

**Supporting Statement for OMB
Clearance Request**

Parts A and B

**Evaluation of the Centers for
Chemical Innovation
(CCI) Program**

Executive Summary: Evaluation of the Centers for Chemical Innovation (CCI) Program

Introduction

The National Science Foundation (NSF) established the Centers for Chemical Innovation (CCI) Program (formerly known as Chemical Bonding Centers) in 2004 to support research centers focused on major, long-term fundamental chemical research challenges. The goals that NSF set forth for the CCI Program include that Centers will (a) produce transformative research, leading to innovation, and attract broad scientific and public interest; (b) be agile structures that can respond rapidly to emerging opportunities through enhanced collaborations; and (c) integrate research, innovation, education, broaden participation, and informal science communication. The program supports research centers based at academic institutions or non-profit, non-academic organizations via a two-phase funding model. Phase I centers receive a total budget of \$1.8 million and are funded for three years.¹ The awardees are expected to engage in research and activities leading to broader impacts.² In addition, Phase I CCIs develop the policies, programs, and infrastructure necessary for a much larger Phase II center. Within 15 months of the Phase I award, grantees submit a strategic plan (a key deliverable for this phase), describing all aspects of CCI operations, which is reviewed by NSF and external reviewers. Phase I CCIs are eligible to compete for Phase II awards, with a total funding level of up to \$20 million for five years, and a possibility of one competitive renewal of the same size. Phase II CCIs are expected to build upon the results achieved in Phase I, to ultimately address important challenges in fundamental chemistry, and to contribute to society.

Between 2004 and 2017, the CCI Program funded 28 Phase I grants. Among these, nine successfully proceeded to Phase II, and six of the nine received competitive renewals.

The National Science Foundation contracted with Abt Associates (Abt) and its partner, NET ESolutions Corporation (NETE), to conduct an evaluation of the outcomes of the CCI Program and implementation factors (e.g., Center-level structures and operations, program-level funding model) contributing to research, collaboration, and broader impact activities and outcomes. This is an application to the Office of Management and Budget under the Paperwork Reduction Act for approval of data collection instruments associated with the evaluation. The instruments in this application include: (1) CCI Principal Investigator (PI) and Co-Investigator (Co-I) Survey; (2) CCI Phase II Principal Investigator (PI) and Co-Investigator (Co-I) Interview; (3) CCI Graduate Student and Postdoctoral Researcher Survey; and (4) CCI Center Industry Partners Interview. **The CCI Program has been in existence for nearly 15 years but has**

¹ <https://www.nsf.gov/pubs/2018/nsf18555/nsf18555.pdf>

² The American Innovation and Competitiveness Act (2017) defines broader impacts as 1) increasing the economic competitiveness of the U.S., 2) advancing the health and welfare of the American public, 3) supporting the national defense of the U.S., 4) enhancing partnerships between academia and industry in the U.S., 5) developing an American STEM workforce that is globally competitive through improved kindergarten through grade 12 STEM education and teacher development, and improved undergraduate STEM education and instructions, 6) improving public scientific literacy and engagement with science and technology in the U.S., and 7) expanding participation of women and individuals from underrepresented groups in STEM. See legislation: S. 3084 (114th) American Innovation and Competitiveness Act (2017). Section 526(a) of the America COMPETES Reauthorization Act of 2010 (42 U.S.C. 1862p–14(a)) 42 U.S.C. 1862p–14(a) 42 U.S.C. 1862p–14(a) 42 U.S.C. 1862p–14(a) 42 U.S.C. 1862p–14(a)

never been systematically evaluated. As this is the first assessment of the CCI program, new data collection is necessary to provide critical evidence to assess the CCI Program's progress in achieving its goals, to communicate the outcomes of the program, and to inform improvements in CCI Program and Center-level design and operation. Across the NSF, the evaluation will also inform planning decisions about the center-based research concept and phased funding mechanisms. Additionally, the evaluation findings will be used to communicate the outcomes of the CCI program to the wider chemistry community.

Part A: Justification

A.1. Explain the circumstances that make the collection of information necessary

This Information Collection Request (ICR) seeks to establish a new information data collection, consisting of two surveys and two interview protocols to support the Evaluation of the Centers for Chemical Innovation (CCI) Program.

The goals of the CCI Program can be divided into two categories that correspond to the NSF merit review criteria of Intellectual Merit and Broader Impacts: 1) advance knowledge in chemistry (Intellectual Merit) and 2) benefit society and contribute to desired societal outcomes (Broader Impacts). The CCI Program directly contributes to NSF's strategic goals as outlined in the report "Investing in Science, Engineering, and Education for the Nation's Future – NSF Strategic Plan for 2014-2018." The CCI Program principally aligns with Strategic Goal 1, Objective 1: to transform the frontiers of science and engineering by investing in fundamental research to ensure significant advances across science, engineering, and education. The program also aligns with Strategic Goal 1, Objective 2: to integrate education and research to support development of a diverse STEM workforce and cutting-edge capabilities. The broader impacts of innovation, higher education and professional development, broadening participation, and informal science communication also align with Strategic Goal 2, Objective 1: to stimulate innovation and address societal needs through research and education, specifically by strengthening the links between fundamental research and societal needs through investments and partnerships.

