PROTECTING THE INTEGRITY OF GOVERNMENT SCIENCE

A Report by the

SCIENTIFIC INTEGRITY FAST-TRACK ACTION COMMITTEE

of the

NATIONAL SCIENCE AND TECHNOLOGY COUNCIL

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Foreword

In his first days in office, President Biden affirmed that evidence-based decisions and policy—informed by robust science and unimpeded by political interference—is a core pillar of the Biden-Harris administration.

A robust democracy requires a common wellspring of reliable information. Scientific and technological information, data, and evidence are crucial to the American public's health, safety, and prosperity, and to the development, assessment, and equitable delivery of Federal programs and services.

The American public has the right to expect from its government accurate information, data, and evidence and scientifically-informed policies, practices, and communications. This requires scientific integrity—based on rigorous scientific research that is free from politically motivated suppression or distortion.

Violations of scientific integrity damage trust in both science and government. These lapses are contrary to the core ideals of the U.S. scientific enterprise, including openness, transparency, honesty, equity, and objectivity. They also erode the morale and innovation of Federal scientists and technologists.

Responding to the President's call to evaluate current policies and practices and to propose needed improvements, nearly five dozen Federal scientists brought a range of methods and perspectives to their work as members of the Scientific Integrity Task Force. This work was broad in scope. Because evidence-based policymaking happens across government, the task fell not only to the "science agencies," but also to all agencies and departments engaged in the production, analysis, communication, and use of evidence, science, and technology.

The release of this important report is the culmination of the Task Force's efforts and the first-ever comprehensive assessment of scientific integrity policy and practices in the U.S. Government. We thank the Task Force members and the many others who contributed their insights, experiences, and recommendations.

In 2009, the Obama Administration identified six principles of scientific integrity. Drawing on the insights and highlighted areas of needed improvement in the 2021 Task Force report, five additional principles warrant special mention:

- *Dissent.* Science benefits from dissent within the scientific community to sharpen ideas and thinking. Scientists' ability to freely voice the legitimate disagreement that improves science should not be constrained.
- *Whole of Government.* Because evidence-based policymaking happens across government, scientific integrity policies should apply not only to "science agencies," but to all Federal agencies and departments engaged in the production, analysis, communication, and use of evidence, science, and technology. These policies must also apply to all career employees, contractors, and political appointees.
- *Science at the policy table.* For science to inform policy and management decisions, it needs to be understood and actively considered during decision-making. This requires having scientists participate actively in policy-making.

- *Transparency in sharing science.* Transparency underpins the robust generation of knowledge and promotes accountability to the American public. Federal scientists should be able to speak freely, if they wish, about their unclassified research, including to members of the press.
- *Accountability.* Violations of scientific integrity should be considered on par with violations of government ethics, with comparable consequences.

These principles will guide OSTP's ongoing assessment and coordination of Federal scientific integrity policy.

In the coming months, OSTP will draw upon the findings of the Task Force to develop a plan for the regular assessment and iterative improvement of scientific integrity policies and practices. In addition, agency leadership, working closely with OSTP, will deploy this framework to ensure that their scientific integrity policies are informed by Task Force report and adhere to scientific integrity principles.

The release of the Task Force report provides an opportunity to salute the scientists and technologists across government, who every day make science-informed and evidence-based policymaking a reality and, in so doing, strengthen trust in government. Through their excellence, innovation, and professionalism, they inspire and serve the Nation.

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About the National Science and Technology Council

The National Science and Technology Council (NSTC) is the principal means by which the Executive Branch coordinates science and technology policy across the diverse entities that make up the Federal research and development enterprise. A primary objective of the NSTC is to ensure science and technology policy decisions and programs are consistent with the President's stated goals. The NSTC also prepares research and development strategies that are coordinated across Federal agencies aimed at accomplishing multiple national goals. The work of the NSTC is organized under committees that oversee subcommittees and working groups focused on different aspects of science and technology. More information is available at http://www.whitehouse.gov/ostp/nstc.

About the Office of Science and Technology Policy

The Office of Science and Technology Policy (OSTP) was established by the National Science and Technology Policy, Organization, and Priorities Act of 1976 to provide the President and others within the Executive Office of the President with advice on the scientific, engineering, and technological aspects of the economy, national security, homeland security, health, foreign relations, the environment, and the technological recovery and use of resources, among other topics. OSTP leads interagency science and technology policy coordination efforts, assists the Office of Management and Budget with an annual review and analysis of Federal research and development in budgets, and serves as a source of scientific and technological analysis and judgment for the President with respect to major policies, plans, and programs of the Federal Government. More information is available at http://www.whitehouse.gov/ostp.

About the Scientific Integrity Fast-Track Action Committee

The Scientific Integrity Fast-Track Action Committee (SI-FTAC) is an interagency forum for discussing scientific integrity and facilitating improvement of policies that promote scientifically informed, evidence-based decision-making at the Federal level. The SI-FTAC is charged as the Task Force on Scientific Integrity to support short-term, high-priority tasks to implement the January 2021 Presidential Memorandum on Restoring Trust in Government Through Scientific Integrity and Evidence-Based Policymaking and lay the groundwork for longer-term coordination of agency efforts related to scientific integrity. It aims to offer insight and analysis that will move the Federal Government toward a more trustworthy science system to serve the American people.

About this Document

This report is the first product of the SI-FTAC. As called for in the 2021 Presidential Memorandum, it assesses scientific integrity policies of Federal departments and agencies and instances in which they have not been followed or enforced, and it identifies effective practices for strengthening scientific integrity in specific areas, including training and transparency in scientific integrity, handling scientific disagreements, supporting professional development of Federal scientists, addressing emerging challenges to scientific integrity, and effective communication of the results of Federal scientific activities. The report is intended to assist Federal departments and agencies in creating or updating scientific integrity policies and implementing effective practices. It was developed by the SI-FTAC with contributions from other Federal Government staff, extensive public engagement, and support from the IDA Science and Technology Policy Institute.

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Abbreviations and Acronyms

ASPE	Assistant Secretary for Planning and Evaluation, HHS
ASPR	Assistant Secretary for Preparedness and Response, HHS
CDC	Centers for Disease Control and Prevention, HHS
CSO	Chief Science Officer
DHS	Department of Homeland Security
DEIA	Diversity, Equity, Inclusion, and Accessibility
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
ED	Department of Education
DOI	Department of the Interior
DOJ	Department of Justice
DOT	Department of Transportation
EPA	Environmental Protection Agency
FACA	Federal Advisory Committee Act
FDA	Food and Drug Administration, HHS
FTAC	Fast-Track Action Committee
HHS	Department of Health and Human Services
NASA	National Aeronautics and Space Administration
NIH	National Institutes of Health, HHS
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NSF	National Science Foundation
NSTC	National Science and Technology Council
OIG	Office of the Inspector General
OMB	Office of Management and Budget
OSTP	Office of Science and Technology Policy
R&D	Research and development
RFI	Request for information
SIO	Scientific Integrity Official
STPI	Science and Technology Policy Institute
USDA	United States Department of Agriculture
USGS	United States Geological Survey

Executive Summary

Protecting scientific integrity in government is vital to the Nation. The convergence of economic, public health, social justice, biodiversity, and climate crises facing the Nation underscores the need for evidence-based decisions guided by the best available science.[1] Scientific integrity aims to make sure that science is conducted, managed, communicated, and used in ways that preserve its accuracy and objectivity and protect it from suppression, manipulation, and inappropriate influence—including political interference. It is a central issue not only for Federal departments and agencies (referred to collectively as "agencies" in this report) that conduct and fund scientific research,[2] but also for all agencies that communicate or make use of scientific and technical information in decision-making and for members of the American public who are affected by government decisions.

This report identifies approaches to bolster the ability of Federal agencies to protect government science. It responds to the January 2021 Presidential Memorandum on Restoring Trust in Government Through Scientific Integrity and Evidence-Based Policymaking,[3] which calls for an interagency Scientific Integrity Task Force ("Task Force") to review agency scientific integrity policies; consider whether they prevent political interference in the conduct, management, communication, and use of science; and identify effective practices for improving their implementation. The report reflects the deliberations of the Task Force, informed by engagement with more than a thousand individuals in Federal agencies, the scientific community, and the general public. It presents the Task Force's assessment of agency scientific integrity policies and identifies good practices for improving their implementation.

Strengthening scientific integrity policies

Upholding scientific integrity means protecting science during all stages of its development and application, from conducting and managing research, to communicating scientific results, to making use of scientific and technical information in decision-making. In reviewing the effectiveness of agency scientific integrity policies, the Task Force finds that:

- *Scientific integrity is essential to helping ensure informed government decision-making, accountability, and trust, while maintaining a vibrant scientific enterprise.* Protecting scientific integrity results in better decisions, which translate into better policies that help people and communities of all backgrounds thrive.
- *Existing agency policies are responsive to the principles and guidance in previous Executive actions.* All major science agencies, and a number of others, have scientific integrity policies that address

[1] In this report, the terms "science" and "scientific" refer to the full spectrum of scientific endeavors, including basic science, applied science, evaluation science, engineering, technology, economics, social sciences, and statistics, as well as the scientific and technical information derived from these endeavors. See Appendix D for descriptions of terminology used in this report.

[2] These agencies are referred to as "Federal science agencies" in this report.

[3] Presidential Memorandum on Restoring Trust in Government Through Scientific Integrity and Evidence-Based Policy Making, January 27, 2021. Available at: https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/memorandum-on-restoring-trust-in-government-through-scientific-integrity-and-evidence-based-policymaking/.

most if not all of the guidance articulated in Memoranda issued by the President and Office of Science and Technology Policy (OSTP) in 2009 and 2010, respectively.[4]

- *Agencies need to strengthen scientific integrity policies to deter undue influence in the conduct, management, communication, and use of science*. Although violations of scientific integrity are small in number compared to the magnitude of the Federal Government's scientific enterprise, they can have an outsized, detrimental impact on decision-making and public trust in science. As illustrated by high-profile cases, political intrusion into the conduct, management, communication, and use (or misuse) of science has a severe impact on public trust in Federal science.
- *Violations involving high-level officials are the most problematic and difficult to address*. Implementation and enforcement of scientific integrity policies take place at the agency level, meaning senior agency leaders, including political appointees, can either enable or undermine these policies. While the scientific community benefits from a culture of integrity that is supported by professional standards and agency efforts to guard against research misconduct, these protections are not effective against high-level officials.
- *Further action is needed.* Concerted efforts are needed to establish and maintain a culture of scientific integrity across all individuals and agencies that conduct, manage, communicate, and make use of science. A strong organizational culture of scientific integrity is a necessary foundation to reduce the potential for wrongdoing, protect against inappropriate influence, reinforce agency missions and goals, and ensure equitable delivery of Federal Government programs.

Making scientific integrity everyone's responsibility

A first step in creating a broader culture of scientific integrity is establishing it as a responsibility of all those who conduct, manage, communicate, and use science in decision-making. This means explicitly extending scientific integrity policies beyond Federal science agencies and scientists:[5]

- *All Federal agencies—not just those that fund and conduct scientific research—need to develop, implement, and periodically review and update scientific integrity policies*. Scientific integrity involves both protecting science from political—and other forms of—interference, and fostering the appropriate and transparent use of science in decision-making. All agencies that conduct, manage, communicate, or use science in decision-making need scientific integrity policies, not just Federal science agencies.
- *Agencies need to apply scientific integrity policies to all those in Federal agencies who conduct, manage, communicate, or use science*. Scientific integrity extends well beyond science and scientists. It includes all those who help communicate science and make decisions guided by it.

[4] Presidential Memorandum for the Heads of Executive Departments and Agencies on Scientific Integrity. March 9, 2009. The White House. Available at: https://obamawhitehouse.archives.gov/the-press-office/memorandum-heads-executive-departments-and-agencies-3-9-09; Memorandum for the Heads of Executive Departments and Agencies on Scientific Integrity. December 17, 2010. Office of Science and Technology Policy. Available at: https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/scientific-integrity-memo-12172010.pdf.

[5] In this report, the term "scientist" refers to an individual whose responsibilities include collection, generation, use, or evaluation of scientific and technical data, analyses, or products. It does not refer to individuals with scientific or technical training whose primary job functions are non-scientific (e.g., policymakers, communicators, managers).

Scientific integrity policies need to encompass leadership at all levels and those involved in communications and decision-making.

Scientific integrity policies must be tailored to the specific mission of each agency, while adhering to common principles across all agencies. A one-size-fits-all approach cannot begin to reflect the considerable diversity among agencies that conduct, manage, communicate, or use science and evidence in decision-making. While all agencies can adhere to common principles to uphold scientific integrity, individual agencies need to adapt policies to their particular functions.

