Quantria Strategies, LLC

Technical Description and Supporting Information of the Estimates of Provisions to Enhance Life Sciences Research in the United States

Prepared for the Life Sciences Investment Act Coalition

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Technical Description of the Methods Used to Estimate Provisions Enhancing Life Sciences Research in the United States

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I. Increased R&D Tax Incentives for Life Science

The proposed legislation provides two temporary (through 2015) tax incentives to encourage increased life sciences research – an enhanced R&D credit and tax-free repatriation of permanently reinvested foreign earnings.[1] The eligible firms may not use both provisions during the same tax year and the maximum amount of life sciences R&D qualifying for the incentives each year is $150 million. The following sections provide a detailed description of these provisions.

A. Enhanced R&D Tax Credit

The proposal provides an enhanced R&D tax credit for amounts invested in qualified life sciences research through December 31, 2015.

The proposal increases the R&D credit to 40 percent (from the current law 20 percent) of the amount by which qualified life sciences research exceeds a base amount. The Alternative Simplified Credit also increases for qualified life sciences research, from 14 percent to 28 percent and from 6 percent to 12 percent in the case of taxpayers with no qualified research expenses in the three preceding taxable years. Under the proposal, no more than $150 million of qualified life sciences research would be eligible for the enhanced credit in any year.

Taxpayers can claim the credit with respect to their qualified life sciences research expenses, which includes any research relating to human beings in the fields of biology, biochemistry, biophysics, bioengineering, biotechnology, microbiology, genetics, or physiology, but does not include research in the fields of sociology or psychology. In addition, the research must be considered scientific research and development under Code 5417 of the North American Industry Classification System, which includes "establishments engaged in conducting original investigation undertaken on a systematic basis to gain new knowledge (research) and/or the application of research findings or other significantly improved products or processes (experimental development)."[2]

Qualified life sciences research expenses include in-house research expenses and certain contract research expenses. Under current law, only 65 percent of contract research expenses can be taken into account in computing the credit, except for amounts paid for energy research to eligible small businesses, universities, and Federal laboratories. In the case of contract research expenses, the proposal permits 100 percent of qualified life sciences research expenses, if the expenses are payable to certain tax-exempt organizations, eligible small businesses (average of 500 or fewer employees during either of the preceding two years), universities, and Federal laboratories for qualified life sciences research. Qualified life sciences expenses do not include

[1] The description of the proposed tax incentives is based on the provisions of S. 4018, introduced by Senator Casey in the 111th Congress.

[2] See, http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=5417&search=2007

payments (1) to certain highly compensated employees, (2) to pay dividends to shareholders of the taxpayers, or (3) to pay interest or principal on any debt security of the taxpayer.

Taxpayers who claim the enhanced life sciences R&D credit are not entitled to utilize the limited deduction for life sciences jobs and investment in the United States (described below).

The bill requires taxpayers to provide substantiation of their compliance with the bill's requirements and certification of such compliance by the corporate CEO and the independent director serving as head of the taxpayer's audit committee.

Table 1 – Comparison of R&D Credit for Life Sciences Research to Current Law R&D Credit

Provision	Current Law	Proposed Legislation
Base Credit Percentage	20%	40%
Credit Percentage for Basic Research Payments	20%	40%
Alternative Simplified Credit Percentage	14%	28%
Alternative Simplified Credit If No Qualified Research Payments in Any of 3 Preceding Years	6%	12%
Percentage of Life Sciences Expenses Qualifying for Research Credit	100 percent of in-house expenses; 100 percent of contract expenses for energy research paid to eligible small businesses, universities, and Federal research laboratories; 65 percent of other contract expenses	100 percent of in-house expenses; 100 percent of contract expenses paid to certain tax-exempt entities, qualifying small businesses, universities, and Federal research labs for life sciences research

B. Limited Deduction for Foreign Earnings Invested in U.S. Life Sciences Research

In lieu of the enhanced R&D credit, the proposal allows taxpayers to claim a temporary deduction (through 2015) for cash dividends received from a controlled foreign corporation, as long as the taxpayer invests all the dividends received in life sciences research. Thus, companies that have financial statement earnings permanently reinvested outside the United States can repatriate these earnings without paying U.S. Federal taxes on the amounts repatriated. The deduction in any year is limited to the lesser of $150 million or the amount of financial statement earnings permanently reinvested outside the United States.

For purposes of the repatriation deduction, life sciences research includes:

(1) The new hiring of scientists, researchers, and comparable personnel engaged in qualified life sciences research,

(2) Payments to certain tax-exempt entities, small businesses, universities, and Federal research laboratories for qualified life sciences research, and
(3) The building and leasing of new facilities used primarily to conduct life sciences research.

Taxpayers may not use the repatriated amounts to make payments to:

(1) Employees who make more than $1,000,000 per year,
(2) Pay dividends to shareholders of the taxpayers, or
(3) Pay interest or principal on any debt security of the taxpayer.

In addition, the proposed legislation requires the taxpayer to hold the repatriated dividends in a separate account, trust, or other arrangement to segregate the amounts until they are used for qualified life sciences research.

The proposed legislation requires taxpayers to provide substantiation of their compliance with the bill's requirements and certification of such compliance by the corporate CEO and the independent director serving as head of the taxpayer's audit committee.