The National Science Foundation contracted with Abt Associates (Abt) and its partner, NET ESolutions Corporation (NETE), to conduct an evaluation of the outcomes of the CCI Program and implementation factors (e.g., Center-level structures and operations, program-level funding model) contributing to research, collaboration, and broader impact activities and outcomes. The evaluation will cover CCI Center awards starting in fiscal year 2004, with an emphasis on Phase II Centers. The CCI Evaluation aims to address five key research questions:

1. What are the important contributions of the CCI Program to our current understanding of fundamental chemistry?
2. How successful have the CCI centers been at transferring their basic research results into societal or economic benefits (innovation)?
3. What are the contributions of the CCI Program in the areas of workforce development (education and professional development), broadening participation, and informal science communication?
4. How effective are the center structures and operations in achieving the program's goals?
5. How effective is the two-phase funding model for the CCI Program?

The evaluation design combines data collection from secondary sources, including publications and administrative data, with online surveys and phone interviews, which are the subject of this ICR. Combined, the data from primary and secondary sources will give a more complete picture of the CCI Program- and project-level processes, outcomes, and lessons learned than could be possible with either source alone.

Overview of Study Design and Data Collection Strategy

To address the key research questions, Abt proposed a mixed-methods evaluation, which will rely on both extant administrative and public data as well as new data, as follows.

Administrative and public data includes the following:

- a. Coding of grantee-produced administrative data (including grant proposals and annual Research Performance Progress Reports (RPPRs)), to capture intended and realized management structure(s), accomplishments and outputs, activities, participants and collaborators, and changes in plan (if any) occurred, primarily from Principal Investigators' perspectives.
- b. Coding of NSF-produced administrative data (including oversight/funding memos, site visit reports, internal interim reviews, and committee of visitor reports), to capture some external-to-the-Center perspective on grant accomplishments, challenges, and recommendations.
- c. Analysis of public publication records (bibliometrics) for CCI PIs and Co-Investigators as well as for a comparison group of PIs on individual-investigator grants funded by NSF's Chemistry Division, to measure research productivity and research networks.

This ICR seeks approval for data collection for the following: (1) CCI Principal Investigator (PI) and Co-Investigator (Co-I) Survey (PIs); (2) CCI Phase II Principal Investigator (PI) and Co-Investigator (Co-I) Interview; (3) CCI Graduate Student and Postdoctoral Researcher Survey; and (4) CCI Center Industry Partners Interview. Details on each component of the data collection appear below. The surveys and interview protocols were previously tested under a Fast Track clearance, OMB Control #3145-0215.

1. CCI Principal Investigator (PI) and Co-Investigator (Co-I) Survey. Surveys of CCI Phase I and Phase II PIs and Co-Is will be used to understand the role of the center in facilitating achievement research, collaboration, and broader impacts, to assess grantee satisfaction with the center structure and a two-phase funding model, to document outcomes, and to describe challenges encountered. The survey request and reminder emails, consent language, and survey instrument appear in Appendix A.
2. CCI Phase II Principal Investigator (PI) and Co-Investigator (Co-I) Interview. Interviews of Phase II CCI PIs and Co-Investigators will be used to further explore the data emerging from the survey. Up to 27 CCI Phase II Center PIs and Co-Investigators will receive requests to complete both a survey and an interview. The interview request email, consent language, and omnibus interview protocol appear in Appendix B, with notation of items to be delivered to PI and to Co-Investigators.
3. CCI Graduate Student and Postdoctoral Researcher Survey. Surveys of graduate students and postdoctoral researchers who contributed to and/or received financial support under Phase I and Phase II CCI center activities will be used to understand the role of CCI in education, training, and career development. The survey request and reminder emails, consent language, and survey instrument appear in Appendix C.
4. CCI Center Industry Partners Interview. Interviews of industry partners that contributed to Center activities will be used to capture knowledge exchange with CCIs and other benefits of partnership as well as perspective on CCI contributions to chemistry and society. This data collection will inform NSF about whether CCI is enhancing partnerships between academia and industry and therefore meeting broader impact goals. The interview request email, consent language, and interview protocol appear in Appendix D.