Implementing good practices is essential

Well-developed policies, while fundamental, are insufficient to protect scientific integrity. Agencies need effective practices for policy implementation. The Task Force identified numerous good practices that Federal agencies can readily adopt and adapt for use as appropriate to their different missions and needs. These practices address a wide range of activities necessary to foster scientific integrity, including and extending beyond those identified in the 2021 Presidential Memorandum:

- *Fostering an organizational culture of scientific integrity* starts from the top, with effective agency leadership and modeling of appropriate behaviors. It is reinforced by training and education of agency staff and by making scientific integrity policies and instructions for reporting concerns visible to staff and the public.
- *Protecting the integrity of the research process* includes shielding data collection and analysis from interference, encouraging legitimate scientific debates while minimizing disputes that serve a desired outcome or interest, encouraging continued professional development of Federal scientists, and applying conflict of interest rules to all those involved in the conduct, management, communication, and use of science, including those on scientific advisory committees.
- *Communicating science with integrity* entails effective and transparent communication of scientific information to decision-makers, the media, and the American people. Good practices protect against suppression and interference to facilitate the timely, free flow of scientific information in media engagements, social media, written scientific reports, and presentations. They are based on collaborative relationships between agency scientists and communications staff.
- *Safeguarding scientific integrity* requires clear, visible procedures for reporting concerns, robust assessment and adjudication, and consistent enforcement of consequences when violations are found. Good practices promote early detection and reporting of concerns, protect whistleblowers and provide due process, equip those managing scientific integrity programs with the tools necessary for independent and objective assessments, and establish mechanisms to correct the scientific record and hold individuals accountable.

What is needed now is broader dissemination and adoption of good practices across the Federal Government. Establishing an interagency body is essential to effective dissemination and uptake across the Federal sector and developing a cadre of scientific integrity officials. Such an interagency body could also assist agencies in addressing allegations of scientific integrity violations by senior-level officials that cannot be suitably handled at the agency level.

Addressing emerging themes

In addition to being reaffirmed and expanded to all appropriate communities of practice, scientific integrity policies also need to be updated to address important, emergent issues of our time. Most notable are several issues identified in the 2021 Presidential Memorandum:

- *Diversity, equity, inclusion, and accessibility,* which is essential to improving the representativeness and eminence of the scientific workforce, innovation in the conduct and use of science, and equitable participation in science by diverse communities across the Nation.
- *New technologies, including artificial intelligence and machine learning,* present new challenges to scientific integrity, including the potential for bias when data used to train algorithms are not representative of the underlying phenomenon and algorithms themselves are not transparent.
- *Emerging modes of science, such as citizen science and community-engaged research*, can be important avenues for public engagement and building trust in Federal science. Agencies need scientific integrity guidelines and practices for these types of programs and the participants involved in them when conducted with support of Federal agencies.
- *Coordination is needed with related policy domains*, including open science, which enhances transparency into research processes and outputs; quality guidelines for data and information that agencies release; promotion of safe, equitable workplaces free from harassment and discrimination; and protection of research security and responding to research misconduct.

Institutionalizing scientific integrity

The importance of science in guiding decisions that affect individuals and communities across the Nation means that agencies must give scientific integrity high priority. The 2021 Presidential Memorandum instructs all agencies to designate a senior career employee as the agency's Scientific Integrity Official and all Federal science agencies to designate a Chief Science Officer. Agencies need to ensure these officials are empowered and resourced to carry out a broad set of responsibilities with significant implications. Empowerment means positioning them with visibility, authority, and independence to serve as the focal point for scientific integrity issues and coordinate as needed with other agency officials involved in related administrative functions (e.g., human resource officials, Inspectors General, Special Counsels). It also entails providing them with needed training and staffing to carry out a broad portfolio of work.

Taking next steps

This report identifies important steps for enhancing scientific integrity in Federal agencies. More work is needed to assist Federal agencies in assessing and strengthening scientific integrity policies, improving engagement with individuals and communities affected by decisions that are guided by Federal science, and making progress on other issues outlined in this report. The 2021 Presidential Memorandum lays out next steps, charging the Task Force to develop a framework to support regular assessment and iterative improvement of agency scientific integrity policies. The Task Force will begin developing this framework immediately upon publication of this report. It seeks continued meaningful community engagement that will allow those who are most vulnerable, underrepresented, and impacted by Federal Government policy decisions to have a voice in its deliberations and help strengthen trust in government through decision-making that is guided by science.

1. Introduction

The Presidential Memorandum on Restoring Trust in Government Through Scientific Integrity and Evidence-Based Policymaking, issued on January 27, 2021 (2021 Presidential Memorandum),[6] states the Administration's goal to make evidence-based decisions guided by the best available science and data, recognizing that scientific and technological information, data, and evidence are central to the development and iterative improvement of sound policies and to the equitable delivery of programs across every area of the Federal Government. It emphasizes that political interference[7] in the work of Federal scientists[8] and other scientists who support the work of the Federal Government (e.g., government contractors, volunteers) and in the communication of scientific facts undermines the welfare of the Nation, contributes to systemic inequities and injustices, and violates the trust that the public places in government to best serve its collective interests.

The 2021 Presidential Memorandum calls for an interagency task force of the National Science and Technology Council (NSTC) to conduct a thorough review of the effectiveness of agency scientific integrity policies. It charges the Task Force to include in its review the existing policies issued pursuant to the Presidential Memorandum on Scientific Integrity of March 9, 2009 (2009 Presidential Memorandum),[9] the Office of Science and Technology Policy (OSTP) Memorandum on Scientific Integrity of December 17, 2010 (2010 OSTP Memorandum),[10] or any other scientific integrity policies published on websites of Federal departments and agencies (referred to collectively in this report as "agencies") and commonly accepted scientific integrity practices. It further charges the Task Force to:

- Consider whether existing Federal scientific integrity policies prevent political interference in the conduct of scientific research and the collection of scientific or technological data; prevent the suppression or distortion of scientific or technological findings, data, information, conclusions, or technical results; support scientists and researchers of all genders, races, ethnicities, abilities, and backgrounds; and advance the equitable delivery of Federal Government programs;[11]

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[6] Presidential Memorandum on Restoring Trust in Government Through Scientific Integrity and Evidence-Based Policymaking. January 27, 2021. Available at: https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/memorandum-on-restoring-trust-in-government-through-scientific-integrity-and-evidence-based-policymaking/.

[7] In this report, the term "interference" is used to mean inappropriate, scientifically unjustified intervention in the conduct, management, communication, or use of science. See Appendix D.

[8] In this report, the term "scientist" is used to refer to an individual whose responsibilities include collection, generation, use, or evaluation of scientific and technical data, analyses, or products. It does not refer to individuals with scientific or technical training whose primary job functions are non-scientific (e.g., policymakers, communicators, managers). The term "Federal scientist" is used to refer to a scientist who is a Federal employee. See Appendix D.

[9] Presidential Memorandum for the Heads of Executive Departments and Agencies on Scientific Integrity. March 9, 2009. Available at: https://obamawhitehouse.archives.gov/the-press-office/memorandum-heads-executive-departments-and-agencies-3-9-09.

[10] Memorandum for the Heads of Executive Departments and Agencies on Scientific Integrity. December 17, 2010. Office of Science and Technology Policy.
Available at: https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/scientific-integrity-memo-12172010.pdf.

[11] In this report, the term "equitable delivery of Federal Government programs" is used to refer to the delivery and availability of government programs (including funding of government programs) to serve all communities, identities, races, ethnicities, backgrounds, abilities, cultures, and beliefs. See Appendix D.

- Analyze instances in which existing scientific integrity policies have not been followed or enforced, including whether such deviations from existing policies have resulted in political interference in the conduct of scientific research and the collection of scientific or technological data; led to the suppression or distortion of scientific or technological findings, data, information, conclusions, or technical results; disproportionately harmed Federal scientists and researchers from groups that are historically underrepresented in science, technology, and related fields; or impeded the equitable delivery of the Federal Government's programs; and
- Identify effective practices regarding engagement of Federal scientists, as well as contractors working on scientific matters for agencies, with news media and on social media; effective policies that protect scientific independence during clearance and review, and that avoid political interference in research or data collection; effective approaches for handling disagreements about scientific methods and conclusions; effective reporting practices that promote transparency in the implementation of agency scientific integrity policies and in the handling of any allegations of misconduct; effective practices for educating and informing employees and contractors of their rights and responsibilities related to agency scientific integrity policies; promising opportunities to address gaps in current scientific integrity policies related to emerging technologies, such as artificial intelligence (AI) and machine learning (ML), and evolving scientific practices, such as citizen science and community-engaged research; effective approaches to minimizing conflicts of interest in Federal Government science; and policies that support the professional development of Federal scientists in accordance with, and building on, section IV of the 2010 OSTP Memorandum.

Notably, the 2021 Presidential Memorandum expands the application of scientific integrity beyond agencies that fund or conduct scientific or technical research (referred to in this report as "Federal science agencies") to include agencies that communicate and make use of science in policymaking processes. It calls on the heads of all agencies to designate a lead Scientific Integrity Official (SIO) to oversee implementation and iterative improvement of scientific integrity policies and processes, recognizing that science, facts, and evidence are vital to addressing policy and programmatic issues across the Federal Government.

The 2021 Presidential Memorandum specifies additional steps for the Task Force, OSTP, and Federal agencies to take to enhance scientific integrity among Federal agencies. It calls upon the Task Force to develop a framework to inform and support the assessment and improvement of scientific integrity policies and practices in Federal agencies. It further directs heads of agencies to ensure their scientific integrity policies reflect the Task Force findings and to develop, update, and implement policies and procedures needed to ensure the integrity of scientific decision-making.

Methodology

To conduct this review, the NSTC established a Scientific Integrity Task Force composed of experts from a broad range of Federal agencies that reflect the scope of scientific integrity issues presented in the 2021 Presidential Memorandum. The Task Force includes 57 representatives from 29 Federal science agencies, Federal statistical agencies,[12] and other Federal agencies that communicate and use science

[12] The following are designated "principal statistical agencies" of the U.S. Government: Bureau of Economic Analysis (DOC), Bureau of Justice Statistics (DOJ), Bureau of Labor Statistics (DOL), Bureau of Transportation Statistics (DOT), Economic Research Service (USDA), National Agricultural Statistics Service (USDA), National Center for Education Statistics (ED), National Center for Health Statistics (HHS), National Center for Science and

in their decision-making processes.[13] It reflects a diversity of perspectives related to scientific integrity, including scientists, statisticians, engineers, SIOs, policymakers, and legal experts, both career Federal staff and political appointees. Many participants developed and implemented their agency scientific integrity policies. Many brought first-hand knowledge of instances in which existing scientific integrity policies were not followed or enforced and the implications of those lapses in scientific integrity. Some brought first-hand knowledge of agency success with the implementation of scientific integrity policies (see Box 1-1).

Box 1-1. Defining Scientific Integrity

The 2021 Presidential Memorandum does not define the term "scientific integrity." Rather it reaffirms and builds on the 2009 Presidential Memorandum and 2010 OSTP Memorandum, which establish principles and guidance, respectively, for protecting scientific integrity, without explicitly defining the term. The Task Force has taken a similar approach, focusing its initial efforts on assessing agency scientific integrity policies against the principles and guidelines articulated in the memoranda and identifying practices for improving policies and their implementation as called for in the 2021 Presidential Memorandum. The Task Force notes that some, but not all, agencies provide definitions of scientific integrity in their scientific integrity policies. These definitions vary across agencies and would benefit from greater harmonization. The Task Force intends to produce a definition of scientific integrity for adoption by Federal agencies as it develops a framework for assessing scientific integrity policies. The definition will be informed by the insight gained in preparing this report.

The Task Force supplemented its experience and expertise with extensive stakeholder engagement, including:

- A Request for Information (RFI) to collect input from interested parties about: 1) the perceived effectiveness of Federal scientific integrity policies and needed areas of improvement; 2) good practices Federal agencies could adopt to improve scientific integrity, including in the communication of scientific information, addressing emerging technologies and evolving scientific practices, supporting professional development of Federal scientists, and promoting transparency in the implementation of agency scientific integrity policies; and 3) other topics or concerns that Federal scientific integrity policies should address.[14] More than 200 individuals and organizations submitted comments.[15]
- Agency roundtables that convened scientists, communicators, and SIOs from across the U.S. Government to gain insight into agency concerns about scientific integrity and identify effective practices for improving it. Four roundtables convened more than 175 participants to discuss challenges and best practices in scientific integrity.

Engineering Statistics (NSF), Office of Research, Evaluation, and Statistics (Social Security Administration), Statistics of Income (Treasury), U.S. Census Bureau (DOC), and U.S. Energy Information Administration (DOE).

[13] In this report, the term "science" refers to the full spectrum of scientific endeavors, including basic science, applied science, evaluation science, engineering, technology, economics, social sciences, and statistics, as well as the scientific and technical information derived from these endeavors. The term "Federal science" refers to science conducted by Federal scientists or contractors to the Federal Government. The See Appendix D.