II. Defining Life Sciences Research

'Life sciences' is a broad term encompassing the branch of science relating to the study of human organisms. The American Heritage Dictionary defines life sciences as "any of several branches of science, such as biology, medicine, anthropology, or ecology, that deal with living organisms and their organization, life processes, and relationships to each other and their environment."[3] In this broad sense, life sciences is the study of living organisms, compared to physical science, such as physics or astronomy, dealing with nonliving organisms. In this broad definition of life science, life sciences refer to studies of human organisms as well as the study of other living organisms, such as animals and plants.

Under the proposed legislation, the proposed tax incentives would apply to a narrower definition of life sciences research.[4] Under the proposed legislation, qualified life sciences research would include research

> "(I) with respect to the branch of knowledge or study of biology, biochemistry, biophysics, bioengineering, biotechnology, microbiology, genetics, or physiology (in each case as such knowledge or study relates to human beings), and
> (II) that is considered scientific research and development for purposes of North American Industry Classification System code 5417."[5]

Under the proposed legislation, the term qualified life sciences research does not include sociology or psychology.

Many people have a general idea of what "life sciences research" means. However, there is no single definition for data collection purposes. In addition, it is clear that there are overlaps between research that would qualify as life sciences research and other scientific research. Research conducted for one purpose may have applications in other branches of science. As a result, the line between life sciences research and other (closely related) research may depend on the initial purpose of the research and the type of firm that conducts the research, rather than on the ultimate results.

An examination of the industry codes used in the North American Industry Classification System (NAICS) helps to narrow the view of research that may qualify as life sciences research.[6] Using the specific industry subcategories, Table 2 shows the following types of establishments that may be engaged in life sciences research, based on the National Science Foundation reports

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[3] American Heritage Dictionary of the English Language, Fourth Edition. Houghton Mifflin Company, 2006.
[4] The definition of life sciences research is contained in S. 4018, introduced in the 111th Congress.
[5] S. 4018, proposed IRC sec. 41(h)(2)(B).
[6] NAICS is a system of business classification adopted in 1997 for data collection purposes by the United States, Canada, and Mexico. Federal agencies use the NAICS system to classify business establishments to collect, analyze, and publish statistical data related to U.S. businesses and the economy. Classifications under NAICS range from broad industry categories (2-digit NAICS codes) to detailed industry subcategories (4-, 5-, and 6-digit codes). For purposes of the NAICS, an establishment is a single physical location where businesses conduct operations or where they perform services or industrial operations. A business entity, such as a corporation, can consist of a single establishment or multiple establishments. Each establishment receives a NAICS code based on the primary business activity at that establishment.

identifying research activities and based on the type of research necessary per NAICS Code 5417, as explained in the Appendix (footnote 21).

Table 2 – Life Sciences Research Activities by NAICS
(Source: National Science Foundation Reports, 2007 and 2008)

NAICS
3254 – Pharmaceuticals and Medicines Manufacturing
325411 – Medicinal and Botanical Manufacturing
325412 – Pharmaceutical Preparation Manufacturing
325413 – In-Vitro Diagnostic Substance Manufacturing
325414 – Biological Product (except Diagnostic) Manufacturing
3345 – Navigational, Measuring, and Electromedical and Control Instruments
334510 – Electromedical and Electrotherapeutic Apparatus Manufacturing
3391 – Medical Equipment and Supplier†
339112 – Surgical and Medical Instrument Manufacturing
339113 – Surgical Appliance and Supplies Manufacturing
339114 – Dental Equipment and Supplies Manufacturing
5417 – Scientific Research and Development Services
541711 – Research and Development in Biotechnology
541712 – Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)
5419 – Other Professional Scientific and Technical Services
541990 – All Other Professional, Scientific, and Technical Services
621- 623 Health Care Services[7]
622110 – General Medical and Surgical Hospitals
622310 – Specialty (except Psychiatric and Substance Abuse) Hospitals
†In addition to these subsectors, two additional classes (339115 and 339116) may engage in research. However, it appears that the vast majority of manufacturers in these subsectors are primarily manufacturing operations.

Approximately 60 percent of U.S. life sciences research occurs in establishments classified under NAICS code 3254 – pharmaceutical and medicine manufacturing and its subcategories (325411 through 325414). Establishments classified under NAICS codes 5471, 5419, and 3345 contribute approximately 35 percent to U.S. life sciences research, with the remaining amounts conducted by establishments classified under the other codes (3391 and 621-623) listed above.

[7] The vast majority (86 percent) of facilities in this industry sector are not subject to Federal income tax. Further, it is unlikely that hospital based research facilities would maintain significant foreign presence. Therefore, the analysis assumes that most of these facilities would not receive benefits from the enhanced tax incentives.

III. Supporting Information for the Revenue Analysis

A. Supporting Data and Methods to Calculate Eligible Taxpayers

The proposed legislation provides two temporary and limited tax incentives to encourage increased life sciences research – an enhanced R&D credit for life sciences research and a deduction for the repatriation of foreign earnings invested in life sciences research. However, the eligible firms may not use both provisions during the same tax year and to the extent they are eligible to use both, are likely to choose the incentive that provides the greatest current benefit.

