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Testimony

Before the Subcommittee on Investigations and Oversight,  
Committee on Science, Space, and Technology,  
House of Representatives

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NSF REVIEW

Review Process for the  
National Science Foundation's  
Science and Engineering  
Pipeline Study

Statement of Jim Wells,  
Associate Director, Energy Issues,  
Resources, Community, and Economic Development Division

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Mr. Chairman and Members of the Subcommittee:

We are pleased to discuss the results of our work for today's hearing on the National Science Foundation (NSF) April 1987 study entitled "The Science and Engineering Pipeline." As you requested, our work focused on the type and level of review the study received before it was issued. More specifically, we (1) examined how the study was reviewed within NSF and (2) analyzed information that NSF provided in a September 13, 1991, letter to the Subcommittee on the external review process used for the study. As agreed with your office, this completes our work on your request.

In summary, we found that the April 1987 study was approved by several levels of officials within NSF and the internal review it received appears to have followed existing NSF procedures. However, information that NSF reported with its September 1991 letter may have conveyed the impression that the study received more formal external review than we were able to verify. For example, the letter states that the study was reviewed by nine specific individuals, seven from outside of NSF and two from another NSF division. However, we contacted these nine individuals and found that eight of them had not provided formal review in the form of written or oral comments to NSF. The ninth could not remember if he had or had not provided this type of review. When we brought this information to NSF officials' attention, they told us that they used the word "review" to mean "professional interaction" which includes discussions within the professional community on concepts and topics related to the study.

Before I discuss these issues in more detail, let me provide some background information on the study.

#### BACKGROUND AND DEBATE OVER THE "PIPELINE" STUDY

NSF's Policy Research and Analysis Division (PRA) began analyzing the demand-supply balance for scientists and engineers in 1984 at the request of the White House's Office of Science and Technology Policy. NSF formally published the results of this analysis for the first time in an April 1987 study entitled "The Science and Engineering Pipeline" (PRA Issue Paper 87-2) and distributed it to over 2,000 individuals on PRA's general mailing list. The study became known as the "pipeline study" because it said that natural scientists and engineers flowed through a "pipeline" from undergraduate education to professional employment in natural science and engineering occupations. NSF defined natural scientists as excluding behavioral and social scientists.

As a part of its analysis, PRA projected a cumulative "shortfall" of 692,000 bachelor of science degrees during the period from 1985 to 2010. NSF uses the term shortfall to refer to

the difference between an historical or expected value and an actual or adjusted expected value. Since 1987 the results of PRA's analysis have been published and distributed on eight other occasions in the form of issue papers, working drafts, and a book.

In August 1991, this Subcommittee sent a letter to NSF that requested information in response to questions related to the PRA projections. NSF responded to these questions in a letter sent in September 1991, along with accompanying documents.

#### INTERNAL REVIEW OF THE PIPELINE STUDY

NSF has given its directorates (NSF's major organizational units) responsibility for the technical review of all reports within their organization. This includes assuring that the reports offer information that is of value and is adequate, timely and concise. However, NSF also has a formal organizational publication clearance process to assure that publications are consistent with current policies and do not involve duplication of effort or excessive expenditures.

We found that the pipeline study was drafted by analysts within the Science Innovation Policy Section of PRA and then approved by officials in charge of that Section, the PRA Division, and the Scientific, Technological and International Affairs Directorate.<sup>1</sup> For example, the Science Innovation Policy Section Head, PRA Director, and Scientific, Technological, and International Affairs Assistant Director signed the clearance sheet approving publication of the April 1987 study.

Also, according to the PRA Director, others within the Directorate reviewed versions of the pipeline study. NSF documents show that, in November of 1985, a Senior Staff Associate in the Directorate and the Section Head of Scientific and Technical Personnel Studies in the Science Resources Studies Division of the Directorate provided written comments to PRA regarding the study.

The NSF Director at the time the study was issued told us that he and the Deputy Director were heavily involved in the development of the April 1987 pipeline study. For example, an October 1, 1985, memo refers to a September 5, 1985 briefing at which they discussed, raised questions, and made suggestions on issues relating to the pipeline study. The Director also stated that the pipeline study was discussed in briefings before the National Science Board and the Board's Education and Human Resources Committee. For example, meeting minutes indicate that on November

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<sup>1</sup>The National Science Foundation has since been reorganized. All references to the organization of NSF contained in this testimony are based on the diagram in appendix I which represents NSF's organization at the time of the study.

21, 1985, PRA staff presented a report on PRA's pipeline study to a meeting of the Education and Human Resources Committee of the National Science Board.

The pipeline study was also approved for publication by the Office of Legislative and Public Affairs Director, the Scientific, Technological, and International Affairs Assistant Director, and the PRA Director. The Director of the NSF Office of Legislative and Public Affairs told us, however, that he would not approve the April 1987 version of the pipeline study for publication as an NSF report because publication of a policy document like it was unusual, if not unprecedented at NSF. He said that documents that NSF directorates publish are usually publications like newsletters that are directed at grant recipients. Accordingly, the 1987 study was issued as a PRA report with a disclaimer stating that it did not represent the official policy of NSF or PRA.

#### EXTERNAL REVIEW OF THE STUDY

In its September 1991 letter to the subcommittee, NSF listed seven individuals employed outside the Foundation and two NSF Science Resource Studies employees as reviewers of the April 1987 study. We found no documentation indicating that these individuals provided formal comments to NSF on the study. When we contacted these nine individuals, eight of them told us that they had not provided formal review in the form of written or oral comments to the PRA staff on the April 1987 study. One of the eight said that he had discussed the model used in the study with PRA staff, three said that they may have had informal discussions with PRA staff related to the study prior to the study's publication in April 1987 and four indicated they had received copies of the paper but had not provided any written or oral comments to PRA. The ninth individual could not remember if he had or had not provided this type of review. When we brought this information to NSF's attention, officials told us that they used the word "review" to mean "professional interaction" which includes discussions within the professional community on concepts and topics related to the study.