[14] White House Office of Science and Technology Policy. "Request for Information to Improve Federal Scientific Integrity Policies." *Federal Register.* Doc. 2021-13640. June 28, 2021. Available at: https://www.federalregister.gov/documents/2021/06/28/2021-13640/request-for-information-to-improve-federal-scientific-integrity-policies.

[15] A compilation of the submitted comments is available at: https://www.whitehouse.gov/ostp/nstc/scientific-integrity-task-force/.

- Public listening sessions to hear from individuals who conduct, manage, communicate, or make use of science.[16] The three listening sessions gathered more than 650 individuals from across the country to share their views on the effectiveness of Federal scientific integrity policies, their role in promoting trust in Federal science, and to address concerns about a lack of scientific integrity impeding the equitable delivery of Federal Government programs. The listening sessions generated helpful commentary and input both on concerns related to scientific integrity and approaches that could be taken to improve it.[17]

The Task Force received analytical support from the IDA Science and Technology Policy Institute (STPI). STPI synthesized material from the external engagement and examined public information about agency scientific integrity policies, their implementation, and public reports of violations.

The Task Force drew upon this information to conduct its assessment and identify steps for improving scientific integrity policy and its implementation. Because the Task Force was neither charged nor equipped to address new allegations of scientific integrity violations, it based its assessment on existing public information about scientific integrity policies and violations, as well as experiences of its members. It took a prospective approach, focusing on identifying practices to improve implementation of scientific integrity policies. It clustered the topics specified in the 2021 Presidential Memorandum into three broad categories that shaped much of its work and its presentation in this report:

- Training & transparency, which includes effective reporting practices that promote transparency in the implementation of agency scientific integrity policies and in the handling of any allegations of misconduct; and effective practices for educating and informing employees and contractors of their rights and responsibilities related to agency scientific integrity policies;
- Conduct of science, which includes effective policies to avoid improper political interference in research or data collection; effective approaches for handling any disagreements about scientific methods and conclusions; effective approaches to minimizing conflicts of interest in Federal Government science; policies that support the inclusion of diverse Federal scientists and their professional development; and opportunities to address gaps in current scientific integrity policies related to emerging technologies, such as AI and ML, and evolving scientific practices, such as citizen science and community-engaged research; and
- Communication of science, which includes effective practices regarding engagement of Federal scientists, as well as contractors working on scientific matters for agencies, with news media and on social media; effective policies that protect scientific independence during clearance and review, and that avoid improper political interference in research or data collection.

The Task Force recognized the importance of effective procedures for reporting, adjudicating, and responding to violations of scientific integrity policies, and it expanded the scope of its review to examine practices for doing so.

Given the timeframe available for its analysis, the Task Force could not fully evaluate the effectiveness of individual practices. It therefore focused on identifying good practices that, based on expert opinion

[16] White House Office of Science and Technology Policy. "Public Listening Sessions on Scientific Integrity and Evidence-Based Policymaking." *Federal Register*. Doc. 2021-15309. Available at: https://www.federalregister.gov/documents/2021/07/20/2021-15309/public-listening-sessions-on-scientific-integrity-and-evidence-based-policymaking.

[17] Summaries and transcripts of the public listening sessions are available at https://www.whitehouse.gov/ostp/nstc/scientific-integrity-task-force/.

and contextual evidence from implementing agencies, it considers worthy of further review and consideration for adoption by Federal agencies. The Task Force views them not as a definitive set of actions for all agencies to adopt but as a collection of exemplary practices for agencies to consider, adopt, and adapt as appropriate to their agency mission and needs related to scientific integrity. They are intended for use within Federal agencies and can apply most readily to science conducted, managed, communicated, or used by Federal agencies, whether by Federal employees or others whose work is directed by agencies, such as contractors and volunteers. In some cases, the practices may be extended to those external to Federal agencies whose work is funded by the agencies, such as grantees, through terms and conditions of awards for Federal financial assistance.

As it conducted its work, the Task Force also came to realize that effective development and implementation of scientific integrity policies takes commitment from agencies individually and collectively. It identified essential steps for institutionalizing scientific integrity within Federal agencies to ensure that the SIO, chief science officer (CSO), and others with responsibility for supporting and protecting scientific integrity are sufficiently empowered, trained, and resourced to carry out a broad scope of functions within their agencies and through a nascent but growing community of practice.

Organization of This Report

The remainder of this report presents the Task Force's findings. Chapter 2 reviews Federal agency efforts to-date to establish and implement scientific integrity policies and challenges to scientific integrity. It identifies shortcomings in existing policies and areas for improvement. The balance of the report identifies good practices for improving implementation of scientific integrity policies. Chapter 3 describes good practices for building a culture of scientific integrity in Federal agencies, including practices for demonstrating leadership, improving training, and promoting transparency. Chapter 4 describes good practices for protecting integrity in the research process. It examines practices for shielding scientific research from interference, handling scientific disagreements, and fostering the professional development of scientific and engineering staff. It recognizes the need to strengthen linkages between policies for scientific integrity and for diversity, equity, inclusion, and accessibility (DEIA) and explores opportunities for scientific integrity policies to address new technologies, such as AI and ML, and evolving forms of research, including citizen science and community-engaged research. Chapter 5 identifies good practices for maintaining integrity in the communication of science, including in relations with public media, use of social media, and clearance of agency scientific reports. It also identifies practices for building trust between scientific and communications staff. Chapter 6 focuses on safeguarding scientific integrity, identifying good practices to encourage reporting of concerns, adjudicate them objectively, correct the science, and enforce consequences when appropriate. Chapter 7 identifies steps for institutionalizing scientific integrity, including by empowering SIOs and CSOs to fulfill the important missions they have been assigned. Chapter 8 concludes the report with a brief overview of the Task Force's next steps, including a framework for assessing scientific integrity policies and continued engagement with the public to better communicate the values of scientific integrity and understand how lapses in scientific integrity affect equity and effectiveness of the delivery of Federal Government programs.

2. Assessing Scientific Integrity

Assessing integrity of Federal science requires consideration of the challenges agencies face in protecting Federal science, as well as the scientific integrity policies currently in place to support it. This chapter highlights the importance of scientific integrity to the effective conduct, management, communication, and use of science in decision-making, identifies ways in which scientific integrity can be undermined, and reviews Federal efforts to protect science through development and implementation of scientific integrity policies. It highlights the need for comprehensive scientific integrity policies that apply to a broad range of individuals who engage in the conduct, management, communication, and use of science in decision-making and that both protect science from interference and promote its effective use in decision-making.

Ensuring the Integrity of Science

Protecting scientific integrity is essential to the progress of science and its application to a broad set of economic and societal objectives supported by Federal Government action (e.g., advancing public health, addressing climate change, ensuring food production, and protecting national and energy security). The scientific and technical information that is used in Federal decision-making around these and other issues must reflect rigorous and independent research that is free from suppression, manipulation, and other interference. That is the goal of scientific integrity policies. Protecting scientific integrity contributes to better government decision-making, which leads to better policies that help people and communities across the Nation thrive.

Violations of scientific integrity can substantially undermine science and ultimately harm decision-making and public trust in government. Violations can distort the science itself, altering the types of data collected, the way they are collected, the way they are analyzed, or whether they are collected at all. Violations can undermine the accuracy of scientific information communicated to the public by suppressing or delaying the release of results or changing conclusions. They can hamper effective decision-making by ignoring, undervaluing, or misinterpreting relevant scientific findings. To the extent violations of scientific integrity distort or ignore findings related to different demographic groups, they can threaten the equitable delivery of Federal Government programs and perpetuate systemic inequities and injustices. An environment characterized by weak scientific integrity can further undermine Federal science by making it more difficult for Federal agencies to attract, recruit, and retain a diverse workforce of highly qualified scientists and engineers.

Upholding scientific integrity is therefore an issue not only for scientists and Federal agencies that support scientific and technical research, but also for decision-makers and the general public. While efforts to protecting scientific integrity cannot fully address public skepticism about science, they are an essential ingredient in building public trust in Federal science and decisions guided by it. A recent survey suggests that public attitudes about the benefits of science and the general scientific community

have remained stable and positive over many years, but that concerns about specific issues related to science and technology, such as climate change, have increased.[18, 19]

Challenges to Scientific Integrity

Protecting science means upholding scientific integrity during all stages of its development and application, from conducting and managing research to communicating the results and making use of them in decision-making. Agency experience demonstrates that scientific integrity can break down at any point along this process, as summarized below (Appendix C contains a more complete listing):

- In *conducting science*, scientific integrity can be undermined by poor scientific practice, including issues with study design, data collection, systematic review, statistical analysis, and peer review, as well as by research misconduct (fabrication and falsification of data and plagiarism). It can also be undermined by bias or conflicts of interest, including those stemming from outside influence or research funding.
- In *managing science,* scientific integrity can be undermined by managers and supervisors exerting scientifically unjustified influence on research. Examples include unduly halting research, demanding changes in methods, removing data from results, delaying or suppressing the release of scientific reports (to the public and/or decision-makers) without a scientific basis.
- In *communicating research* results, scientific integrity can be undermined during agency review and communication processes, e.g., by problematic review of scientific reports, delay or suppression of publication of results, alteration of results and scientific reports that is not scientifically justified, or preventing scientists from communicating with media.
- In *decision- and policymaking*, scientific integrity can be impeded by mischaracterizing, fabricating, removing, or disregarding relevant scientific information, including in ways that might affect the equitable delivery of Federal Government programs.

The types of violations that occur differ across agencies and types of agencies. Agencies that focus mostly on funding extramural research, such as the National Science Foundation (NSF) and National Institutes of Health (NIH), are less likely to experience interference in decision-making and

[18] For example, the public reports greater confidence in the scientific and medical communities than in the executive branch of the Federal Government: 44% of respondents reported "a great deal" of confidence in the scientific community, while 44% reported "hardly any" confidence in the executive branch. See Figure 7-4, "Public confidence in institutional leaders, by selected institution: 2018" in National Science Foundation, Science & Engineering Indicators. Available at https://ncses.nsf.gov/pubs/nsb20207/public-attitudes-about-s-t-in-general.

[19] Another recent survey found that 87% of respondents had a great deal or fair amount of confidence in scientists in 2020, an increase from 2016–2019, and that the percentage of Americans that have "a great deal" of confidence in scientists is among the most stable response when assessing institutions such as the military, education, and the media in surveys dating back to the 1970s. See https://www.pewresearch.org/fact-tank/2020/08/27/public-confidence-in-scientists-has-remained-stable-for-decades/. Notable differences remain across demographic lines, suggesting that more work is needed to ensure public trust in science across the full population. For example, gaps remain between white and black Americans, with the latter twice as likely to report having "not too much or no confidence" in scientists to act in the best interests of the public. See https://www.pewresearch.org/fact-tank/2020/08/28/black-americans-have-less-confidence-in-scientists-to-act-in-the-public-interest/.

policymaking than science agencies with a strong regulatory role, such as the Environmental Protection Agency (EPA) and Food and Drug Administration (FDA), which may experience challenges across the spectrum. Agencies with limited research activity, but that make use of research results in decision-making (e.g., Departments of State and Treasury), may experience challenges in the communication and use of science. Federal statistical agencies, such as the Census Bureau, must protect against interference in their efforts to create and release data that provide a set of common facts to inform policymakers, researchers, and the public.[20]

Scientific integrity can also be undermined by actions that impede the effective operation of scientific integrity programs and the efficient reporting, investigation, and adjudication of allegations. These actions can include:

- *Intimidation or coercion,* such as threats of retaliation and retribution, that undermine willingness of individuals to report violations—and can be used to violate scientific integrity by demanding unjustified alteration of a scientific product or changes in the research process.
- *Obstruction and interference* that can delay or misdirect inquiry into allegations of scientific integrity violations.
- *Immunity from consequences* through lack of enforcement or repercussions for a violation of scientific integrity.

Actions such as these can undermine efforts to maintain scientific integrity and erode the trust in Federal science among Federal employees and the American public. Although these types of actions may violate the Whistleblower Protection Act,[21] they may still occur overtly or covertly. Policies and practices must protect against all such challenges to scientific integrity and ensure concerns and allegations are investigated and addressed by appropriate authorities.

In addition to scientific integrity policies, agencies need robust procedures for detecting, adjudicating, and remedying alleged violations of scientific integrity. Determining whether particular action constitutes a violation of scientific integrity policy requires careful consideration. The line between appropriate intervention and interference is often not clear without deeper analysis. For example, a supervisor's edits to a scientific report could result from valid concerns about analytical techniques and conclusions (legitimate intervention) or the supervisor's desire to distort outcomes to meet preferred policy objectives (interference). A policymaker's decision that does not follow the scientific evidence could result from consideration of non-scientific factors such as cost and feasibility that dictated a different outcome (legitimate intervention) or from intentional mischaracterization of the relevant science in the decision-making process (interference). When allegations are substantiated, agencies need approaches for correcting the scientific record and holding accountable those who knowingly violated scientific integrity policies.