New data collection from primary sources is necessary for the following reasons:

- Because the RPPRs are standardized across all NSF programs, PIs have some degree of latitude in reporting on their activities, accomplishments, outputs, and broader impacts. Thus, what is reported and the nature and level of detail is not systematic across all Centers or reporting periods and do not provide a complete dataset.
- Information included in administrative data covers only the award period and, therefore, does not fully address the contribution of the program to longer-term outcomes accumulating over time, such as societal or economic benefits, workforce development, public education, or the perceived effectiveness of the two-phase funding model in advancing science, collaboration, and broader impacts.
- Surveys and interviews with CCI PIs and Co-Investigators would allow an examination of the participant experience, the role of the Centers in advancing science, challenges encountered, lessons learned, effective center structures and management, and other topics.
- Surveys of graduate students and postdoctoral researchers are the only source of data to examine in detail the experience of these groups and the role of CCI in their career development. This is an important goal of the program, but limited information on this topic is available from administrative data.
- The role of CCIs in advancing industry connections and economic development will be explored in interviews with industry partners. This is an important goal of the program, but limited data on this topic are available from administrative data, and only from the perspective of the Center PI.

Topics covered in the PI/Co-Investigator survey and interview that are not fully available in the administrative data include:

- Characteristics of research projects
- Collaborations
- Benefits of participation to research progress, workforce development, broadening participation, and public engagement
- Benefits to industry and research community
- Changes in publication behavior and personal visibility
- Satisfaction with and role of center structure, management and organizational strategies
- Sustainability of activities and accomplishments
- Challenges encountered because of center structure
- Role of and satisfaction with Phase I
- Benefits and limitation of a two-phase model

Topics covered in the graduate student/postdoc survey that are not available in administrative data include:

- Research and professional development opportunities made available through CCIs
- Mentorship received
- Work in a lab/research group of CCI partner
- Center activities in which individual participated
- Satisfaction with CCI participation

- Benefits of CCI participation
- Reasons for leaving CCI project
- Career status and plans and influence of CCI on career goals
- Demographic characteristics

Topics covered in the industry partners interviews that are not available in administrative data include:

- Benefits to industry
- Center activities in which individual participated
- Benefits of CCI participation
- Collaborations
- Sustainability of activities and accomplishments
- Challenges encountered because of center structure

Exhibit 1 shows how the information being collected from surveys and interviews is linked to the primary research questions and their intended use. The interview and survey protocols can be found in Appendices A-D. The program logic model, which informs the evaluation questions, administrative data coding schema, and new data collection instruments and protocols appears in Appendix E.

Exhibit 1: Research Questions Linked to New Data Collection Strategies

Research question	PI/Co-Investigator survey	Graduate student/postdoc survey	CCI PI interviews	Industry partner interviews	Intended Use
1. What are the important contributions of the CCI Program to our current understanding of fundamental chemistry?	Q4 – interdisciplinary and transformative characteristics of funded projects Q5-7 – role of pre-existing collaboration and contribution of participation in CCI to collaboration Q8-10 – program role in advancing research, improving personal visibility/productivity, and benefiting the research community through capacity/infrastructure building		Q4 – change in scientific program and productivity due to CCI participation Q5 – types of research best suited to the center model Q6 – most important scientific accomplishments of CCIs Q8 – how did CCI demonstrate leadership in the field Q12 – reputation of CCI in and benefits to the chemistry community		NSF CCI Program Officers, Division of Chemistry Leadership and Staff: Understand and communicate progress in achieving goals and outcomes of the CCI Program Broader Chemistry Community: Communicate outcomes of the program
2. How successful have the CCI centers been at transferring their basic research results into societal or economic benefits (innovation)?	Q14 – program benefits to industry		Q6 – most important economic benefits resulting from CCI	Q1-3 – nature and extent of partnership Q4 – benefits of partnership to industry	NSF CCI Program Officers, Division of Chemistry Leadership and Staff: Understand and communicate progress in achieving goals and outcomes of the CCI Program Broader Chemistry Community: Communicate outcomes of the program
3. What are the contributions of the CCI Program in the areas of workforce development, broadening participation, broadening participation,	Q11-13 – program role in workforce development, broadening participation, and informal science communication	Q7 – mentorship during CCI participation Q8 and 12 – role of CCI participation in career choices	Q6 – most important workforce development and public education benefits resulting from CCI		NSF CCI Program Officers, Division of Chemistry Leadership and Staff: Understand and communicate progress in