Estimating Aggregate Life Sciences R&D – The first step involves estimating the number of firms engaged in life sciences research.[8] For purposes of the estimate, this includes the firms with establishments in the NAICS codes listed in Table 2. However, with the exception of NAICS code 3254, all the industry classes include subsectors that would not be eligible for the incentives contained in the proposed legislation. Therefore, it is necessary to eliminate those subsectors to avoid overstating the eligible R&D investment.

To eliminate subsectors from the industries shown in the table, the estimate relies on data found in the Economic Census from the Census Bureau. The economic census provides detailed industry characteristics by six-digit NAICS. Weights derived from the Economic Census provide an indicator of the share of the sector attributable to the relevant life sciences subsector.[9] The result provides an estimate of the total Life Sciences R&D eligible for the tax incentives.

In addition to considering the appropriate industry classes, the analysis distinguishes between domestic and foreign research and development expenses. The NSF provides detailed estimates of domestic research and development expenditures by industry. These domestic expenditures may also include expenditures for research expenses paid domestically to other institutions (e.g. medical schools) to conduct Life Sciences research.[10]

Estimating the Number of Life Sciences Firms – In addition to providing weights to allocate the R&D to the Life Sciences industry, the Economic Census provides detailed estimates of the number of establishments by subsector. It is important to clarify that establishment data represents the activity of a business in a single physical location. This is useful and important information, but not comparable to tax return data. Firms file Federal tax returns for all their business activities. For instance, if a firm has several establishments (located in different states), they would file one tax return for the entire firm.

The Economic Census does not provide both firm and establishment data for all industry sectors and subsectors. However, it does provide this information for the largest sectors indentified for Life Sciences. Therefore, to convert establishments to firms, the analysis relies on the evidence

[8] While there may be some ability of firms to elect the incentives for research only marginally considered life sciences, the estimate focuses on those firms identified in accepted life sciences research fields.

[9] The Economic Census does not provide uniform series for each sector and subsector. Therefore, the weights rely on research and development statistics as well as shipments or sales, based on the available data.

[10] The proposed incentives also include a provision that would increase from 65 percent to 100 percent the deductible amount paid to other research institutions to conduct Life Sciences research.

for the largest sectors and assumes that the relationship of establishments to firms corresponds for the other subsectors.[11]

The result provides an estimate of the number of firms engaged in Life Sciences research by receipts, which corresponds to classes used by the Internal Revenue Service (IRS) Statistics of Income division (SOI).

Table 3 – Investment in Life Sciences Research by NAICS
(Source: National Science Foundation Reports, 2007 and 2008)

NAICS	R&D Investment (Company and other)	
	2007	2008
3254 – Pharmaceuticals and Medicines Manufacturing	47,624	45,126
325411 – Medicinal and Botanical Manufacturing		
325412 – Pharmaceutical Preparation Manufacturing		
325413 – In-Vitro Diagnostic Substance Manufacturing		
325414 – Biological Product (except Diagnostic) Manufacturing		
3345 – Navigational, Measuring, and Electromedical and Control Instruments	12,262	14,526
334510 – Electromedical and Electrotherapeutic Apparatus Manufacturing		
3391 – Medical Equipment and Supplier†	5,116	‡
339112 – Surgical and Medical Instrument Manufacturing		
339113 – Surgical Appliance and Supplies Manufacturing		
339114 – Dental Equipment and Supplies Manufacturing		
5417 – Scientific Research and Development Services	12,017	19,443
541711 – Research and Development in Biotechnology		
541712 – Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)		
5419 – Other Professional Scientific and Technical Services	3,307	‡
541990 – All Other Professional, Scientific, and Technical Services		
621- 623 Health Care Services[12]	1,274	1,502
622110 – General Medical and Surgical Hospitals		
622310 – Specialty (except Psychiatric and Substance Abuse) Hospitals		
Total R&D Investment		

†In addition to these subsectors, two additional classes (339115 and 339116) may engage in research. However, it appears that the vast majority of manufacturers in these subsectors are primarily manufacturing operations.
‡ Not classified separately

[11] The analysis allows the relationship between establishments and firms to vary by the size of the firm (receipts, where available, and employment size of the firm).
[12] The vast majority (86 percent) of facilities in this industry sector are not subject to Federal income tax. Further, it is unlikely that hospital based research facilities would maintain significant foreign presence. Therefore, the analysis assumes that most of these facilities would not receive benefits from the enhanced tax incentives.

Distributing Investment by Firm Size – The third step involves distributing the research and development investment (from the NSF) by firm size, using weights developed from the Economic Census.

Estimating Responsiveness to the Incentives – In addition to the data provided by the NSF, the Internal Revenue Service provides statistics on the use of the R&D credit at the industry sector level. However, the detail level is not comparable to the available information from either the Economic Census or the National Science Foundation. As described above, it is necessary to eliminate the estimated use of the R&D credit for those industry sectors and subsectors that are not engaged in Life Sciences research.

After eliminating the industry sectors and subsectors from the IRS estimates, it is possible to estimate the average use of the R&D credit by firm size. In addition, it is possible to impute the R&D expenses eligible for the credit, based upon the type of credit claimed.