[20] Statistical agencies may be implicated when external researchers misuse or misinterpret statistical data, but their scientific integrity policies do not extend to subsequent analyses of data they release.

[21] The Whistleblower Protection Act, Public Law 101-12, protects Federal employees who disclose illegal activities, or instances of fraud, waste, and abuse in the Federal Government. See https://www.govinfo.gov/content/pkg/STATUTE-103/pdf/STATUTE-103-Pg16.pdf.

Minimizing interference

In aiming to make sure that science is conducted, managed, communicated, and used in ways that preserve its accuracy and objectivity and protect it from suppression, manipulation, and interference, scientific integrity policies build on and intersect with several related concepts, including:

- *Research misconduct*, which is defined as fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results;[22]
- *Research integrity*, which promotes the use of honest and verifiable methods in proposing, performing, and evaluating research; reporting research results with particular attention to adherence to rules, regulations, guidelines; and following commonly accepted professional codes or norms;[23] and
- *Research security*, which focuses on safeguarding research from interference and exploitation, often from foreign institutions or governments.[24]

Research misconduct, lapses in research integrity, and loss of research security typically result from actions of scientists. While these kinds of violations are challenging, agencies are generally equipped to address them using internal practices that build on longstanding and well-articulated principles of research ethics. The scientific community has a strong culture of protecting against research misconduct and promoting the responsible conduct of research,[25] and Federal science agencies have robust procedures for identifying and addressing such concerns, e.g., through established offices of research integrity and research ethics and programs to promote research integrity.

Of greater concern across agencies are violations of scientific integrity caused by interference from senior leaders and other individuals outside the research process who interfere in the conduct, management, communication, and use of science. Whether resulting from the actions of those involved in proposal review, research management, external communication, or policymaking, violations of scientific integrity that result from senior leadership and others outside the research process are particularly challenging. Because senior leaders are likely in the management chain of designated SIOs or other agency management, agency officials may be less willing to pursue violations and have fewer opportunities for imposing meaningful sanctions. Over time, continued interference can undermine the research process itself, as scientists self-censor their work (e.g., avoiding subjects that attract interference) or leave the Federal scientific workforce.

Overall, Federal science remains fundamentally sound. Reported violations of scientific integrity policies are small in number compared to the magnitude of the Federal Government's scientific

[22] Office of Science and Technology Policy. "Federal Policy on Research Misconduct." *Federal Register*, Vol. 65, No. 235. Dec. 6, 2000. Available at: https://www.govinfo.gov/content/pkg/FR-2000-12-06/pdf/00-30852.pdf.

[23] National Institutes of Health. "What is Research Integrity?" November 29, 2018. Available at: https://grants.nih.gov/policy/research_integrity/what-is.htm.

[24] See Lander, Eric. "Clear Rules for Research Security and Research Responsibility." *OSTP Blog*. August 10, 2021. Available at: https://www.whitehouse.gov/ostp/news-updates/2021/08/10/clear-rules-for-research-security-and-researcher-responsibility/.

[25] See National Academies of Sciences, Engineering, and Medicine. *Fostering Integrity in Research*. Washington, DC: National Academies Press. 2017. Available at: https://www.nap.edu/catalog/21896/fostering-integrity-in-research.

enterprise,[26] even if available data underestimate violations because agency staff and the public underreport concerns or use informal approaches to address them.[27] Nevertheless, interference by non-researchers appears to be growing. A recent analysis of scientific integrity violations in the U.S. Government extending back to the 1950s found that instances of political interference in science have increased in both breadth and number in recent years.[28]

Even if they remain small in number, violations of scientific integrity can have an outsized negative impact on decision-making and public trust in science. Several high-profile examples demonstrate the degree to which violations of scientific integrity can harm the communication of scientific information, undermine the effectiveness of Federal Government programs, and exacerbate inequity (See Box 2-1).

Box 2-1. Hurricane Dorian Forecast

During the course of Hurricane Dorian's passage in 2019, the President offered forecast information that contrasted with the public safety information broadcast by the professional forecasters of NOAA's National Weather Service (NWS). Instead of clarifying the error, the political leadership of the White House and Department of Commerce directed NOAA's political officials to issue a press release purporting to correct the NWS forecasters, rather than stating the origin of the true error. The effect of this press release was to amend the scientific assessment of the forecasters without consulting them about the change or critique of their work. Multiple people filed complaints alleging violations of NOAA's Scientific Integrity policy. Owing to the seniority of the actors involved, NOAA engaged the National Academy of Public Administration (NAPA) to investigate the events and potential violations of the NOAA Policy, while the Department of Commerce Office of Inspector General (OIG) independently examined the circumstances to determine the facts of the matter but not to evaluate potential violations of the NOAA policy. These two parallel investigations proceeded independently. The OIG and the NAPA found mismanagement by the Department of Commerce and NOAA officials and overt violations of the NOAA policy, respectively. The OIG found "significant flaws" in the process for drafting and issuing press release, including the leading roles of Department lawyers who lacked subject-matter expertise in meteorology or emergency communications. No punitive actions were taken for the mismanagement and violations. The officials who could have imposed actions were the very people who had instructed that the offenders take the wrongful actions. The Department of Commerce officials declared the matter closed and took no further action.

See: U.S. Department of Commerce, Office of the Inspector General. "Evaluation of NOAA's September 6, 2019, Statement About Hurricane Dorian Forecasts." Final Report No. OIG-20-032-1. June 26, 2020. Available at: https://www.oig.doc.gov/OIGPublications/OIG-20-032-I.pdf; National Academy of Public Administration. *An Independent Assessment of Allegations of Scientific Misconduct filed under the National Oceanic and Atmospheric Administration Scientific Integrity Policy*. March 2020. Available at: https://s3.us-west-2.amazonaws.com/napa-2021/studies/independent-assessment-of-allegations-of-scientific-misconduct-noaa/NOAA_Scientific_Integrity_Final_Report_Redacted.pdf.

[26] See, for example, reports from EPA (https://www.epa.gov/scientific-integrity/reports-and-additional-resources); DOI (https://www.doi.gov/scientificintegrity/closed-cases); NOAA (https://sciencecouncil.noaa.gov/Scientific-Integrity-Commons/SIC-Reports-Allegations); and USDA (https://www.usda.gov/our-agency/staff-offices/office-chief-scientist-ocs/scientific-integrity-and-research-misconduct).

[27] EPA reports an average of more than 10 requests per year for advice on scientific integrity, with up to 60–90 such requests in some years. https://www.epa.gov/scientific-integrity/2019-annual-report-scientific-integrity.

[28] Berman, Emily and Jacob Carter. "Policy Analysis: Scientific Integrity in Federal Policymaking Under Past and Present Administrations." *Journal of Science Policy and Governance,* Vol. 13. No. 2. September 2018. https://www.sciencepolicyjournal.org/uploads/5/4/3/4/5434385/berman_emily__carter_jacob.pdf.

To address the growing challenge, agencies must apply scientific integrity policies to all those who conduct, manage, communicate, and make use of science in decision-making. In addition, agencies need to establish organizational cultures to protect against violations of scientific integrity from interference, including inappropriate actions from those involved in conducting, managing, communicating, or making decisions based on science. Chapter 3 identifies good practices for doing so.

Navigating the science-policy interface

Inherent in efforts to protect scientific integrity is the need to navigate the interface between science and policy, more accurately between scientific (and technical) research and policy-related decision-making. Scientific information can and does inform decision-making, and decision-making can and does raise questions that scientific research can address or inform. This interplay is inherent in notions of evidence-based policymaking.[29] However, policymaking requires consideration of factors beyond scientific data alone. Difficulties arise when the distinctions between research and decision-making are unclear, poorly understood, or ignored. This can occur when decision-makers distort, mischaracterize, or suppress scientific and technical research results that conflict with desired policy directions, or when they interfere in the research process to obtain desired results (see Box 2-2). It can also occur when researchers fail to appreciate the limits of their analysis or the broad set of factors that inform decision-making.

The degree to which scientific research guides policy decision-making varies significantly from one decision to another. Some decisions are largely "science-based" in that scientific information is the primary factor driving decision-making, ideally characterizing the best available science and associated uncertainty. Examples include the listing of species as endangered or threatened under the Endangered Species Act[30] and the determination of sustainable fishing limits in Federal waters under the Magnuson–Stevens Fishery Conservation and Management Act.[31] Decisions under these authorities that do not align with the best available scientific information can suggest potential violations of scientific integrity.

Many policy decisions are "science-informed," meaning that factors in addition to science shape decision-making. These factors may include financial, budget, institutional, cultural, legal, or equity considerations that may outweigh scientific factors alone. In designating critical habitat for threatened or endangered species, for example, decision-makers may consider factors other than scientific information, including economic, national security, or other relevant impacts. Of particular importance in this context is policy research, which often applies multi-disciplinary scientific approaches to analyze the tradeoffs and interactions among factors that affect how a policy decision was made.

At a time when agencies are encouraged to pursue evidence-based policymaking, it is all the more important to ensure appropriate interaction, maintain scientific integrity, and prevent interference. Improving transparency of scientific research and policy decision-making processes can also provide a means of ensuring that robust research and decision-making processes were followed and to demonstrate the range of factors that contributed to a policy decision.

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[29] See, for example, *Foundations of Evidence-Based Policymaking Act* (Public Law No. 115-434). Available at: https://www.congress.gov/bill/115th-congress/house-bill/4174.

[30] *Endangered Species Act of 1973, As Amended.* 16 United States Code Chapter 35. Available at: https://www.fws.gov/endangered/esa-library/pdf/ESAall.pdf.

[31] *Magnuson-Stevens Fishery Conservation and Management Act, As Amended* (Public Law No. 109479). Available at: https://media.fisheries.noaa.gov/dam-migration/msa-amended-2007.pdf.

Policymakers who are trained as scientists or working also as scientists can play key roles in navigating the science-policy interface. They need to make clear (to themselves and others), however, which role they are playing at any particular point in time, i.e., conducting research, managing science, or making policy decisions guided by science. They can also play key roles in ensuring science is appropriately considered in policymaking. CSOs designated under the 2021 Presidential Memorandum may be especially well-placed to play this role and ensure that science is appropriately considered in policymaking.

Box 2-2. 2020 Decennial Census

The Census Bureau, a statistical agency housed within the Department of Commerce, has responsibility for running and publishing the decennial census. The most recent census, completed in 2020, faced scientific integrity challenges related to two issues that deviated from best scientific practice: a proposal to add a citizenship question to the census, and denial of a request to extend the deadline for completing the census and releasing the data.

On the citizenship question, the Department of Justice formally requested reinstatement to the 2020 census of a question regarding citizenship to use in enforcing the Voting Rights Act.[32] The Census Bureau wrote to the Secretary of Commerce outlining three options for responding to the DOJ request and assessing the potential costs and benefits of each. Based on its research and review, the Census Bureau recommended against including a citizenship question because it would almost certainly depress the response rate and lead to "major potential quality and cost disruptions."[33] The Secretary nevertheless informed the Census Bureau that "after a thorough review of the legal, program, and policy considerations. . . reinstatement of a citizenship question on the 2020 decennial census is necessary to provide complete and accurate data in response to the DOJ request."[34] Accusations immediately arose that the Secretary ignored the scientific evidence presented by the Census Bureau and instead made a political decision at the behest of DOJ.[35] The issue was eventually brought to the courts and elevated to the Supreme Court, which rejected the Secretary's reasoning, finding it "contrived."[36] Ultimately, the census proceeded without the citizenship question.

On the deadline, the Census Bureau planned to extend the data collection for the 2020 Census and delay the publication of the state population counts from December 2020 to April 2021 due to challenges stemming from the COVID-19 pandemic. Bureau officials explained the delay was needed to ensure a complete and accurate count, especially for hard-to-count communities like those in rural areas with limited internet access. Because

[32] U.S. Department of Justice, Justice Management Division. "Request to Reinstate Citizenship Question on 2020 Census Questionnaire." Letter to U.S. Census Bureau, December 12, 2017. Available at: https://www.documentcloud.org/documents/4340651-Text-of-Dec-2017-DOJ-letter-to-Census.html.

[33] U.S. Department of Commerce, Economics and Statistics Administration. "Memorandum: Technical Review of the Department of Justice Request to Add Citizenship Question to the 2020 Census." January 19, 2018. Available at: https://www.osec.doc.gov/opog/FOIA/Documents/AR%20-%20FINAL%20FILED%20-%20ALL%20DOCS%20%5bCERTIFICATION-INDEX-DOCUMENTS%5d%206.8.18.pdf#page=1289.