Research question	PI/Co-Investigator survey	Graduate student/postdoc survey	CCI PI interviews	Industry partner interviews	Intended Use
and informal science communication?		Q9-11 – current career status Q13-16 – CCI experiences and satisfaction with these experiences Q17-18 – role of CCI participation in quality of training and skill development Q19-20 – demographic characteristics			achieving goals and outcomes of the CCI Program Broader Chemistry Community: Communicate outcomes of the program
4. How effective are the center structures and operations in achieving the program's goals?	Q15-16 – role of center structure in success Q17-19 – satisfaction with the center and challenges experienced		Q1-3, Q9 – reason to participate in CCI and history of partnership Q10 – evolution of the CCIs Q11 – sustainability of CCIs Q13 – most and least effective organizational components of CCIs Q14 – participation challenges Q15-16 – challenges and advantages of center model	Q5 – sustainability of partnership Q6 – participation challenges	NSF Directorates: Inform planning decisions about the center-based research concept CCI Program Officers: Inform CCI Program design and operations CCI Center PIs and Co-investigators: Inform Center- and Project- level design and operations
5. How effective is the two-phase funding model for the CCI Program?	Q20-25 – role of Phase I and benefits/limitations of two-phase model		Q17-18 – strengths and weaknesses of two-phase model		NSF Directorates: Inform planning decisions about the center-based phased funding mechanisms CCI Program Officers: Inform CCI Program design and operations

Note: Questions 1-3 in the PI/Co-Investigator survey and 1-4 in the graduate student/postdoctoral researcher survey are for verification purposes and to enable subgroup comparisons of the data.

A.2. Indicate how, by whom, and for what purpose the information is to be used

The CCI Program has been in existence for nearly 15 years but has never been systematically evaluated. The CCI Program is a significant investment for NSF and it is critical that the findings of the evaluation are as widely used as possible. The following knowledge will be generated:

- For CCI Program Officers, Division of Chemistry leadership, and other Directorates at NSF: the contribution of the program to advancing fundamental chemistry, improving connections to industry, and providing professional development and career opportunities to junior scholars; experiences of participants; effective and ineffective center structure and management processes; and the benefits/limitations of this unusual two-phase funding model.
- For CCI Center PIs and Co-Investigators: more and less effective center structure and management processes.
- For the broader chemistry community: the contribution of the program to advancing fundamental chemistry, improving connections to industry, and providing professional development and career opportunities to junior scholars.
- For the evaluation community at NSF and beyond: the strengths and weaknesses of various evaluation strategies for examining the processes and outcomes of large research centers.

As described in Exhibit 1 above, the new data collection from primary sources enables NSF CCI program officers and Division of Chemistry leadership and staff to more comprehensively examine the processes, outputs, and outcomes of Centers toward determining the CCI Program's progress in achieving its goals, to communicate the outcomes of the program, and to inform improvements in CCI Program and Center-level design and operations. The new data collection from primary sources will also inform planning decisions about the center-based research concept and phased funding mechanisms across NSF directorates and divisions. Additionally, the findings of the new data collection from primary sources will be used to communicate the outcomes of the CCI program to the wider chemistry community.

A.3. Describe whether, and to what extent, the collection of information involves the use of automated, electronic, mechanical, or other technological collection techniques or other forms of information technology

Abt will conduct the survey using an online, internet-accessed survey software. This will allow respondents to take the survey at any time within the window of the data collection period and to submit their responses electronically. There are no paper forms involved in the survey. Burden-reducing features include:

- **Secure personalized access.** Each grantee will receive a customized link to the survey. The survey software allows respondents to save responses and return to the survey later to finish at their convenience.
- **Automated skip patterns.** Skip logic embedded in the survey minimizes respondent burden by omitting non-applicable questions.
- **Automated validation checks.** The software will check for allowable ranges for numeric questions, minimizing out of range or unallowable values. This reduces entry errors that may require follow-up contacts to gather correct information.

- **Close-ended questions.** These types of questions reduce burden on respondents and facilitate data analysis. A small number of “other” options are included to make sure that respondents have an opportunity to enter information which does not fit pre-existing options.
- **Response not required.** Most questions will not require a response in order for the respondent to proceed, save, or submit. A limited number of items designed with survey logic to automate skip patterns will require responses.

NSF will send an advance e-mail to PIs to inform them of the evaluation and that they, Co-Investigators, graduate students, and postdoctoral researchers will be receiving surveys via email from the evaluation team. All communications with respondents, including survey launch and follow-up and interview scheduling, will be conducted by email to keep respondent burden to a minimum. Survey responses will be tracked in real time to help guide the follow-up strategy. Data collected in the survey will be analyzed using a semi-automated process, whereby response frequencies will be generated using SAS software.

Interviews will be digitally recorded with respondent permission and transcribed. Abt will use the transcripts for accurate recall and efficient content analysis of the interviews. Interview respondents will not be asked to complete any forms.

The results of the information collection will be made available to the public over the internet (subject to technical peer review, see A.16 for details). Privacy, confidentiality and data security related to this information collection are detailed in Section A.10.

A.4. Describe efforts to identify duplication. Show specifically why any similar information already available cannot be used or modified for use for the purposes described in item 2 above

NSF and Abt made every effort to avoid duplication and to determine how the research questions could be addressed while minimizing new data collection. Topics of interest not available from administrative data are described in section A1. Because this is the first systematic external evaluation of the CCI Program and no other studies have examined the effectiveness of the program, there are no existing evaluation datasets or other sources which could be reused.