Estimating the relative tax savings by firm size of the credit will determine the responsiveness to the incentives and the decision to choose the credit or the repatriation provision. The relative tax savings is the ratio of the current R&D credit value (eligible investment multiplied by the current credit levels) to the enhanced R&D credit value (eligible investment multiplied by the enhanced credit levels), holding investment constant.

This ratio provides the relative importance of the credit to Life Sciences firms as firm size changes. Empirically, it correlates negatively with firm size. In other words, as the firm size increases (and the corresponding R&D investment increases), the value of the enhanced credit decreases. The credit design creates this relationship by limiting the use of the enhanced credit in any year to $150 million. Therefore, this credit creates an important incentive to smaller and mid-sized firms.

In addition to identifying the incentive effects of the proposal, it is important to estimate the percentage of firms that are not subject to Federal income tax. Those firms would not benefit in the current tax year from the credit or the repatriation proposal. While unused credits may carry over to previous or subsequent tax years, the incentives are somewhat dampened for firms with no tax liability. Generally, a significant percent (over 90 percent across all industries) of firms have Federal income tax liability.

Choosing Between the Provisions – For purposes of this estimate, the analysis assumes that firms maximize the tax benefits for their situation when choosing between the two provisions. However, there are factors that will determine how firms respond to this choice. The primary determining factor is whether the firm has permanently reinvested foreign earnings available for repatriation. Among the smallest firms, the analysis assumes this is much less likely than for the largest firms.[13]

One secondary factor is the total amount of accumulated foreign earnings available for repatriation. Since the provision limits the amounts that firms may repatriate to $150 million per

[13] The analysis assumes that engaging in Life Sciences research with foreign companies correlates positively with firm size.

year, the analysis assumes that this constraint is binding for the largest firms. However, for the mid-sized firms and smaller firms with permanently reinvested foreign earnings, the provision provides stronger incentive effects.[14]

Generally, taxpayers will likely prefer to use the repatriation provision if it is available.

B. Behavioral Responses

This analysis estimates approximately $74 billion dollars per year as the baseline activity for Life Sciences investment in R&D. Approximately 29.8 percent of this amount is eligible for the current-law R&D credit (based on an analysis of historical Internal Revenue Service (IRS) Statistics of Income (SOI) data). Therefore, it is necessary to segregate the Life Sciences taxpayers into two groups – those eligible for the current-law credit (and eligible for the enhanced credit) and those not eligible.[15]

Of those taxpayers that are eligible for the current-law R&D credit, we consider the following possible behavioral responses. The analysis assumes that some taxpayers will:

- Forego the enhanced credit to take advantage of the ability to repatriate foreign earnings;
- Increase investment in response to the enhanced credit (induced investment);
- Accelerate the timing of future investment activities in response to the enhanced credit (speed up investment plans); and
- Maintain their current investment plans, but receive the benefits from the enhanced credit (unchanged behavioral response).

Taxpayers that are unable to take the R&D credit in a given year (because their investment does not provide sufficient increased activity relative to the base to qualify for the credit) have two options depending upon their foreign operations. Taxpayers with foreign operations will most likely take advantage of the incentive to repatriate foreign earnings. Those taxpayers that do not have foreign operations and are not currently eligible for the R&D credit may respond to the incentives of the enhanced credit by increasing their current investment.

Within the class of taxpayers that will repatriate foreign earnings, it is necessary to classify taxpayers according to their assumed baseline activity to estimate the tax consequences. Similar to the response to the enhanced credit, there are three potential options for taxpayer response. In response to the proposal, taxpayers may:

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[14] Assumptions about the behavioral response to the repatriation provision rely on details in Kleinbard, Edward D. and Patrick Driessen, *A Revenue Estimate Case Study: The Repatriation Holiday Revisited,* Tax Notes, September 22, 2008 and Redmiles, Melissa, *The One-Time Received Dividend Deduction,* IRS Statistics of Income Bulletin, Spring 2008.

[15] The base investment calculation means that eligible taxpayers will vary from year to year. In other words, previous periods of high R&D investment may make certain taxpayers ineligible in future years. Conversely, periods of low investment could make eligible those taxpayers that respond to the incentives. This analysis attempts to characterize the nature of the R&D credit base calculation.

- Repatriate foreign earnings that would not otherwise have been repatriated during the budget window in response to this provision (induced repatriation);
- Accelerate the timing of future foreign dividends planned in a future period, but within the budget window (speed up of future repatriation activity); and
- Maintain their current repatriation activity, but benefit from the proposed relief (unchanged behavioral response).

In addition to these behavioral responses, the revenue analysis assumes that certain revenue increases will offset a portion of the revenue losses attributable to the proposal. These revenue increases will occur as a result of changes, relative to the baseline, in:

- Current deductions for R&D expenses by the amount of the enhanced credit,
- Deductions for capitalized expenses (for plant and equipment investment), and
- Other tax provisions that might apply (e.g., foreign tax credit, dividends-received deduction, etc.).