[34] U.S. Department of Commerce, Secretary of Commerce. "Memorandum: Reinstatement of a Citizenship Question on the 2020 Decennial Census Questionnaire." March 26, 2018. Available at: https://www.osec.doc.gov/opog/FOIA/Documents/AR%20-%20FINAL%20FILED%20-%20ALL%20DOCS%20%5bCERTIFICATION-INDEX-DOCUMENTS%5d%206.8.18.pdf#page=1325.

[35] See, for example: Williams, Timothy. "What You Need to Know About the Census Citizenship Question." *The New York Times*. June 27, 2019. Available at: https://www.nytimes.com/2019/06/27/us/citizenship-question-census.html; and Denniston, Lyle. "It's Final: No Citizenship Question on 2020 Census." *Constitution Daily*. July 3, 2019. Available at: https://constitutioncenter.org/blog/its-final-no-citizenship-question-on-2020-census.

[36] Supreme Court of the United States, "Department of Commerce et al. v. New York et al." Slip Opinion No. 18-966. Decided June 27, 2019. Available at: https://www.supremecourt.gov/opinions/18pdf/18-966_bq7c.pdf.

the December 31 deadline for the release of the apportionment counts is spelled out in law, the Bureau and the Commerce Department requested that Congress extend the statutory deadline. Both the House of Representatives and Senate introduced legislation to extend the deadline, with the House passing its bill. The Bureau, however, issued a press release in August announcing a decision to accelerate the census. An investigation by the Office of the Inspector General found that the schedule change was not the Census Bureau's decision. Since census counts are used for the purpose of redistricting and reallocation of representation in the House of Representatives, these challenges to the 2020 census deadline were viewed as political interference that would undermine the integrity of the census counts. Similar concerns were raised about pressure to release state-level counts of unauthorized immigrants based on administrative records that Census Bureau officials believed did not have sufficient data quality to release.[37] While some of these concerns were settled through the judicial system, the Department of Commerce Office of the Inspector General investigated concerns about the rigor and accuracy of the census and concluded that the rushed timeline indeed led to uncertainty as to the quality of the final census count[38] and increased the risks to obtaining complete and accurate data.[39] To date no individuals have been held accountable for these allegations.

Improving Scientific Integrity Policies

Current Federal scientific integrity policies have been shaped by the 2009 Presidential Memorandum on Scientific Integrity and 2010 OSTP Memorandum on Scientific Integrity. The 2009 Presidential Memorandum assigns responsibility to the Director of OSTP for ensuring the highest level of integrity in all aspects of the executive branch's involvement with scientific and technological processes and articulates six principles to guide recommendations for Presidential action to guarantee scientific integrity throughout the executive branch (See Box 2-3).

Box 2-3. Principles for Scientific Integrity in 2009 Presidential Memorandum

1. Selection and retention of candidates for science and technology positions in the executive branch should be based on the candidate's knowledge, credentials, experience, and integrity.
2. Agencies should have appropriate rules and procedures to ensure the integrity of the scientific process within the agency.
3. Scientific and technical information used in agency decisions should be subject to established scientific processes, including peer review.
4. Agencies should make available to the public the scientific or technological findings or conclusions considered or relied upon in policy decisions (to the extent release is not restricted).
5. Agencies should have in place procedures to identify and address instances in which the scientific process or the integrity of scientific and technological information may be compromised.
6. Agencies should adopt procedures, including whistleblower protections, needed to ensure the integrity of scientific and technological information and processes used for decision-making or otherwise prepared.

[37] Bazelon, Emily and Michael Wines. "How the Census Bureau Stood Up to Donald Trump's Meddling." *The New York Times.* August 12, 2021. Available at: https://www.nytimes.com/2021/08/12/sunday-review/census-redistricting-trump-immigrants.html.

[38] U.S. Department of Commerce, Office of the Inspector General, "2020 Census Alert: Inability to Finish Nonresponse Followup RIs Raises Concerns Over the Quality of More than 500,000 Cases." Memorandum. December 28, 2020. Available at: https://www.oig.doc.gov/OIGPublications/OIG-21-015-M.pdf.

[39] U.S. Department of Commerce, Office of the Inspector General. "The Acceleration of the Census Schedule Increases the Risks to a Complete and Accurate 2020 Census." Final Management Alert No. OIG-20-050-M. September 18, 2020. Available at: https://www.oig.doc.gov/OIGPublications/OIG-20-050-M.pdf.

The 2010 OSTP Memorandum articulates detailed guidance in four areas essential to scientific integrity (See Appendix A for more detailed summary of the guidance in the 2010 OSTP Memorandum):

1. *Foundations of scientific integrity*, including a culture of scientific integrity free from political interference, credible government research characterized by independent peer review, free flow of scientific and technical information, and public communications with clear descriptions of uncertainties and underlying assumptions;
2. *Public communications*, including mechanisms for offering articulate, knowledgeable spokespersons to address the media and allowing scientists to speak to the media and the public about their official work;
3. *Use of Federal Advisory Committees* for scientific advice that engage qualified members with relevant expertise and balanced points-of-view; and
4. *Professional development of government scientists and engineers* that supports publication of findings in peer-reviewed professional or scholarly journals, presentations at professional meetings, participation in scholarly societies and on editorial boards, and receipt of honors and awards for their research and discoveries.

Since issuance of the 2010 OSTP Memorandum, more than 20 Federal agencies have developed and published policies to support scientific integrity (Appendix B). They include all major U.S. science agencies, as well as some agencies that issue regulations or use scientific findings in agency decision-making, including the Department of State and U.S. Agency for International Development. Agencies' current scientific integrity policies are generally responsive to the 2009 Presidential Memorandum and 2010 OSTP Memorandum. Of the published scientific integrity policies, most address at least partially the 4 areas of scientific integrity. Some agencies have updated their initial policies, reflecting ongoing experience.

More work is needed to strengthen and coordinate scientific integrity policies across Federal agencies. As a first step, agencies need to ensure their scientific integrity policies address all elements of the 2009 and 2010 Memoranda. Additional efforts can address notable differences that remain across agency policies, including:[40]

- *Definition of scientific integrity*. As noted in Chapter 1, some agency policies define scientific integrity, while others define a breach of scientific integrity. Several define neither term but reference the principles and guidelines articulated in the 2009 Presidential Memorandum and 2010 OSTP Memorandum.
- *Relationship between scientific integrity and research misconduct*. Some policies embed research misconduct in their scientific integrity policies, while others keep the two concepts separate. Some agencies place scientific integrity in the same organizational structure that handles research integrity, while others keep them separate.

[40] Nek, R., Eisenstadt, A.R. 2016. *Review of Federal Agency Policies and Scientific Integrity*. IDA Document D-8305. https://www.ida.org/research-and-publications/publications/all/r/re/review-of-federal-agency-policies-on-scientific-integrity.

- *Individuals covered by the policy*. Most policies focus on Federal workforce and intramural research activities, but some explicitly include contractors and grantees who receive Federal research funding and/or those who supervise scientific work or communicate findings to the public.[41]
- *Elements of the policy*. Some policies specifically address report clearance, communication with the media, and use of social media, while others are silent on these issues or leave them to separate communications policies. Some policies include specific mechanisms for addressing differing scientific opinions and scientists' right of last review of communications, while other policies are silent on these issues (see Chapter 5 for good practices on communicating scientific information).

Furthermore, agencies need to update scientific integrity policies to address emerging themes highlighted in the 2021 Presidential Memorandum and not yet addressed specifically in most agency scientific integrity policies, notably:[42]

- *Diversity, equity, inclusion, and accessibility (DEIA),* which is important to the composition of the scientific and technical workforce, the questions that scientific research is asked to answer, and the utilization of science in the equitable delivery of Federal Government programs;
- *New technologies, including artificial intelligence (AI) and machine learning (ML)*, which present new challenges to scientific integrity, including the potential for bias in AI and ML algorithms; and
- *Evolving modes of science, such as citizen science and community-engaged research,* which can be important avenues for public engagement and building public trust in Federal science.

Care needs to be taken to allow agencies to tailor policies to their specific missions. A one-size-fits-all approach cannot begin to reflect the considerable diversity among agencies that conduct, manage, communicate, or use science and evidence (see Box 2-4). While all can adhere to common principles to uphold scientific integrity, their policies need to be adapted to their particular roles and functions. For example, statistical agencies have a coordinated commitment to scientific integrity and mission autonomy that is well suited to their specific focus.[43]

[41] EPA issued a rule to include a scientific integrity clause in solicitations and contracts that might require a contractor to perform, communicate, or supervise scientific activities or use scientific information to perform advisory and assistance services. This clause complements the EPA scientific integrity policy to ensure all scientific work developed and used by the EPA is accomplished with scientific integrity. https://www.federalregister.gov/d/2020-20665/p-amd-4.

[42] Good practices for addressing these issues are identified in Chapter 4 of this report.

[43] Statement of Commitment to Scientific Integrity by Principal Statistical Agencies. Available at: https://www.census.gov/content/dam/Census/about/about-the-bureau/policies_and_notices/scientificintegrity/Scientific_Integrity_Statement_of_the_Principal_Statistical_Agencies.pdf.

Box 2-4. Scientific Integrity Policy at the U.S. Department of State

As an agency that uses science and data in decision-making and policymaking and communicates broadly to international audiences, the Department of State has maintained public scientific integrity guidance since 2012, with updates in 2013 and 2018. This guidance, published within the Foreign Affairs Manual, provides definitions of key themes, processes for scientific clearances and communications, and reporting mechanisms for violations of scientific integrity. The Department engages on a variety of international scientific topics and pervasive technologies, including nuclear nonproliferation, chemical and biological weapons, synthetic biology, AI, space, climate change, and ocean fisheries, among many others, and coordinates closely with scientific and technical agencies to uphold the scientific integrity principles of the originating agencies for any data and information utilized. Recently, the Department released the "Enterprise Data Strategy – Empowering Data Informed Diplomacy" to drive evidence-based and data-informed decision-making. One of the strategy's five guiding principles underscores the importance of scientific integrity across data literacy, analytics, management, and governance. The Department engages externally on science and technology with international partners, and it also engages within the Department and across agencies on critical mission and management functions, including strategic competition and DEIA, that advance the Department's targeted implementation of the Enterprise Data Strategy and support the execution of its overall mission.

McKeon, Brian. 2021. "Enterprise Data Strategy." Washington, DC. Department of State. https://www.state.gov/wp-content/uploads/2021/09/Reference-EDS-Accessible.pdf

Strengthening Policy Implementation

Beyond strengthening the content of scientific integrity policies, additional effort is needed to improve implementation of policies and their translation into practice. Well-considered policies, while necessary and challenging to achieve, are not enough. Additional efforts are needed to identify and implement good practices for policy implementation that can achieve measurable outcomes and impacts. A recent review by the U.S. Government Accountability Office noted good progress toward policy development and implementation and called on several agencies to enhance implementation, including to educate and communicate with staff about scientific integrity policies; designate SIOs; take steps to evaluate and monitor implementation of policies; and document procedures for identifying and addressing alleged violations of scientific integrity policies.[44]

Subsequent chapters of this report identify good practices that agencies can put in place to foster a culture of scientific integrity, protect the integrity of Federal science, communicate scientific information with integrity, and identify and address instances in which scientific integrity may be compromised.

[44] U.S. Government Accountability Office. *Scientific Integrity Policies: Additional Actions Could Strengthen Integrity of Federal Research*. Report Number: GAO-19-265. April 2019. Available at: https://www.gao.gov/assets/gao-19-265.pdf.

3. Building a Culture of Scientific Integrity

Robust scientific integrity policies are essential to protecting Federal science, but they cannot be effective without a supportive agency culture of scientific integrity. A culture of scientific integrity fosters open discussion, refined understanding, and transparent processes. It promotes principled behavior, as well as awareness of, and compliance with, scientific integrity policies by scientists and non-scientists at all levels. The shared behaviors and norms of rigorous science are a powerful force against unjustified interference in Federal science.

The 2021 Presidential Memorandum calls for the Task Force to identify effective practices for educating and informing employees and contractors of their rights and responsibilities related to scientific integrity policies and for promoting transparency in the implementation of agency scientific integrity policies and in handling allegations of misconduct. The Task Force views agency leadership, training, and transparency as three important components for building a culture of scientific integrity. Together, leadership, training, and transparency can help weave scientific integrity into the fabric of agencies' organizational and professional culture. This chapter identifies good practices for implementing each of these elements.

Demonstrating Leadership

Enhancing a culture of scientific integrity begins with agency leadership. Leaders at all levels within agencies must recognize the importance of organizational culture in shaping behavior and commit to strengthen the knowledge, norms, and habits that support scientific integrity. Agency leaders can develop visions for scientific integrity in their organizations and actively support efforts to achieve it. Together with staff, supervisors, and other key partners and stakeholders, agency leaders can work to set clear scientific integrity policy expectations; maintain support; regularly communicate expectations; and highlight and reward successful efforts. Leaders should model good practices and mediate negative influences on scientific integrity.