During the design phase of the project, the Abt evaluation team invested significant effort to review samples of all available administrative data, including grant proposals, annual Research Performance Progress Reports, program solicitations, merit review summary statements, committee of visitors reports, and other documents generated by the program to determine what type of information is consistently available from these sources. In parallel, Abt reviewed published literature and evaluation studies related to center-based research evaluation to identify appropriate performance metrics. As a result of these efforts, a framework was developed which listed all indicators relevant to the study and the sources where these data could be obtained. This mapping process revealed clear gaps in administrative data which could be filled using new data collection described in this request.

A.5. If the collection of information impacts small businesses or other small entities, describe any methods used to minimize burden

Some of the CCI Program PIs and Co-Investigators included in the survey and/or interview sample may have established small businesses in addition to continuing their academic research. From administrative data, we estimate this to be a small proportion of the study population. Given that a goal of the CCI Program is to produce transformative research leading to innovation, to fully evaluate program

performance it may be necessary to survey and/or interview individuals that have established small businesses as an extension of their CCI-funded activities.

A.6. Describe the consequence to Federal program or policy activities if the collection is not conducted or is conducted less frequently, as well as any technical or legal obstacles to reducing the burden

This is a one-time data collection for the purposes of program evaluation. The data collection efforts proposed in this ICR will affect most respondents only once. The nine Phase II Center PIs and a sample of 18 Phase II Co-Investigators will receive both the survey and an invitation to take part in an interview. Each of the two types of data collection will occur only once.

This is the first time that data will be collected for the purposes of assessing the effectiveness of the CCI Program. Without the information collection (or a less frequent collection since this is a one-time data collection), NSF will not be able to assess whether the CCI Program is achieving its goals related to 1) advancing knowledge in chemistry (Intellectual Merit) and 2) benefiting society and contributing to desired societal outcomes (Broader Impacts). Without the surveys and interviews, NSF will not have a clear understanding of program outcomes, potential areas for improvement in CCI program design and implementation, and center-based research concept and phased funding mechanisms.

There are no technical or legal obstacles to reducing the burden. The designated Contracting Officer is authorized to approve changes in any of the requirements under this contract.

A.7. Explain any special circumstances that would cause an information collection to be conducted in a manner: Requiring respondents to report information to the agency more often than quarterly; Requiring respondents to prepare a written response to a collection of information in fewer than 30 days after receipt of it; Requiring respondents to submit more than an original and two copies of any document; Requiring respondents to retain records, other than health, medical, government contract, grant-in-aid, or tax records, for more than 3 years; In connection with a statistical survey, that is not designed to produce valid and reliable results that can be generalized to the universe of study; Requiring the use of a statistical data classification that has not been reviewed and approved by OMB; That includes a pledge of confidentiality that is not supported by authority established in statute or regulation, that is not supported by disclosure and data security policies that are consistent with the pledge, or that unnecessarily impedes sharing of data with other agencies for compatible confidential use; or Requiring respondents to submit proprietary trade secrets or other confidential information unless the agency can demonstrate that it has instituted procedures to protect the information's confidentiality to the extent permitted by law.

There are no special circumstances for the proposed data collection efforts. None of the above special circumstances apply. While some questions ask respondents about patents and licenses in a general sense, they do not request details. Furthermore, none of these responses are required.

A.8. If applicable, provide a copy and identify the date and page number of publication in the Federal Register of the agency's notice, required by 5 CFR 1320.8(d), soliciting comments on the information collection prior to submission to OMB

Federal Register Requests

On May 18, 2018, a 60-day Federal Register Notice was published at 83 FR 23301. No pertinent comments were received.

Consultations Outside the Agency

To provide input on all aspects of the CCI evaluation, a distinguished external Technical Working Group (TWG) was recruited in collaboration with NSF. It is composed of five chemistry experts and three experts in evaluation, bibliometrics, and science, technology, and innovation (STI) policy. The members of the TWG have expertise aligning to all of the primary chemistry research disciplines of the Phase II CCIs; are involved in industry; participate in other NSF-funded center leadership and advisory activities; and hold numerous honors and awards in innovation, research, and teaching from NSF, scientific associations, and other organizations. They also have extensive experience in STI evaluation and bibliometric methods. The following individuals are serving as members of the TWG:

Chemistry Experts

1. Prof. Victor Batista, Professor of Chemistry, Yale University
2. Prof. Emilio Bunel, Director of Division of Chemical Sciences and Engineering, Argonne National Laboratory
3. Dr. Cynthia Friend, Professor of Chemistry, Department of Chemistry and Chemical Biology; Professor of Materials Science, School of Engineering and Applied Sciences, Harvard University
4. Prof. Melissa Hines, Professor of Chemistry, Cornell Center for Materials Research
5. Prof. Tara Meyer, Professor of Chemistry, Assistant Dean of Graduate Studies, University of Pittsburgh

