[11]We note, however, that the wages petitioner included in QREs paid to those whom it described as providing either direct supervision or direct support services (Don Foertsch, Mr. Fleischmann, and Messrs. Gass, Harpenau, and Kellems) sum to $134,221, which is more than 20% of the $609,276 of wages paid to all nonproduction employees that petitioner treated as QREs.

[*50] administration of the research credit burdensome for the IRS." REG-112991-01, 2002-4 I.R.B. 404, 409. Therefore, the amendments eliminated a more detailed recordkeeping requirement that had been included in the regulations before 2004. The amendments reflect policymakers' "conclusion that taxpayers must be provided reasonable flexibility in the manner in which they substantiate their research credits." Id. The regulations, as amended, thus do not require taxpayers "to keep records in a particular manner". Id. But a taxpayer's records, however kept, must be "in sufficiently usable form and detail to substantiate that the expenditures claimed are eligible for the credit". Id. While the 2004 amendments to the regulations reflect a goal of reducing the need for taxpayers to keep records not otherwise necessary, the drafters accepted that they could not eliminate that possibility. CIS' choice not to maintain detailed records of how its nonproduction employees spent their time placed on petitioner the burden of demonstrating--in some manner--the portion of those individuals' work that did and did not involve a process of experimentation. Petitioner's failure to introduce evidence on that point indicates a failure to comply with even the liberalized substantiation requirement adopted in 2004.

[*51] B. The Dry Dock

According to petitioner, the substantially all analysis in regard to the dry dock "is much simpler" than the analysis regarding the tanker. In the case of the dry dock, "[t]he entire vessel is new." On the premise that "[t]here is no aspect of the vessel that was not newly designed during the development process", petitioner concludes that "the development of the entirety of the Detyens 730 Dry Dock (100%) constituted elements of a process of experimentation."

We agree that petitioner's analysis is "simple[]". But it is not the analysis that section 1.41-4(a)(6), Income Tax Regs., requires. Again, the substantially all test does not consider the proportion of a business component that differs from other business components the taxpayer has developed. Instead, it measures activities--in particular, the proportion of (i) a taxpayer's research activities in regard to a business component that constitute elements of a process of experimentation for a qualifying purpose to (ii) those research activities whose costs are deductible under section 174. Accepting that the dry dock consisted entirely of novel elements that CIS had not previously designed and built would establish only that the design of those elements was uncertain at the start of the development process. Resolving that design uncertainty may have required, but did not necessarily require, a process of experimentation. See sec. 1.41-4(a)(5)(i),

[*52] Income Tax Regs. ("Uncertainty concerning the development or improvement of * * * [a] business component (e.g., its appropriate design) does not establish that all activities undertaken to achieve that new or improved business component constitute a process of experimentation.").

As was the case with the Apex tanker, we see no basis in the record for concluding that CIS' research in developing the dry dock met the substantially all requirement of section 41(d)(1)(C). The substantially all test measures activities. Therefore, even when those activities are measured by their cost, the $1,943,265 CIS paid for supplies used in building the dry dock would not be part of the fraction described in section 1.41-4(a)(6), Income Tax Regs.

Petitioner has not established that any of the activities engaged in by CIS' production employees in working on the dry dock should be included in the numerator of the relevant fraction. As explained supra part II.A.2., the distinction section 41(b)(2)(B) draws between engaging in qualified research and directly supporting qualified research means that a production worker who directly supports research is not engaged in that research and thus cannot be engaged in any process of experimentation that research might involve.

Moreover, even if we were to accept that activities provided in direct support of experimentation could be viewed as elements of the process of

[*53] experimentation, it would not follow that all of the work on the dry dock performed by CIS' production employees was part of that process of experimentation. Petitioner asserts that "CIS's uncertainty as to the appropriate design of the Detyens 730 Dry Dock was not resolved until the final raise and lower test was conducted". But Detyens itself conducted that test after taking delivery of the dry dock at CIS' facility and transporting it to Charleston, South Carolina. CIS' actions in tendering the dry dock to Detyens and requesting final payment demonstrate that, as far as it was concerned, it had determined an appropriate design for the vessel and built it in accordance with that design.