Upholding a culture of scientific integrity means demonstrating the importance of scientific integrity to an agency's mission through principles and action. Supporting and encouraging agency work on writing, updating, and implementing scientific integrity policies is at the base of scientific integrity leadership. In addition to ensuring work is accomplished in a manner that is consistent with scientific integrity policy, leaders can enhance the culture of scientific integrity by holding accountable those whose behavior is not consistent with scientific integrity. They can talk about scientific integrity often, promote and reward discussions that include various perspectives, hire staff with appropriate scientific credentials, encourage professional development, listen openly, judge fairly, and act according to their scientific integrity policies.

Leaders can demonstrate commitment to scientific integrity by establishing governance bodies that promote clear scientific integrity practices. These bodies can be charged to ensure that an agency's scientific integrity policy is well-documented, supported by agency guidance, and implemented transparently. They can also be responsible for maintaining the policy, developing and conducting outreach to agency staff and the broader scientific community, requiring appropriate enterprise-wide training programs in scientific integrity, and establishing clear procedures for reporting, investigating, and if appropriate, ensuring accountability.

Leaders are also a critical barrier to inappropriate political, ideological, or economic influences on science. It is up to leaders to recognize these influences and speak up or seek help to address them. Leaders are also responsible for preventing and exposing lapses in scientific integrity by encouraging

reporting of concerns and being transparent about their own decision-making. To demonstrate their commitment to scientific integrity, political appointees in some agencies sign a statement or certificate attesting that they have received scientific integrity training and understand the policy. This information can then be made available on the agency's scientific integrity website to publicize leadership's commitment to scientific integrity.

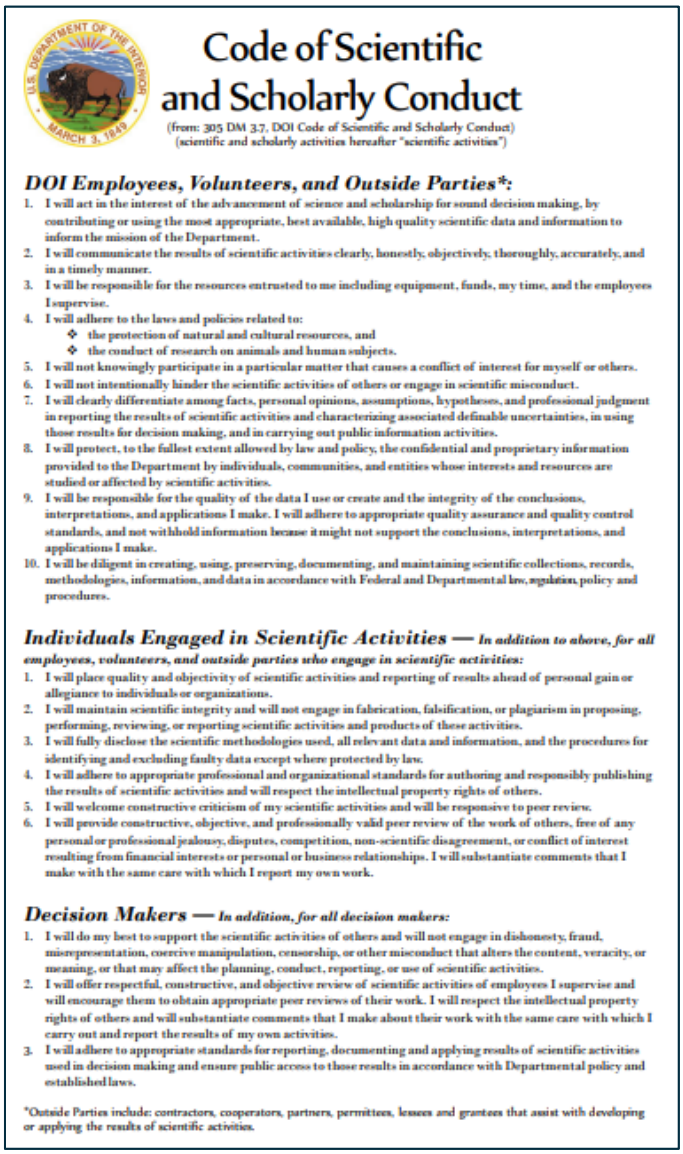
Improving Training in Scientific Integrity

Success of agency scientific integrity policies depends on training all employees, contractors, awardees, and other collaborators in these policies and practices. Scientific integrity training reinforces agency culture by: helping employees understand relevant policies, providing a common language for communicating about scientific integrity, and delineating specific roles and responsibilities. Good practices for agencies to consider for improving training in scientific integrity include the following:

- *Mandate scientific integrity training for everyone in Federal agencies who plays a role in conducting, managing, communicating, or making use of science in decision-making.* Extending scientific integrity training requirements beyond Federal scientists to include all others whose job functions relate to the conduct, management, communication, or utilization of scientific research is essential to ensuring all understand how the policy applies to them and their actions. Training needs to include agency leaders, senior executives, political appointees, supervisors of scientists, contractors engaged in scientific activities, and communications professionals, among others. Because scientific integrity is everyone's responsibility, agencies might consider training all staff, noting that they do not have to be directly connected to scientific activities to uphold scientific integrity when they suspect a policy has been violated. Especially important is having agency leaders visibly and transparently take scientific integrity training themselves and tracking completion of training requirements.
- *Train promptly and repeatedly*. Initial scientific integrity training is best provided as part of onboarding procedures. Staff need to understand agency scientific integrity policies and procedures when they enter the Federal workforce. Many staff move around within agencies, and someone who is not connected to science when they are first hired might move to a position that touches science, its communication, or its use in decision-making. Additional training and regular refreshers may vary depending on an employee's responsibilities. Also important are training updates at critical junctures in employees' careers, such as promotions and changes in position and responsibilities.
- *Take advantage of teachable moments.* Include scientific integrity training in established gatherings. Regular staff meetings, retreats, all-hands meetings, and gatherings provide opportunities for refreshers and reminders.
- *Tailor training for senior-level staff and appointees.* While senior-level staff, including political appointees, should take standard scientific integrity training, tailored training can focus on specific considerations. This training can include leadership roles and responsibilities in scientific integrity, concerns about political interference, and agency-specific scientific integrity issues. It can also promote discussion and build strong working relationships with SIOs.
- *Design training to be engaging and interactive.* Use of interactive modules, case studies, and roleplay is especially valuable in scientific integrity training. Live training has the advantage of allowing for questions and building trust between SIOs and agency staff. Several agencies have

developed module-based training approaches that allow for tailored programs based on the scope of work of the employee.

- *Implement codes of conduct.* These codes provide plain-language interpretation of policy requirements that support training by helping individuals see more clearly how policy requirements apply directly to them. Some agencies state specifically that a violation of the code of conduct is a violation of the scientific integrity policy (See Figure 3-1).
- *Review and revise training content on a regular basis* to ensure it fully supports the goals of the agency's scientific integrity policy and any updates to that policy. Such updating may be particularly timely following the issuance of the 2021 Presidential Memorandum.
- *Connect foundational elements from related training with scientific integrity training.* Agencies provide separate training on several concepts related to scientific integrity, such as ethics, responsible conduct of research, financial conflict of interest, data collection and management, and scientific review. Coordinating such training with scientific integrity training ensures consistency, reduces confusion, and can bolster trust in scientific integrity policies.



Code of Scientific and Scholarly Conduct

(from: 305 DM 3.7, DOI Code of Scientific and Scholarly Conduct)
(scientific and scholarly activities hereafter "scientific activities")

DOI Employees, Volunteers, and Outside Parties*:

1. I will act in the interest of the advancement of science and scholarship for sound decision making, by contributing or using the most appropriate, best available, high quality scientific data and information to inform the mission of the Department.
2. I will communicate the results of scientific activities clearly, honestly, objectively, thoroughly, accurately, and in a timely manner.
3. I will be responsible for the resources entrusted to me including equipment, funds, my time, and the employees I supervise.
4. I will adhere to the laws and policies related to:
   - the protection of natural and cultural resources, and
   - the conduct of research on animals and human subjects.
5. I will not knowingly participate in a particular matter that causes a conflict of interest for myself or others.
6. I will not intentionally hinder the scientific activities of others or engage in scientific misconduct.
7. I will clearly differentiate among facts, personal opinions, assumptions, hypotheses, and professional judgment in reporting the results of scientific activities and characterizing associated definable uncertainties, in using those results for decision making, and in carrying out public information activities.
8. I will protect, to the fullest extent allowed by law and policy, the confidential and proprietary information provided to the Department by individuals, communities, and entities whose interests and resources are studied or affected by scientific activities.
9. I will be responsible for the quality of the data I use or create and the integrity of the conclusions, interpretations, and applications I make. I will adhere to appropriate quality assurance and quality control standards, and not withhold information because it might not support the conclusions, interpretations, and applications I make.
10. I will be diligent in creating, using, preserving, documenting, and maintaining scientific collections, records, methodologies, information, and data in accordance with Federal and Departmental law, regulation, policy and procedures.

Individuals Engaged in Scientific Activities — *In addition to above, for all employees, volunteers, and outside parties who engage in scientific activities:*

1. I will place quality and objectivity of scientific activities and reporting of results ahead of personal gain or allegiance to individuals or organizations.
2. I will maintain scientific integrity and will not engage in fabrication, falsification, or plagiarism in proposing, performing, reviewing, or reporting scientific activities and products of these activities.
3. I will fully disclose the scientific methodologies used, all relevant data and information, and the procedures for identifying and excluding faulty data except where protected by law.
4. I will adhere to appropriate professional and organizational standards for authoring and responsibly publishing the results of scientific activities and will respect the intellectual property rights of others.
5. I will welcome constructive criticism of my scientific activities and will be responsive to peer review.
6. I will provide constructive, objective, and professionally valid peer review of the work of others, free of any personal or professional jealousy, disputes, competition, non-scientific disagreement, or conflict of interest resulting from financial interests or personal or business relationships. I will substantiate comments that I make with the same care with which I report my own work.

Decision Makers — *In addition, for all decision makers:*

1. I will do my best to support the scientific activities of others and will not engage in dishonesty, fraud, misrepresentation, coercive manipulation, censorship, or other misconduct that alters the content, veracity, or meaning, or that may affect the planning, conduct, reporting, or use of scientific activities.
2. I will offer respectful, constructive, and objective review of scientific activities of employees I supervise and will encourage them to obtain appropriate peer reviews of their work. I will respect the intellectual property rights of others and will substantiate comments that I make about their work with the same care with which I carry out and report the results of my own activities.
3. I will adhere to appropriate standards for reporting, documenting and applying results of scientific activities used in decision making and ensure public access to those results in accordance with Departmental policy and established laws.

*Outside Parties include: contractors, cooperators, partners, permittees, lessees and grantees that assist with developing or applying the results of scientific activities.

***Figure 3-1**. Everyone at DOI, including leadership, is covered by the Code of Scientific and Scholarly Conduct. The Code incorporates expectations for all employees, volunteers, and outside parties; individuals engaged in scientific activities; and decision-makers at all levels. Violating the Code may be considered as a violation of scientific integrity.*

Promoting scientific integrity among extramural researchers

Greater attention is needed on scientific integrity training for extramurally funded researchers. Grantee institutions do not conform to any standards for training in scientific integrity and wide variability exists across institutions. Efforts to harmonize common elements of scientific integrity policies across the Federal Government could serve to inform extramural scientific integrity policies and training requirements. Where relevant, scientific integrity training requirements could be incorporated into the terms of the contracts or agreements. Improving scientific integrity training at extramural grantee institutions can have expansive, long-term benefits. To the extent scientific integrity training is embedded in university-

level scientific training programs, future generations of researchers will enter the workforce better able to appreciate and uphold the principles of scientific integrity.

Increasing Transparency to Support Scientific Integrity

Transparency can serve multiple functions in building a culture of scientific integrity. Improving transparency of agency policies, practices, and procedures can help agencies demonstrate their commitment to scientific integrity. Transparency can also help deter violations of scientific integrity policies and detect them when they occur by making sure relevant information is readily available to all who can use it. Improving the transparency of scientific and decision-making processes can allow violations of scientific integrity to be more easily discovered.