C. Revenue Estimates

Table 4 provides the preliminary revenue analysis of the proposed enhanced R&D credit and repatriation of foreign earnings. This revenue analysis assumes that the current credit is permanent and considers only the additional cost of the enhanced incentive provisions.[16]

Table 4 – Preliminary Revenue Estimates of the Proposed Enhanced R&D Credit and Repatriation of Foreign Dividends, Fiscal Years
(Dollar amounts in Billions)

	Five-Year Estimate	**Ten-Year Estimate**
Enhanced R&D Credit	-1.365	-1.415
Repatriation of Foreign Earnings	-6.590	-7.950
Total Revenue Effect	-7.955	-9.365
Note: Estimates assume interactions between the two proposals. Revenue estimates of individual provisions would change if considered separately.		

These revenue estimates have been prepared in a manner consistent with the conventions used by the Joint Committee on Taxation and Department of Treasury economists, as required by the Congressional Budget Act of 1974 and historical estimating procedures. However, it is important to note that the estimates are highly sensitive to assumptions made about current and future repatriation behavior, to assumptions concerning future IRS activity with respect to the ability of taxpayer to repatriate foreign earnings on a tax-favored basis, and to assumptions concerning the interaction between the two provisions. In addition, small variations in assumptions could materially affect the revenue estimates. In addition, if one of the provisions is modified, there may be interactive effects with the other provision.

[16] The analysis relies on the provisions contained in S. 4108, introduced in the previous Congress.

IV. Total Investment and Potential Job Creation

In addition, Table 5 shows the projected increased jobs resulting from the response to the proposed changes. The potential increase in employment relies on the estimates of new investment. In this case, the estimates identify investment induced by the enhanced tax provisions as well as investment accelerated into the years that the provisions are effective from later years in the budget window (or from years outside the budget window).

A. Investment

Analysis of these two provisions suggests that these tax incentives will make available approximately $28 billion in new investment over the five-year period.[17] These increased resources provide an infusion of capital dedicated to life sciences research in the United States. As with any increase in investment capital, there is the potential to increase jobs as well as stimulate new capital expenditures.

B. RIMS Parameters

For purposes of this analysis, the job creation estimates rely on the RIMS II final-demand employment multiplier provided by the U.S. Department of Commerce's Bureau of Economic Analysis. The RIMS employment multipliers used in this analysis are specific to the life sciences industry. The RIMS multiplier for the life sciences industry is 24.19 per $1 million in new investment.

C. Estimated Jobs Creation Potential

Table 5 provides the potential total jobs created or retained in the Life Sciences industry resulting from these incentives.[18] The jobs estimates include direct and indirect jobs creation or retention.

Table 5 – Estimated Potential Job Creation and Economic Stimulus from Increased Investment, Attributable to the Enhanced R&D Credit and the Repatriation of Foreign Dividends, **through 2011 to 2015**
(Numbers of Jobs in Thousands)

	Total
New Jobs Resulting from Increased R&D Investment	**683,000**
Average per year from Increased R&D Investment	**136,600**

[17] This estimate includes only induced investment and investment that accelerated into the early years of the budget window (encouraged to take place sooner). It does not include investment that receives a windfall from the current provisions.

[18] These estimates show the maximum potential job creation given our estimates of the extent to which the proposal will induce U.S. investments in life sciences research.

APPENDIX A – Defining Life Sciences Research

One of the difficulties in estimating the amount of life sciences research activity that will occur because of the proposed tax incentives is defining the scope of activities that constitute "qualified life sciences research." There is no single definition of life sciences for data collection purposes. In addition, it is clear that there are overlaps between research that would qualify as life sciences research and other scientific research. Research conducted for one purpose, in fact, may have applications in other branches of science. As a result, while there are some kinds of research contemplated as "life sciences research," other types of research may have both a life sciences research component as well as other scientific research component.

This section provides a detailed discussion of the steps involved in identifying research that may qualify as life sciences research for purposes of the proposed tax incentives.

1. Defining Life sciences Research

'Life sciences' is a broad term encompassing the branches of science relating to the study of living organisms. The American Heritage Dictionary defines life sciences as "any of several branches of science, such as biology, medicine, anthropology, or ecology, that deal with living organisms and their organization, life processes, and relationships to each other and their environment."[19] In this broad sense, is the study of living organisms, compared to physical science, such as physics or astronomy, dealing with nonliving organisms. In this broad definition of life science, life sciences refer to studies of human organisms as well as the study of other living organisms, such as animals and plants.

New York State's Empire State Development (ESD) defines the life sciences industry as "companies in the fields of biotechnology, pharmaceuticals, biomedical technologies, life systems technologies, biomedical devices and organizations and institutions that devote the majority of their efforts in the various stages of research, development, technology transfer, and commercialization."[20] The pharmaceutical industry consists of drug manufacturers and biotechnology companies, plus the distribution and wholesale companies that handle the products. The pharmaceutical industry concentrates on medicinal and biological compounds to create prescription, generic, and over-the-counter drugs for human and veterinary use. Biotechnology companies use biological knowledge to manipulate living cells, animals, or plants. According to ESD, many biotechnology companies serve as first-stage research and development arms of pharmaceutical companies.

[19] American Heritage Dictionary of the English Language, Fourth Edition. Houghton Mifflin Company, 2006.
[20] *Life Sciences.* Accessed at www.esd.ny.gov/whynewyork/lifesciences.html.