Experts in Evaluation, Bibliometrics, and Science, Technology, and Innovation Policy

1. Dr. Kevin Boyack, President, SciTech Strategies (bibliometrics)
2. Dr. Daryl Chubin, Independent consultant, co-chair of *Understanding Interventions*, and author of an evaluation of the NSF Science and Technology Centers, including multiple surveys from which the CCI evaluation draws³
3. Dr. Gretchen Jordan, Independent consultant (federal science innovation and program evaluation)

Two TWG meetings have been planned. The first took place on April 6, 2018, to review the evaluation design and instruments, and the second will take place toward the end of the project to discuss preliminary findings. For the convenience of the TWG members, both meetings will use a video-conference system. Two weeks prior to the April 6, 2018 meeting, Abt emailed the TWG members the evaluation plan and a set of questions to provide feedback. An evaluation framework and literature review were also included as background material. The feedback provided to Abt and other aspects of the study

³ Chubin, D. E., Derrick, E., Feller, I., & Phartiyal, P. (2010). AAAS review of the NSF science and technology centers integrative partnerships (STC) program, 2000-2009. *Washington, DC: American Association for the Advancement of Science.*

were discussed during the meeting. Abt will also consult with the TWG members as necessary during the course of the study.

A.9. Explain any decision to provide any payment or gift to respondents, other than remuneration of contractors or grantees

No payments to respondents are proposed for this information collection.

A.10. Describe any assurance of confidentiality provided to respondents and the basis for the assurance in statute, regulation, or agency policy

Abt will take several steps to safeguard respondent information:

1. All staff on the project were instructed in the privacy requirements of the study and signed statements affirming their obligation to maintain privacy.
2. Access to any data with identifying information will be limited to contractor staff directly working on the survey and will require individual usernames and passwords.
3. Respondents will be fully informed about the purpose of the study, given assurances of confidentiality, and told that the data collection is voluntary.
4. Names and other identifying information for survey respondents will be replaced with numerical identifiers after the data are collected and prior to analysis. A key linking the names to the identifiers will be kept in a separate location with access for Abt staff on a need-only basis.
5. All data will be reported in aggregated form only.
6. When evaluation data is transferred to NSF, all survey and interview data will be de-identified.
7. Any quotations from responses used in public reporting will be edited to ensure that the identity of the respondent cannot be ascertained.

Similar procedures will be used for interview data. All data collection instruments and procedures have been reviewed by Abt's Institutional Review Board.

Data collected as a result of this study will be used in accordance with criteria established by NSF for monitoring research and education grants, and in response to Public Law 99-383 and 42 USC 1885c.

A.11. Provide additional justification for any questions of a sensitive nature, such as sexual behavior and attitudes, religious beliefs, and other matters that are commonly considered private

The survey of graduate students and postdoctoral researchers collects gender and race/ethnicity information on a voluntary basis (an option "choose not to provide information" is included). This information is being collected to determine how effective the CCI Program has been in broadening participation for individuals underrepresented in science. These data are not available from other sources.

A.12. Provide estimates of the hour burden of the collection of information

Exhibit 2 presents the estimated response burden to participants. Survey estimates were informed by pilot testing performed under Fast Track Clearance 3145-0215. Abt will administer 211 PI/Co-Investigator and 859 graduate student/postdoc surveys. The PIs and Co-Investigator survey is estimated to take approximately 20 minutes and the student survey approximately 15 minutes to complete. The resulting total time burden for all surveys is expected to be 285 hours. Abt will conduct approximately 42 interviews. The estimates for PIs/Co-Investigator interviews is 60 minutes each and for industry partners

20 minutes each. The total time burden for all interviews is approximately 32 hours. The total burden for new data collection for this ICR should not exceed 317 hours.

Exhibit 2: Estimated Response Burden in Hours

Respondent Type	Number of Respondents	Time Per Response (Hours)	Number of Responses	Total Time Burden (Hours)
SURVEYS (Total)			1,070	285
PIs/ Co-Investigators	211	0.33	211	70
Graduate Students/ Postdocs	859	0.25	859	215
INTERVIEWS (Total)			42	32
Phase II CCI PIs/ Co-Investigators	27	1.00	27	27
Industry Partners	15	0.33	15	5
SURVEYS AND INTERVIEWS (Total)			1,112	317

Exhibit 3 presents the estimated total cost burden to respondents participating in interviews and surveys, which totals \$9,517. The estimated total cost burden for 1,070 PIs/Co-Investigators and graduate students/postdocs to complete the surveys is \$7,882. The estimated total cost burden of participating in 42 interviews is \$1,635.