CIS' conduct of its own tests upon completing construction of the dry dock, such as the partial raise-and-lower test, does not establish that the design of every element of the vessel remained uncertain before those tests were successfully completed. The dry dock's failure to meet one or more of those tests might have required the redesign of some of its elements. Again, however, we trust that CIS would not have been compelled in that event to scrap the entire vessel and start afresh. Accepting that the design of the vessel's various elements involved "more than ordering off a menu", see Trinity Indus., 691 F. Supp. 2d at 692, does not require us to accept that the construction of the entire vessel was part of a process of experimentation.

[*54] If the activities of the production employees carried out in their work on the dry dock were included in the denominator of the relevant fraction but not the numerator, the state of the record would, as explained above, require us to measure the relevant activities by cost. In that event, the $146,109 of wages paid to production employees for work on the dry dock would be included in the fraction's denominator. Consequently, the fraction would equal or exceed 80% only if the numerator were at least $584,436 ($584,436 = 0.8 ($584,436 + $146,109)). That would be the case only if about 96% of the nonproduction employee wages that petitioner claimed as QREs for all projects ($584,436 ÷ $609,276) related to the dry dock alone--and, even then, only if all of the nonproduction employee wages allocable to the dry dock were for activities that constituted elements of a process of experimentation.

If the dry dock did not qualify as a pilot model, within the meaning of section 1.174-2(a)(4), Income Tax Regs., some or even all of the activities carried out by production employees in the vessel's construction might be excluded from the denominator of the fraction described in section 1.41-4(a)(6), Income Tax Regs. The fraction might measure only the proportion of the activities engaged in by members of CIS' engineering and management teams in developing the dry dock that involved a process of experimentation. Again, however, petitioner has

[*55] not provided sufficient information about how its nonproduction employees spent their time--by project--to allow us to make the required determination. As was the case with the Apex tanker, the record provides us no basis for concluding that substantially all of the research CIS conducted in developing the dry dock constituted elements of a process of experimentation.

C. The "Shrinking-Back" Rule

If research conducted in the development of a business component as a whole fails the process of experimentation requirement, research related to elements of the business component may nonetheless be qualified research under the "shrinking-back rule" provided in section 1.41-4(b)(2), Income Tax Regs. That section provides:

> The requirements of section 41(d) * * * are to be applied first at the level of the discrete business component * * *. If these requirements are not met at that level, then they apply at the most significant subset of elements of the product * * * [or other business component]. This shrinking back of the product is to continue until either a subset of elements of the product that satisfies the requirements is reached, or the most basic element of the product is reached and such element fails to satisfy the test. * * *

Like the taxpayer in Trinity Indus., 691 F. Supp. 2d at 692, petitioner has chosen to employ an "all or nothing" strategy that prevents us from applying the shrinking-back rule of section 1.41-4(b)(2), Income Tax Regs., to identify

[*56] elements of either the Apex tanker or the dry dock whose development involved qualified research. Petitioner did not break down engineering and management team activities by project, much less by elements of each vessel. Mr. Meunier categorized the activities of production employees working on the Apex tanker between work on novel elements, work on elements similar to those of the Penn 80, and work on elements the same as those of the Penn 80. But the record is not sufficiently detailed to allow us to determine activities related to specific elements of either the tanker and the dry dock that may have been part of a process of experimentation. It may well be that CIS' research in regard to some--even many--elements of those vessels satisfied the process of experimentation requirement and the other tests applied in the definition of qualified research. But petitioner has not given us the means of making that determination.

D. Conclusion

For the reasons explained above, we conclude that CIS did not conduct qualified research, as defined by section 41(d), with respect to the Apex tanker or the dry dock.

[*57] III. Issue (2): Applicability of Section 41(d)(4) Exclusions to Research on Apex Tanker or Dry Dock

Because we conclude that CIS did not conduct qualified research, within the meaning of section 41(d), in developing either the Apex tanker or the dry dock, we need not consider the applicability to either project of the exclusions provided in section 41(d)(4).