Improving transparency in scientific integrity policies, practices, and procedures

Improving the transparency of scientific integrity policies, practices, and procedures helps ensure that all stakeholders have access to and awareness of scientific integrity policies and practices. Making information about how to report potential concerns easy to locate can help improve reporting by both agency staff and those outside the agency. Transparency of outcomes of investigations into alleged infractions can demonstrate an agency's vigilance in responding to concerns and can help build public trust. Efforts must be taken to balance transparency and confidentiality. Policies and practices need to protect sources and investigative records to the extent allowable by law, as well as those engaged in investigating allegations. Good practices for agencies to consider for improving transparency in support of scientific integrity include:

- *Post scientific integrity policies online.* Posting scientific integrity policies on public websites makes the agency's commitment to scientific integrity visible to both agency staff and the general public.
- *Make instructions for reporting concerns prominent online*. Agencies can provide information on scientific integrity websites about how to report concerns about scientific integrity. In addition to specifying a point-of-contact (e.g., the SIO), agencies can include descriptions of procedures and resources used to identify and address instances in which policies may have been violated.
- *Provide regular public reports about scientific integrity violations and how they are addressed*. Public reporting can be accomplished in numerous ways, including annual reports or public stakeholder meetings. Public reports must release meaningful information while protecting privacy and confidentiality of those involved in reporting and investigating alleged violations, among others.
- *Create easy to find scientific integrity web pages*. Public websites can ensure that all those covered by agency scientific integrity policy and the public have ready access to relevant agency information in one place. Helpful information to post includes the agency's scientific integrity policy, points-of-contact and procedures for reporting concerns, reports about allegations and findings of investigations, and links to information about related issues such as ethics, whistleblower protections, and human resource policies (see Appendix B for links to several agency scientific integrity policies and websites).

Improving the transparency in scientific and decision-making processes

Beyond improving the visibility of scientific integrity policies and practices, transparency can play a larger role in supporting the integrity of Federal science and its use in decision-making. Efforts to implement open science can make more of the process and outputs of scientific research freely and readily accessible to other scientists, engineers, policymakers, students and educators, and the general

public, while maintaining needed protections of national security, personal privacy, and other sensitive information. By making research publications, study data, analytical software and code, and study protocols more readily available for inspection and reuse—as Federal science agencies are currently doing—open science affords new opportunities to detect instances of interference, mischaracterization, and other policy violations.[45] As such, open science is an essential enabler of scientific integrity.

Similarly, efforts to improve transparency of Federal decision-making processes can improve the ability to assess the degree to which relevant science is taken into account and make more visible those instances in which it is not. For example, development of Federal regulations follows strict procedures that support transparency, e.g., through issuance of Notices of Proposed Rulemaking that solicit public input and establishment of regulatory dockets containing related information that are open for public inspection. Continued vigilance is necessary to ensure these procedures are followed and that all underlying documentation—including related scientific information—is made publicly available. Application of similar, though more streamlined, processes can help provide similar degrees of transparency into other Federal decision-making efforts that do not involve regulatory development (e.g., agency policies and guidance documents), specifically as it concerns documenting the role of science in the decision-making, what science was used, and any differing scientific opinions (Box 3-1).

Box 3-1. Transparency in Decision-making at USDA

The U. S. Department of Agriculture (USDA) is committed to building public trust in USDA research and science-based policymaking. The USDA Scientific Integrity policy, first implemented in 2011 and updated over the years as a Departmental Regulation, provides a strong foundation for protecting and responding to concerns regarding scientific integrity. As described in the current Departmental Regulation, it is USDA policy to ensure the quality, accuracy and transparency of scientific information used in decision-making. This policy includes direction that USDA decision-making use scientific information derived from well-established scientific processes; ensure that scientific data and research undergo independent peer review by qualified experts; reflect scientific information appropriately and accurately; and make scientific findings that are relied upon publicly available online and in open formats.

See: https://www.ocio.usda.gov/document/departmental-regulation-1074-001.

[45] The OSTP Memorandum on Increasing Access to the Results of Federally Funded Scientific Research, issued on February 22, 2013, directs Federal agencies with annual R&D expenditures of more than $100 million to develop plans for providing free public access to the outputs of funded research, in particular, peer-reviewed scholarly publications and digital research data. See: https://obamawhitehouse.archives.gov/blog/2013/02/22/expanding-public-access-results-federally-funded-research.

4. Protecting the Integrity of the Research Process

A central element of scientific integrity is protecting the research process itself. The 2021 Presidential Memorandum states that when scientific or technological information is considered in policy decisions, it should be subjected to well-established scientific processes, including peer review where feasible and appropriate, with appropriate protections for privacy. The Memorandum also directs the Task Force to identify effective approaches for: avoiding interference in research and data collection; handling scientific disagreements about methods and conclusions; minimizing conflicts of interest; supporting the professional development of Federal scientists; and addressing emerging technologies and modes of science. This chapter is organized around these topics. It also examines approaches for enhancing DEIA as an element of scientific integrity policies.

Avoiding Interference in Research and Data Collection

It is critical to protect the entire research process, including research design, data collection, and analysis from political and other forms of interference. Scientifically unjustified intrusions into the research process can result in the use of inadequate or flawed research design or methods, leading to misleading or inaccurate findings. They can also impose requirements to collect or not collect certain types of data, to collect or not collect data on certain timelines, or to use or not use certain types of analyses, undermining the ability of scientists to produce valid, reliable, and useful findings for addressing the most critical issues facing the Nation. Scientific integrity policies need to be clear that such interference is a violation of scientific integrity. Good practices, such as those listed below, can further assist agencies in protecting research and data collection from interference:

- *Early public disclosure of study plans.* Public disclosure of study plans or protocols early in the research process can provide a basis for detecting deviations in data collection or analysis that can signal violations of scientific integrity. Disclosure can be challenging and may not be appropriate for all research studies, but it has been successfully applied in some research domains through pre-registration of studies that discloses key elements of the study methodology and/or through disclosure of the complete study protocol and analytical plan.[46] Ensuring early consensus by relevant subject matter experts on the study protocol can also improve the likelihood of consensus on methodology, interpretation of results, and conclusions.
- *Robust data quality and integrity processes.* Documented procedures for collection, storage, management, analysis, and security[47] of both externally generated and internally generated data provide a base of authoritative information that can inform scientific debates about the interpretation of results. Such procedures can be used to ascertain whether the data are of the right type, quality, and quantity for their intended use, as well as to detect interference or manipulation. They must be consistent with relevant legal authorities and privacy, civil rights, and civil liberties protections.

[46] NIH requires preregistration of all clinical trials it funds and the public posting of study protocols after study completion to support understanding and interpretation of results. See https://grants.nih.gov/policy/clinical-trials/reporting/index.htm. ED's Institute of Education Sciences includes preregistration of studies as one of its Standards for Excellence in Education Research and requires that principal investigators of exploration and causal impact studies register studies within 1 year of a receiving a new award. See https://ies.ed.gov/seer/index.asp.

[47] Security encompasses protection of the data from loss, misuse, modification, and unauthorized access.

- *Timely public release of data and code resulting from Federally supported research, while maintaining necessary protections for privacy and security*. This principle is embedded in a number of current policies and laws covering a variety of types of Federal data related to research and research publications. Availability of such information in a timely manner, e.g., not later than public release of associated publications or manuscripts, can provide an important check on published findings and allow for further analysis and debate about methods and conclusions. Care needs to be taken to release data in ways that do not threaten privacy (e.g., of research subjects) or national security.
- *Increase coordination with the Office of Management and Budget to clarify expectations for the review of data collection instruments for scientific research* that are subject to the Paperwork Reduction Act. Such expectations should include avoiding delays during clearance, ensuring research methods and instruments are consistent with research best practices in the given academic discipline, and maximizing the usefulness of the data to the Federal Government.

Handling Scientific Disagreements

Disagreements about scientific methods and conclusions are part of the scientific process and are essential to continuous advances in understanding the world and to the health of the scientific enterprise itself. Vigorous internal discussion of different points of view helps to anticipate counter-arguments and alternative positions that could arise during public comment and peer review. The scientific process benefits from a culture of rigorous scientific debate that guards against inadequate methods and analysis that welcomes open discussion across potentially disparate perspectives. However, clear and transparent processes are required for addressing scientific disagreements and for ensuring that debates are based on differences of scientific opinion and not on a desire to achieve pre-determined outcomes. Agencies need to provide clear and transparent processes for addressing disagreements and seeking paths toward resolution. Good practices for agencies to consider for handling disagreements about scientific methods and conclusions include:

- *Graduated approaches* that range from extended conversations among a research team to additional outside technical expertise (e.g., technical working groups that advise the agency throughout the conduct of a study) to resolve scientific disagreements and limiting these discussions to those with relevant expertise. (Box 4-1 describes the approach used at EPA).
- *Independent scientific review from an external body* can be helpful for handling scientific disagreements that cannot be adjudicated through internal or external peer review. The charge to any such body should identify the specific issues of the disagreement to be considered.
- *Describe unresolved differing scientific opinions in documents to inform Federal decision-making*. When legitimate scientific disagreements cannot be resolved, scientific documents and resulting reports need to inform decision-makers of relevant limitations, uncertainties, and disagreements. Procedures need to ensure that differing scientific opinions are carried from initial scientific documentation through final decision-making.
- *Leadership support of and respect for differing scientific opinions.* Agency leaders can encourage healthy scientific debate by publicly and consistently stating the importance of differing scientific opinions, as well as limitations and uncertainties of the science as a legitimate and necessary part of providing the best possible scientific information to Federal decision-makers.

Box 4-1. EPA's Approach for Expressing and Resolving Differing Scientific Opinions

The Environmental Protection Agency has developed a set of documented "Approaches for Expressing and Resolving Differing Scientific Opinions" to resolve or record this important part of the scientific process. The document recommends a progression of approaches that employees and managers can use to encourage the expression and satisfactory resolution of differing scientific opinions. Recommended steps begin with discussions within the team developing a scientific product and can proceed to the engagement of additional subject matter experts, managers, and then to internal or external peer review of the scientific merit of the differing opinions, documenting the differing opinions for the policymakers. This progression is in accord with EPA's Scientific Integrity Policy, which envisions the use of internal deliberations and scientific peer review. These approaches have been successfully used many times to resolve or record disputes for decision-makers and have been welcomed by managers as ways of supporting scientists who care deeply that their professional opinions are heard and as a critical mechanism for surfacing issues.

See https://www.epa.gov/scientific-integrity/approaches-expressing-and-resolving-differing-scientific-opinions

Minimizing Conflict of Interest

Public trust in government and science is enhanced by minimizing conflicts of interest in the funding and conduct of science by the Federal Government. The public is best served by science that is free of political, ideological, financial, and corporate influence. Likewise, use of science by Federal employees, government representatives, and advisory bodies in reaching and justifying decisions must be unbiased and unencumbered by special interests. Federal ethics rules establish the basic framework for addressing conflict of interest considerations across a range of activities related to Federal science:

- *For Federal scientists*, Federal ethics rules govern conflicts of interest and requirements for recusal from particular work functions. Agencies can clarify that failure to disclose a conflict of interest is also a violation of scientific integrity policies.
- *For grant reviewers,* Federal ethics rules apply to peer review of grant applications conducted by several Federal science agencies. Some agencies consider factors beyond an individual reviewer's financial conflict of interest when determining a reviewer's suitability for evaluating a particular application, taking into consideration factors such as close personal or professional relationships (including previous co-authorship on a research publication) that might affect a reviewer's judgement of the merit of proposed work. Agencies need to ensure that conflict of interest policies are clear, transparent, and consistently implemented to those reviewing and evaluating research proposals.
- *For Scientific Advisory Committees,* the Federal Advisory Committee Act and ethics rules apply. Such committees play key roles in providing objective scientific advice to the Federal Government and draw their membership from scientists in academia, industry, nonprofits, and state and local governments. Agencies need to clarify which conflicts of interest disqualify individuals from participating on different committees and make processes and criteria used to set them up transparent.

For addressing scientific matters, Federal agencies see a growing need to expand the definition of conflict of interest beyond financial considerations. A broader definition for scientific activities could include a range of financial, personal, professional, or legal considerations and conflicts of commitment that might influence an individual's scientific activities or judgment and undermine their objectivity or

create an unfair competitive advantage for another individual or organization. Such efforts would entail substantial coordination across agencies and with the government-wide Office of Government Ethics.

Supporting Professional Development of Federal Scientists

Professional development opportunities advance scientific integrity by helping Federal scientists stay abreast of scientific developments, engage with the broader community of scientists, and maintain the professional standards and scientific norms of this broader community. A culture that supports continued development of Federal scientists, with special attention paid to the inclusion of scientists from traditionally underrepresented groups, is the culture that best supports scientific integrity. Enhancing opportunities of agency scientists for activities within a community of practice or scientific discipline, improvement of technical and professional skills, open participation in the communication of science, and leadership training build a strong scientific workforce that can safeguard scientific integrity in agency operations. Good practices for agencies to consider include:

- *Conduct periodic independent external reviews of Federal scientists and science.* Reviews of Federal scientists by experts outside of the Federal Government can help measure and guide continued professional development of scientific staff while protecting against internal agency bias and political interference. Some agencies use panels of external scientists (that operate as Federal Advisory Committees). Others make use of regular assessments of laboratory programs via external organizations.
- *Promote attendance at scientific conferences*. Participating in scientific conferences is essential to the professional development of Federal scientists. It enables them to engage with the broader scientific community and stay current on advances in their field. It also signals to the scientific community the Federal Government's commitment to science and supports recruitment of talented scientists. The 2010 OSTP Memorandum directs agencies to encourage the presentation of research findings at professional meetings. Government-wide limitations on conference attendance undermine this guidance and have a disproportionate effect on professional development of Federal scientists.
- *Improve equity of access to professional development opportunities for Federal scientists*, e.g., by developing and applying transparent criteria for allocating limited professional development resources and creating easily accessible websites with information on professional development opportunities and procedures for applying.
- *Work with ethics offices to establish guidelines for participation of Federal scientists as officers and leaders in professional organizations*. Such roles are important to foster professional development. Several agencies have clarified procedures for review and approval of such participation, so that it is done equitably and in ways that manage conflicts of interest and other government ethics issues.
- *Recognize notable professional accomplishments and contributions to the scientific community by Federal scientists*. Although some awards already exist, enhanced use of such recognition can increase the visibility and credibility of Federal scientists to the field and also help retain and develop Federal scientific staff. Such awards can be particularly valuable for Federal scientists who work in regulatory roles with limited ability to disseminate findings in external scientific journal publications.