Exhibit 3: Estimated Cost to Respondents

Respondent Type	Annual Salary Estimate (\$)	Average Hourly Wage (\$)	Time Per Response (Hours)	Cost per Response (\$)	Number of Respondents in Category	Total Cost for Responses (\$)
SURVEYS (Total)					1,070	7,882
PIs/ Co-Investigators*	104,000	50	0.33	17	211	3,587
Graduate Students/ Postdocs**	36,632	18	0.25	5	859	4,295
INTERVIEWS (Total)					42	1,635
PIs/ Co-Investigators*	104,000	50	1.00	50	27	1,350
Industry Partners***	120,000	58	0.33	19	15	285
SURVEYS AND INTERVIEWS (Total)					1,112	9,517

*Salary estimates for PIs/Co-Investigators are based on the average median salary for all full-time employed chemists (excluding biochemists) in 2015 according to the National Science Foundation.⁴

**Postdoctoral and graduate student salary estimates were averaged from two different sources. NSF reported that the median salary for postdocs in the physical sciences was \$48,000 in 2015 (the most recent data point available through NSF).⁵ According to Glassdoor, the national average salary for a chemistry graduate student is \$25,264 per year in 2018 in the U.S. Graduate student salary estimates through Glassdoor were based on 14,894 salaries submitted anonymously by chemistry Graduate student employees.⁶

***The salary estimate for industry partners is based on private, for-profit median salary estimates for U.S. residents employed as chemists (excluding biochemists) in 2015.⁷

⁴ National Science Foundation. Table 69. Median annual salaries of U.S. residing full-time employed doctoral scientists and engineers, by occupation and sector of employment: 2015. Retrieved from https://ncesdata.nsf.gov/doctoratework/2015/html/SDR2015_DST_69.html

⁵ National Science Foundation. Median salaries for recent U.S. Science, Engineering, and Health (SEH) doctorate recipients in postdoc and non-postdoc positions up to 5 years after receiving degree: 2015. Retrieved from <https://www.nsf.gov/statistics/2018/nsb20181/assets/901/tables/tt03-18.pdf>

⁶ Glassdoor. Updated May 3, 2018. Chemistry Graduate Student Salaries. Retrieved from https://www.glassdoor.com/Salaries/chemistry-graduate-student-salary-SRCH_KO0,26.htm

⁷ National Center for Education Statistics. Table 69. Median annual salaries of U.S. residing full-time employed doctoral scientists and engineers, by occupation and sector of employment: 2015. Retrieved from https://ncesdata.nsf.gov/doctoratework/2015/html/SDR2015_DST_69.html

A.13. Provide an estimate for the total annual cost burden to respondents or record-keepers resulting from the collection of information

There are no total capital or start-up costs to respondents or record-keepers resulting from the collection of information. There are also no total operation, maintenance, or purchase of services costs to respondents or record-keepers resulting from the collection of information other than the time spent responding to the survey and interviews attached as appendices to this request.

A.14. Provide estimates of annualized costs to the Federal Government

The estimated cost to the Federal Government for the entire CCI Program evaluation study is \$927,548. Exhibit 4 provides the hour and cost breakdown by Phase of the evaluation and by activity.

The estimated cost of only the survey and interview data collection activities included in this request is \$343,888, which includes instrument development and pretesting, drafting the data collection plan and information collection request, survey data collection and analysis, and interview data collection and analysis. Indirect as well as direct costs are included in the estimate. There are no significant costs beyond the normal labor costs for staff.

The total hour and cost breakdown associated with other Phase 1 and Phase 2 activities that do not involve new data collection (e.g., involving use administrative and public data) are reflected in the table without additional detail.

Exhibit 4: Overall Cost to the Federal Government

Category	Hours	Costs
Phase 0 Project Management and Communications Total	549	\$110,559
Phase 1 Evaluation Design and Planning Total	1322	\$245,071
- Instrument Development and Pretesting	510	\$82,229
- Preparation of Data Collection Plan and Information Collection Request	444	\$82,757
- Other Evaluation Design and Planning Activities	368	\$80,085
Phase 2 Data Collection and Analysis Total	2929	\$437,541
- Survey Data Collection and Analysis	856	\$113,221
- Interview Data Collection and Analysis	497	\$65,681
- Other Data Collection and Analysis Activities	1,576	\$267, 639
Phase 3 Evaluation Reporting Total	681	\$134,377
PHASE 0-3 Total	5481	\$927,548

A.15. Changes in Burden

This is a new data collection.