IV. Issue (3): QREs Paid or Incurred in Development of Apex Tanker and Dry Dock

Our conclusion regarding Issue (1) (conduct of qualified research) also resolves Issue (3) (amount of QREs). As noted above, the QREs petitioner reported in respect of the Apex tanker consist of $2,505,491 of wages that CIS paid to production employees and $3,892,142 of supply costs. Petitioner also reported contract research expenses for that project of $17,504. In regard to the dry dock, petitioner reported QREs of $146,109 for wages CIS paid to production employees and $1,943,265 of supply costs. In addition, petitioner reported QREs of $609,276 for wages paid to nonproduction employees of CIS for work on the 11 vessels whose development petitioner claims involved qualified research. Although the definitions of the different components of QREs vary, they share a common element in that all those amounts must bear a connection to qualified research. If research conducted in the development of a business component is not

[*58] qualified research, none of the expenses incurred in the project can be QREs. In particular, the wages CIS paid to its employees could qualify as "in-house research expenses" only to the extent paid or incurred for "qualified services", as defined by section 41(b)(2)(B). To meet that definition, services must consist of either "(i) engaging in qualified research, or (ii) engaging in the direct supervision or direct support of research activities which constitute qualified research." Because petitioner has not established that the research CIS conducted in developing the Apex tanker and the dry dock was qualified research, as defined by section 41(d), we cannot treat as qualified services, within the meaning of section 41(b)(2)(B), any of the services provided by CIS employees in the course of either project. Thus, none of those wages can be included in QREs by reason of section 41(b)(1)(A) and (2)(A)(i).

Section 41(b)(3)(A) defines "contract research expenses" to mean "65 percent of any amount paid or incurred by the taxpayer to any person (other than an employee of the taxpayer) for qualified research." Unless the research involved in the development of the Apex tanker was qualified research, the amount that CIS paid to Hayes would not be contract research expenses, as defined by section 41(b)(3)(A), regardless of the applicability of the exclusions for quality control testing. Consequently, CIS' payments to Hayes are not includible in QREs under

[*59] section 41(b)(1)(B). Finally, supply costs are included in in-house research expenses only to the extent they are "paid or incurred for supplies used in the conduct of qualified research". Sec. 41(b)(2)(A)(ii). Because petitioner has not established that CIS' development of the Apex tanker and the dry dock involved qualified research, the costs of the supplies used in the development of those vessels cannot be included in in-house research expenses under section 41(b)(2)(A)(ii) and thus cannot be QREs.

For the reasons explained above, the includible amount of QREs for each of the Apex tanker and the dry dock pursuant to section 41(a) and (b) was zero.

V. Issue (4): The TCBW Issues

Our resolution of the general issues exemplified by Projects 720 and 730 renders moot any issues unique to Projects 749 and 750 because of CIS' collaboration with TCBW. As noted above, in their posttrial stipulation, the parties agreed to treat the Apex tanker (Project 720) and the dry dock (Project 730) as representative in regard to the general issues common to all of the development projects for which petitioner reported QREs. Under that stipulation, our resolution of Issues (1) through (3) binds petitioner for purposes of determining the QREs from all 11 of the projects it took into account in its claimed research credit. We have determined that no portion of the QREs petitioner reported in respect of

[*60] Projects 720 and 730 are allowable for the purpose of computing the research credit allowed by section 41(a). Extrapolating from that determination the QREs allowable in respect of Projects 749 and 750 yields the result that the QREs for each of those projects were also zero, without regard to any unique issues raised by CIS' collaboration with TCBW. Our disposition of the case thus does not require that we resolve the issues respondent raised that are unique to Projects 749 and 750.

VI. Issues Remaining for Further Proceedings

The parties' posttrial stipulation contemplated that any second trial necessary in this case would be limited to (1) any arguments we allow respondent to make concerning projects other than Projects 720 and 730, (2) the calculation of the base amount for determining any research credit allowed to petitioner for the taxable year ended June 30, 2014, and (3) petitioner's liability for the accuracy-related penalty respondent determined. We expect that, given our resolution of the generally applicable issues raised by Projects 720 and 730, respondent will have no reason to seek leave to raise additional issues in regard to other projects for which petitioner claimed QREs. In addition, our conclusion that CIS did not pay or incur any QREs for the taxable year in issue in connection with Project 720 or 730--or, by extrapolation, any other development project--renders moot the

[*61] question of petitioner's base amount for determining any allowable research credit. We will therefore issue an order directing the parties to advise us concerning the need for a second trial to address petitioner's liability for the accuracy-related penalty respondent determined or any other issues relevant to petitioner's Federal income tax liability for the year in issue not resolved by this opinion.

An appropriate order will be issued.