2. Definition of Life sciences Research in Proposed Legislation

Under the proposed legislation, the proposed tax incentives would apply to a narrower definition of life sciences research.[21] Under the bill, qualified life sciences research would include research

> "(I) with respect to the branch of knowledge or study of biology, biochemistry, biophysics, bioengineering, biotechnology, microbiology, genetics, or physiology (in each case as such knowledge or study relates to human beings), and
> (II) that is considered scientific research and development for purposes of North American Industry Classification System code 5417."[22]

Under the proposal, the term qualified life sciences research does not include sociology or psychology.

Thus, the proposed legislation excludes life sciences research that relates only to research with respect to nonhuman living organisms, such as animals and plants; on the other hand, if the life sciences research might have applications for both humans and animals, it should qualify under the proposed language. In addition, the bill excludes life sciences research in the social sciences, such as sociology and psychology.

3. North American Industry Classification System

The proposed legislation contains a separate condition that the life sciences research involves scientific research and development for purposes of the North American Industry Classification System (NAICS). NAICS is a system of business classification adopted in 1997 for data collection purposes by the United States, Canada, and Mexico.[23] Federal agencies use the NAICS system to classify business establishments to collect, analyze, and publish statistical data related to U.S. businesses and the economy. Classifications under NAICS range from 2-digit codes representing broad industry categories to 4-, 5-, and 6-digit codes to identify specific businesses within an industry subcategory. For purposes of the NAICS (and generally for other government statistical purposes), an establishment is a single physical location where business is conducted or where services or industrial operations are performed. A business entity, such as a corporation, can consist of a single establishment or multiple establishments. Each establishment receives a NAICS code that indicates the primary business activity of the establishment.

Under the NAICS, code 54 represents the broad industry category of professional, scientific, and technical services. This broad category includes such businesses as legal and accounting services, architectural and engineering services, specialized design services, such as interior design, computer systems design, advertising and public relations, etc.

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[21] The definition of life sciences research is contained in S. 4018, introduced in the 111th Congress. The NAICS code 5417 describes the type of research intended to be covered by the proposed legislation, as involving "…original investigation undertaken on a systematic basis to gain new knowledge (research) and/or the application of research findings or other scientific knowledge for the creation of new or significantly improved products or processes (experimental development). The industries within this industry group are defined on the basis of the domain of research; that is, on the scientific expertise of the establishment."

[22] S. 4018, proposed IRC sec. 41(h)(2)(B).

[23] For background information on the NAICS, see www.census.gov/eos/www/naics/.

Code 5417 under NAICS relates to Scientific Research and Development Services. NAICS defines businesses under code 5417 as follows: "This industry group comprises establishments engaged in conducting original investigation undertaken on a systematic basis to gain new knowledge (research) and/or the application of research findings or other scientific knowledge for the creation of new or significantly improved products or processes (experimental development). The industries within this industry group are defined on the basis of the domain of research; that is, on the scientific expertise of the establishment."[24]

Additional classification subcategories within code 5417 include the following:

54171 – Research and Development in the Physical, Engineering, and Life Sciences
541711 – Research and Development in Biotechnology
541712 – Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)
54172 – Research and Development in the Social Sciences and Humanities
541720 – Research and Development in the Social Sciences and Humanities.

In addition, there are additional subcategories that report research and development investment that is potentially eligible under the proposed legislation.

5419 – Other Professional Scientific and Technical Services
541990 – All Other Professional, Scientific and Technical Services
621- 623 Health Care Services[25]
622110 – General Medical and Surgical Hospitals
622310 – Specialty (except Psychiatric and Substance Abuse) Hospitals

We assume that all of the research conducted by establishments classified under NAICS code 541711 will qualify for the benefits provided under the bill. The proposed bill excludes research that does not relate to human beings and research in the fields of sociology and psychology. Thus, we further assume the benefits provided under the bill (1) will not be available for research conducted by establishments classified under NAICS code 54172 and 541720 and (2) will be available to only a portion of the research conducted by establishments classified under NAICS code 541712 (i.e., only to the portion that would qualify as life sciences research).

It is important to note that the proposed legislation does not limit the tax benefits only to establishments classified under NAICS code 5417. Rather, the reference to NAICS code 5417 intends to identify the type of R&D activities that would qualify under the bill. Specifically, under NAICS 5417, this type of R&D includes "…original investigation undertaken on a systematic basis to gain new knowledge (research) and/or the application of research findings or other scientific knowledge for the creation of new or significantly improved products or processes (experimental development). The industries within this industry group are defined on the basis of the domain of research; that is, on the scientific expertise of the establishment."

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[25] The vast majority (86 percent) of facilities in this industry sector are not subject to Federal income tax. Further, it is unlikely that hospital based research facilities would maintain significant foreign presence. Therefore, the analysis assumes that most of these facilities would not receive benefits from the enhanced tax incentives.

As a result, while it is possible to gather data concerning establishments based on the applicable NAICS codes, this data will identify only a portion of businesses that will qualify for the proposed tax incentives.