In its 1991 reply to the subcommittee, NSF also listed the participants of a 1986 PRA workshop as "reviewers." The workshop focused on the presentation and discussion of the papers NSF had commissioned on five topics related to the production of natural scientists and engineers over the next 25 years. However, an NSF staff analyst responsible for organizing the workshop told us that the pipeline study itself was not reviewed or discussed by the participants of the workshop.

As further evidence of external review in its reply to the Subcommittee, NSF said "the Science and Engineering Pipeline" study was submitted to the Office of Technology Assessment (OTA) as input to its June 1988 Educating Scientists and Engineers: Grade School

to Grad School report. Specifically, NSF said that "[a]s a part of the OTA report, the PRA contributions were reviewed by several OTA staff and consultants and approved by an advisory panel of eminent experts on scientific and engineering personnel from industrial and academic sectors."

However, according to the OTA project director for the June 1988 report, OTA did not review or provide comments to NSF on the study. Moreover, he said an OTA advisory panel did not approve the pipeline study because that is not a function of OTA advisory panels.

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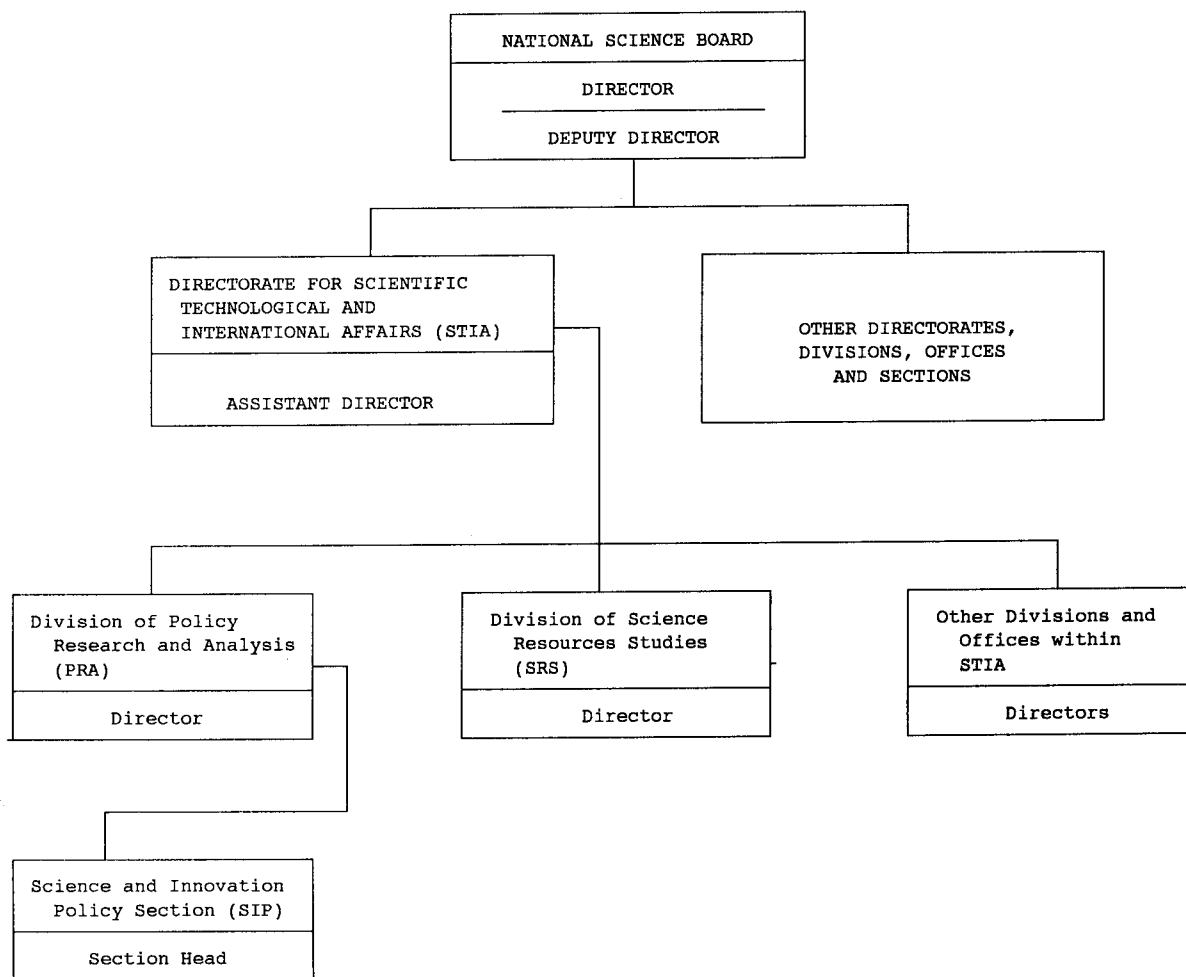
In summary, internal review of the April 1987 study appears to have been consistent with NSF requirements. Officials within the NSF Scientific, Technological, and International Affairs Directorate approved the publication of the April 1987 study and aspects of the study were discussed in briefings before top level NSF officials and the National Science Board prior to its publication.

However, the study appears to have received little or no formal review from persons outside NSF. Further, NSF's September 1991 letter may have conveyed the impression that the study received more external review than we could verify.

This concludes my statement. I would be happy to respond to any questions you or members of the Subcommittee may have.

Organizational Chart of NSF  
 Directorates, Divisions and Sections  
 Involved in Preparing and Reviewing  
 the April 1987 Study

NATIONAL SCIENCE FOUNDATION



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