A.16. For collections of information whose results will be published, outline plans for tabulation and publication. Address any complex analytical techniques that will be used. Provide the time schedule for the entire project, including beginning and ending dates of the collection of information, completion of report, publication dates, and other actions

Abt will conduct bibliometric analyses and abstract and code data from grantee-produced and NSF-produced administrative data during the period of May 2018-December 2018. Surveys will be administered in January 2019, conditional on OMB approval. Interviews will be conducted in February 2019, after we review survey data, conditional on OMB approval.

Analysis of Survey Data. For all survey items, descriptive statistics will be used to summarize responses. For measures using continuous scales, means and standard deviations will be calculated to describe

central tendency and variation. Frequency distributions and percentages will be used to summarize measures on categorical scales. In addition, cross-tabulations will be used to illustrate differences in measures between groups or the distribution of measures across subgroups of interest. Tests for significant differences (e.g., t-test, chi-square, and ANOVA) may be used to compare responses between subgroups of respondents. Where appropriate, factor analysis will be used to explore and assess unobserved latent variables based on the correlation among observed variables.

Analysis of Interview Data. Trained researchers will code major themes that emerge from interview data. An iterative coding process will be used so that codes are regularly refined and new codes are generated in response to emergent themes within the responses. The data that emerge will be summarized as a narrative. Within each respondent group, Abt will quantify how many individuals expressed a given view, to give a sense of the level of agreement. These data will also be used to provide examples and quotes to supplement the survey data. The qualitative data will provide richer and more detailed information on more specific topics than could be gleaned from close-ended questions.

Exhibit 5 shows the schedule of activities associated with the entire evaluation study, including the surveys and interviews included in this request under Phase 2 Data Collection and Analysis Activities.

Exhibit 5: Deliverables and Due Dates

Deliverables	Timeline
Phase 1 Evaluation Design and Planning	October 2017 to May 2018
Phase 2 Data Collection and Analysis	May 2018 to April 2019
- Administrative and public (bibliometric) data collection and analysis	May 2018 to December 2018
- Survey collection start date	January 2019
- Survey collection end date	February 2019
- Survey analysis period	February 2019
- Interview collection start date	February 2019
- Interview collection end date	March 2019
- Interview Analysis period	March 2019 to April 2019
Phase 3 Evaluation Reporting	April 2019 to July 2019
- Draft Evaluation Report	Due 18 months after contract award: April 2019
- Final Evaluation Report and Database	Due 21 months after contract award: July 2019

NSF provided guidance that the contractor may not publish or in any other way reveal data, information or the results of the study, or other analyses or NSF internal discussions of data collected or accessed for the study, without prior written approval from NSF. The contractor shall transfer to NSF all work products, including web surveys, materials necessary to perform data collection, bounce back messages from survey email addresses, and any other items associated with and necessary to administer, analyze, and finalize the surveys, in conformance to OMB requirements associated with confidentiality. All data collected are the sole property of NSF and will not be disclosed or distributed to any non-NSF sources without prior written approval from NSF. All reports will be submitted as MS Office compatible hardcopies and e-files. An electronic copy of the final deliverable(s) will be delivered to the NSF COR.

After the products are delivered, NSF determines whether the quality of the products deserves publication verbatim by NSF; i.e., NSF typically is the exclusive publisher of the information collected by the collections. Often it is only after seeing the quality of the information the collection delivers that NSF decides the format and manner (in its Online Document System or simply a page on the NSF website) in which to publish.

NSF intends to make information about evaluations and findings from evaluations broadly available and accessible, typically on the internet. NSF intends to release results of evaluations that are not specifically focused on internal management, legal, or enforcement procedures or that are not otherwise prohibited from disclosure. Evaluation reports present all results, including favorable, unfavorable, and null findings. NSF intends to release evaluation results in a timely manner—usually within six months of a report's completion—and will archive evaluation data for secondary use by interested researchers (e.g., public use files with appropriate data security protections). After internal technical peer review, the Section Head of NSF's Evaluation & Assessment Capability has authority to seek NSF clearance to approve, release, and disseminate evaluation reports.

A.17. If you are seeking approval to not display the expiration date for OMB approval of the information collection, explain the reasons that display would be inappropriate

We will display OMB approval information on the data collection, including expiration date, at the beginning of all data collection instruments. The following statement will be attached to the data collection instrument:

“The OMB control number for this project is 3145-NEW. Public reporting burden for this collection of information is estimated to average [PI/Co-Investigator survey: 20; PI/Co-Investigator interview: 60; Graduate student/postdoc survey: 15; Industry Partner interview: 20] minutes per respondent, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspects of this collection of information, including suggestions for reducing this burden, to Suzanne H. Plimpton, Reports Clearance Officer, National Science Foundation, 2415 Eisenhower Ave, Alexandria, VA 22314 or send e-mail to splimpto@nsf.gov.”

A.18. Explain each exception to the topics of the certification statement identified in Certification for Paperwork Reduction Act Submissions

No exceptions are necessary for this information collection.