Other NAICS categories that identify establishments that may be engaged in life sciences research including the following subcategories of manufacturing firms:

3254 – Pharmaceutical and medicine manufacturing
- 325411 – Medicinal and botanical manufacturing
- 325412 – Pharmaceutical preparation manufacturing
- 325413 – In-vitro diagnostic substance manufacturing
- 325414 – Biological product (except diagnostic) manufacturing
- 334510 – Electromedical and electrotherapeutic apparatus manufacturing
- 334517 – Irradiation apparatus manufacturing

33911 – Medical equipment and supplies manufacturing
- 339112 –Surgical and medical instrument manufacturing
- 339113 – Surgical appliance and supplies manufacturing
- 339114 – Dental equipment and supplies manufacturing

Some of the establishments in these manufacturing categories will conduct research that qualifies as life sciences research under the proposal. In fact, as noted in the following section, a substantial percentage of life sciences research conducted in the United States is conducted by firms that are classified under NAICS code 3254 (Pharmaceutical and medicine manufacturing).

Finally, certain establishments in the health care and social assistance industry (NAICS 62) may also engage in life sciences research. Data from the National Science Foundation help to quantify the amount of life sciences research conducted by these establishments. Relative to the other industries mentioned above, research and development in the health care industry is relatively small.

4. National Science Foundation

The National Science Foundation and the U.S. Census Bureau conduct a Business R&D and Innovation Survey (BRDIS).[26] The goal of the survey is to collect data on the R&D activities of companies operating in the United States. The most recent published survey, for 2008, collected information from a sample of approximately 40,000 companies nationwide in manufacturing and nonmanufacturing industries; the total population of companies represented by the sample was approximately 1.93 million. The BRDIS is the primary source of information on business research and development activities in the United States and globally.

The data from the 2008 BRDIS survey provides information by industry and NAICS code on worldwide and U.S. sales, R&D expenses worldwide. The BRDIS classifies the expenses by R&D expenses for activities performed by companies in the United States, outside the United

[26] The NSF first conducted the BRDIS in early 2009. This survey replaces earlier surveys of business R&D activity and collects detailed information about the sources of R&D funds and R&D spending by location. For information on the BRDIS, see www.nsf.gov/statistics/srvyindustry/.

States, and paid to others, as well as the cost of R&D paid for by others (such as federal or state agencies or foreign governments or other companies). Under the BRDIS, R&D expenses represent a company's costs paid from its own funds for R&D undertaken to benefit the company.

The BRDIS found that U.S. companies incurred approximately $329.65 billion of worldwide R&D expense in 2008. Of this amount, approximately $233.92 billion (70.9 percent) was attributable to R&D expense performed by companies in the United States, $57.79 billion (17.5 percent) was attributable to R&D expense performed by companies outside the United States, and $37.94 billion (11.5 percent) was attributable to R&D expense paid to others.

We assume that all of the R&D expenses under NAICS code 3254 (pharmaceuticals/medicines) and code 621-621 (health care services) will be treated as life sciences research for purposes of the proposal.[27] A portion of the R&D expenses under NAICS code 3345 (navigational/measuring/electromedical/control instruments) and 5417 (scientific R&D services) will also be treated as life sciences research.

5. Additional Definitional Issues

Because the proposed language offers significant tax advantages to life sciences research relative to other types of research, taxpayers have an incentive to classify research as life sciences research to Federal tax purposes. While the statutory language provides a clear definition of what qualifies as life sciences research, it is likely that some firms may characterize research as life sciences research that may otherwise not qualify within the strict definition in the bill. For example, some research may have both life sciences and non-life sciences applications. Companies are likely to assert that the primary purpose of the research is for life science. Companies engaged in research might also assert a possible life sciences application to research that technically is not life sciences research.

In theory, one might be able to examine the original purpose of the research to identify whether it is indeed life sciences research. However, the IRS will not have the resources to look closely at each particular research project for which taxpayers claim the tax advantages under the bill.

As a result, there is likely to be a larger percentage of R&D expenses claimed to be qualified life sciences research than might be implied by the examination of expenses under current law. In addition, it is possible that there are establishments operating under certain NAICS codes not identified in the sections above that may also have expenses claimed under the proposed bill.

However, the proposed bill language is sufficiently detailed to ensure that the amount of "slippage" that may occur in research that is claimed to be life sciences research will remain relatively small.

[27] However, the vast majority (86 percent) of facilities in this industry sector are not subject to Federal income tax. Further, it is unlikely that hospital-based research facilities would maintain significant foreign presence. Therefore, the analysis assumes that most of these facilities would not receive benefits from the enhanced tax incentives.

APPENDIX B – 2008 Business Research and Development and Innovation Survey

National Science Foundation and U.S. Census Bureau

TABLE 6 – Worldwide sales, R&D expense, and R&D costs paid for by others, by selected industry: 2008
(Millions of US dollars)

Industry and NAICS code	Sales		R&D expense							Cost of R&D paid for by others					
			World-wide	Performed by company				Paid to others		World-wide	Performed by company				Paid to others
	Worldwide	Domestic		Domestic		Foreign					Domestic		Foreign		
All industries, 21–33, 42–81	10,942,915	7,476,021	329,650	233,918		57,790		37,941		62,524	49,320		4,709		8,495
Manufacturing industries, 31–33	6,879,088	4,407,076	233,326	159,736		45,518		28,072		36,761	30,313		1,417		5,031
Food, 311	463,794	363,049	4,000	3,134		683		184		53	43		0		10
Beverage/tobacco products, 312	195,840	133,910	1,157	848		123		186		104	89		*		15
Textile/apparel/leather and allied products, 313–16	169,571	139,991	1,239	811		400		29		15	12		*		2
Wood products, 321	42,717	38,103	266	222		29		15		5	4		*		1
Chemicals, 325	1,243,526	762,048	79,968	49,137		12,962		17,869		5,819	3,312		546		1,962
Pharmaceuticals/medicines, 3254	529,601	353,057	69,516	42,038		10,371		17,107		5,501	3,088		487		1,926
Other 325	713,926	408,991	10,452	7,099		2,590		762		317	223		58		36
Plastics/rubber products, 326	264,978	178,750	3,335	2,524		609		202		110	100		2		7
Nonmetallic mineral products, 327	105,586	89,822	1,736	1,431	i	101		203		51	47		0		4
Primary metals, 331	194,274	151,538	830	651		100		79		48	40		0		8
Fabricated metal products, 332	185,986	150,332	2,640	2,361		196		83		66	56		1		10
Machinery, 333	455,641	267,910	12,071	9,661		1,917		493		365	242		11		112
Computer/electronic products, 334	923,113	492,327	69,737	51,781		15,461		2,496		8,143	7,256		346		541
Computers/peripheral equipment, 3341	306,605	127,639	12,549	9,074		3,220		256		258	162		42		54
Communications equipment, 3342	132,307	81,799	14,987	11,356		2,903		727		1,457	1,431	i	13		13
Semiconductor/other electronic components, 3344	192,258	101,246	28,812	21,166		6,804		842		723	527		153		43
Navigational/measuring/electromedical/ control instruments, 3345	269,779	168,789	12,150	9,405		2,114		631		5,688	5,121		138		430
Other 334	22,164	12,853	1,238	780		419	i	39	i	17	15		*		2
Electrical equipment/appliance/ components, 335	172,771	117,649	4,630	2,927		1,504		200		229	195		10		25
Transportation equipment, 336	1,298,507	879,829	38,221	23,559		9,797		4,865		21,232	18,532		495		2,205

TABLE 6 – Worldwide sales, R&D expense, and R&D costs paid for by others, by selected industry: 2008
(Millions of US dollars)

Industry and NAICS code	Sales		R&D expense							Cost of R&D paid for by others					
			World-wide	Performed by company				Paid to others		World-wide	Performed by company				Paid to others
	Worldwide	Domestic		Domestic		Foreign					Domestic		Foreign		
Motor vehicles/trailers/parts, 3361–63	776,055	483,379	24,262	12,166		8,325		3,772		1,145	909		134		102
Aerospace products/parts, 3364	457,250	339,509	12,584	10,224		1,311		1,049		19,789	17,348		340		2,101
Other 336	65,201	56,941	1,375	1,170		161		44		298	276	i	20	i	2
Furniture/related products, 337	40,754	33,214	540	475		28		37		*	0		*		0
Manufacturing nec, other 31–33	1,122,030	608,605	12,956	10,214		1,609		1,133		523	385		8		130
Nonmanufacturing industries, 21–23, 42–81	4,063,827	3,068,945	96,324	74,182		12,272		9,869		25,762	19,007		3,292		3,464
Information, 51	924,731	574,993	45,930	36,284		7,659		1,988		928	787		56		86
Software publishers, 5112	317,084	183,430	35,070	27,612		6,353		1,106		683	561		47		75
Telecommunications/Internet service providers/Web search portals/data processing services, 517–18	501,859	316,570	9,308	7,349		1,185	i	773	i	188	168		9		10
Other 51	105,788	74,993	1,552	1,323		121		108		58	58		*		0
Finance/insurance, 52	435,237	419,026	1,310	1,154		72		84		9	8		1	i	*
Real estate/rental/leasing, 53	34,898	16,824	517	362		135		20		1	*		*		1
Professional/scientific/technical services, 54	594,424	467,509	30,639	22,438		3,193		5,007		23,891	17,570		3,213		3,108
Computer systems design/related services, 5415	259,001	204,912	11,262	8,597		2,204		461		3,987	3,559		92		336
Scientific R&D services, 5417	179,114	151,607	14,682	10,078		644		3,958		14,462	9,365		2,986		2,111
Other 54	156,308	110,990	4,695	3,763		345		588		5,443	4,646		135		662
Health care services, 621–23	30,438	27,928	1,217	1,048		6		163		428	285		*		143
Nonmanufacturing nec, other 21–23, 42–81	2,044,098	1,562,666	16,711	12,897		1,208		2,607		505	358		21		126

i = >50% of value imputed; * = < $500,000.

NAICS = North American Industry Classification System; nec = not elsewhere classified.

NOTES: Detail may not add to total because of rounding. Industry classification was based on dominant business code for domestic R&D performance where available. For companies that did not report business codes, classification used for sampling was assigned. Sales statistics are for businesses that reported either worldwide R&D expense or worldwide R&D paid for or funded by others. Sales for businesses with no R&D activity are excluded from totals.

SOURCE: National Science Foundation/Division of Science Resources Statistics, Business R&D and Innovation Survey: 2008.