Enhancing Diversity, Equity, Inclusion, and Accessibility

Strengthening scientific integrity is not possible without elevating issues of DEIA as an integral component of the entire scientific process. Attention to DEIA can improve the representativeness and eminence of the scientific workforce, foster innovation in the conduct and use of science, and provide for more equitable participation in science by diverse communities. The responsible and ethical conduct of research requires an environment that is equitable, inclusive, safe, and free from harassment. Activities counter to these values are disruptive to the conduct of science. These issues further align with the Executive Order on Diversity, Equity, Inclusion, and Accessibility in the Federal Workforce, which affirms that "advancing equity, civil rights, racial justice, and equal opportunity is the responsibility of the whole of our Government."[48]

A strong culture of scientific integrity begins with ensuring a professional environment that is safe, equitable, and inclusive of all scientists. Attention must be given to creating welcoming environments across Federal agencies. In addition, many scientific efforts require field work, and agencies often place extensive efforts into the acquisition and use of safety equipment. However, individuals from certain underrepresented groups are more susceptible, especially when in field environments, to violence and harm from others.[49] Protecting scientists from all risks—including potential public threats and harassment—while performing their work is crucial to avoid losing people, including those from diverse backgrounds, in science. Through their support of research training programs, Federal funding agencies have an opportunity to advance such efforts across the broader scientific community.

While numerous programs exist for improving DEIA within the scientific community, they generally operate in parallel with—rather than as an integral part of—scientific integrity policies. There is an opportunity to better connect these two important issues as agencies move forward with efforts to expand DEIA in their scientific workforce and throughout the scientific process. Organizational structures vary across agencies, and implementation falls on different offices (for differing matters of employee protection or administration of appropriate organizational function), but an understanding that such activities are within the scope of scientific integrity could help foster a more collaborative, coordinated community.

Future scientific integrity frameworks can make more explicit consideration of DEIA. Of particular interest is consideration to how scientific integrity policies may enhance equity in the delivery of Federal programs, regulations, and prioritization of funding topic areas as well as the diverse perspectives and debate necessary to scientific innovation and rigorous research.[50]

To integrate DEIA into a culture of scientific integrity, may consider the following good practices:

- *Engage SIOs in broader agency efforts related to DEIA.* The addition of scientific integrity professionals, together with other key leaders, in discussions and planning on the recruitment,

[48] *Executive Order on Diversity, Equity, Inclusion, and Accessibility in the Federal Workforce.* Executive Order 14035. June 25, 2021. Available at: https://www.whitehouse.gov/briefing-room/presidential-actions/2021/06/25/executive-order-on-diversity-equity-inclusion-and-accessibility-in-the-federal-workforce/.

[49] Demery, A.J.C., Monique Avery Pipkin, M.A. . 2021. "Safe fieldwork strategies for at-risk individuals, their supervisors and institutions." *Nature Ecology & Evolution,* Vol. 5, pp. 5–9, October 12, 2021. Available at: https://doi.org/10.1038/s41559-020-01328-5.

[50] For example, due to the greater levels of fish consumed by some Native American communities, disproportionate impacts could occur should there be violations of scientific integrity when regulating chemical exposures linked to bioaccumulation in fish.

retention, development, and advancement of scientists—especially scientists from underrepresented communities—helps to ensure that scientific integrity is appropriately and carefully considered.

- *Embed DEIA issues in scientific integrity policies*. Scientific integrity policies need to explicitly recognize and aim to protect against policy violations that have a disproportionate impact on underrepresented groups or weaken the equitable delivery of Federal Government programs. SIOs must consider the impacts of their determinations and corrective scientific actions in the same light—and should mitigate any concerns for a fair and equitable outcome. Greater agency efforts will be needed to monitor the impacts of Federal science and science-informed policies on underrepresented groups.
- *Incorporate DEIA considerations into all aspects of science planning, execution, and communication.* Such a deliberate approach can help mitigate bias and ensure research efforts help to build an evidence base of effective approaches to advancing science and equity. Emphasizing DEIA in all parts of the scientific process helps to ensure that: 1) scientists are adequately trained on its importance and the potential negative impacts of exclusion on science, 2) scientific research focuses on research questions, samples, and settings that reflect the diversity of the U.S. population, and 3) data are sufficiently disaggregated, where possible, by demographic variables to facilitate identification and analysis of issues affecting people from all backgrounds.

Box 4-2. The U.S. Geological Survey's Approach to Engaging Scientific Integrity Officials in DEIA

The U.S. Geological Survey (USGS) engages scientific integrity officials in DEIA efforts in a number of ways that can be adapted for use in other agencies:

- The senior scientific integrity official serves on the USGS Workplace Equity, Engagement and Excellence Council. The Council is charged with providing direction, guidance, and oversight of programs, practices, policies, and procedures impacting the workplace, diversity, and culture of the entire 8,000-person science organization. The Council includes other science leaders as well as human resources and the Diversity and Equal Opportunity Office.
- The 2021 update to the USGS scientific integrity policy (in progress) places a high priority on investigating potential scientific integrity policy violations that have a disproportionate impact on underrepresented groups or that weaken the equitable delivery of USGS science programs.
- A Youth and Education in Science (YES) program is run by science quality and integrity officials to engage young people from diverse backgrounds in USGS science. Important efforts target two groups highly underrepresented in science, technology, engineering, and mathematics: Native Americans and people with disabilities. The STEP-UP program engages students on the autism spectrum with teachers and job coaches from local schools and USGS scientists on science projects. The students gain valuable job skills to support their goals of seeking employment and greater independence.

See: https://www.usgs.gov/about/organization/science-support/office-science-quality-and-integrity/step-up

Addressing Emerging Technology and Modes of Science

The generation, storage, and use of large amounts of data have grown over the last few decades, with data science continuing to emerge as a critical cross-cutting field. New technology and new approaches to science—such as big data analytics, AI, and ML—have become central to many areas of science and Federal decision-making. While these technological advances provide opportunities to more deeply and efficiently learn about the world, they also present unique challenges and complexities for ensuring

scientific integrity.[51] AI and ML algorithms can magnify biases inherent in underlying data source and may contain their own inherent biases that lead to inaccurate findings, conclusions, and policy decisions. Lack of transparency into ML algorithms can undermine trust in the outcomes generated and ultimately in science and government. The concentration of data and AI capabilities in the hands of the Federal Government and private sector organizations may create inequities in who can conduct leading-edge research and who can access and make use of the results of such work.

Addressing these concerns involves a variety of agency actions, many of which extend beyond scientific integrity policies, including:

- *Research on methodology and operations* geared to issues associated with data generation, curation, storage, and use, such as assessing uncertainty and potential bias when combining data from a variety of data sources and improving the transparency of machine-learning algorithms.
- *Improving transparency* by communicating clearly what is known about the provenance, validity, and accuracy of the agency's data. Measures of data quality (both uncertainty and bias) can be particularly important for work in AI and ML.
- *Enhancing accountability* by ensuring there are always individuals responsible for decisions based on AI and ML algorithms.
- *Public-private partnerships* that harness the innovation capabilities of the private sector and ensure that the public's interests in data access, privacy, and equity are addressed.

Where scientific integrity policies can contribute is in helping ensure:

- AI and ML do not magnify biases inherent in the data they analyze or are trained on;
- Transparency is provided into ML algorithms;
- Quality of data used for AI and ML, including in their generation, sharing, and use;
- Privacy considerations are incorporated into AI and ML processes and privacy risks are mitigated;
- Transparency and access to data and AI capabilities.

Additionally, scientific integrity policies can be extended to offices and work units not traditionally focused on research and that make use of the results of AI and ML-based analyses.

In addition to emerging technology, evolving modes of science—such as citizen science and community-engaged research[52]—present new opportunities and challenges. These forms of science are increasingly used to engage individuals and communities in research efforts. They can improve the efficiency, cost-effectiveness, and democratization of science. Although many citizen science and community-engaged research programs operate without any engagement with Federal agencies, those that involve Federal agencies present new opportunities and challenges. Federal partnerships with citizens and communities to collect data can produce results otherwise unachievable due to time, resource, or access limitations. Nevertheless, expanding participation in Federal science by individuals who are not trained scientific professionals creates new challenges to scientific integrity, including unresolved data quality, management, access, and security issues. Trust is more likely to be built if the

[51] AI and ML also present unique challenges for protecting individual privacy. Such issues can be addressed through coordination with privacy experts and embedding privacy protections at the inception of new projects.

[52] See Appendix D for descriptions of the terms "citizen science" and "community-engaged research."

public can be assured that agencies apply the same scientific quality standards for the outputs of these approaches as for other Federally-supported research. Good practices for agency consideration include:

- *Use citizen science and community-engaged research to build public trust in Federal science*. Federal engagement in these novel forms of science provides members of the public the opportunity to engage with Federal scientists, direct research toward issues of community interest, and contribute data and analytical prowess.
- *Create scientific integrity resources tailored to new modes of science and participants in them.* Some agencies have created guides for volunteers engaged in citizen science projects they support. In some projects, participants are Federal grantees or contractors who are covered by agency scientific integrity policies and need to understand their obligations. Special consideration may need to be given to protecting against interference from local or community interests.
- *Educate participants about scientific integrity and its importance in advancing science.* Federal engagement in citizen- and community-engaged research projects offers opportunities to extend the culture and values of scientific integrity to a broad community of interested participants. Agencies can offer training in scientific integrity principles and practices to citizens and community members engaged in such work.
- *Provide needed institutional support to ensure scientific integrity in agency-supported citizen and community-engaged research*. This support includes institutional review boards for research involving human subjects and data and terminology standards to improve consistency and comparability of results. Agencies can also make use of equipment loan programs to ensure the suitability of research resources and compliance with standards that improve the robustness of community-driven efforts.
- *Produce guidance documents, toolkits, and other resources tailored for citizen- and community-engaged research activities involving Federal agencies*. These resources can address data governance, data integrity and privacy considerations, standardized data formats, and data access options. Standardized quality assurance/quality control guidelines and checklists would increase the credibility (and expanded use) of community-generated data sets.

Beyond these practices, additional efforts are needed to find effective ways to govern multi-jurisdictional projects that collect and process observational data at regional, national, or global scales to improve the quality of the data collected and the findings obtained. More broadly, data use rights and permissions for community-generated data sets and best practices for acknowledging citizen-generated data in agency reports and publications needs to be addressed. Progress in these areas will help agencies maintain the integrity of research processes as they engage in more novel forms of research and data collection.

5. Communicating Scientific Information with Integrity

Fundamental to effective government policy decision-making and restoring trust in government is ensuring the availability of credible and reliable scientific information to both decision-makers and the public, in forms they can readily understand. The 2021 Presidential Memorandum calls for the Task Force to identify effective practices regarding the engagement of Federal scientists and contractors with the news media, on social media, and for protecting scientific independence during clearance and review. When scientific information from the government is suppressed, distorted, or politically influenced, the lack of information—or worse, the misinformation that is shared—can impede the equitable delivery of Federal Government programs and undermine public trust. At a time when the public has access to numerous streams of sometimes conflicting information, open, clear, and trustworthy scientific communications have never been more important.

This chapter identifies good practices for communicating scientific information with integrity. The practices include mechanisms that can enable Federal scientists to communicate about their science without political interference, while complying with agency policies and procedures for planning and conducting scientific activities, reporting scientific findings, and reviewing and releasing scientific products. A cross-cutting theme is ensuring clear distinctions between communication of scientific findings and related policy decision-making. Many of the challenges in communicating scientific information with integrity stem from the often-close relationship between the two in areas of great public interest. Equally important is ensuring that information is disseminated in ways that are accessible to diverse audiences, to avoid exacerbating existing inequities.

Encouraging Openness and Transparency with the Media

In instructing agencies to develop communications policies that promote openness and transparency with the media and the public, the 2010 OSTP Memorandum specifies that Federal scientists be able to speak to the media and the public about their official work, through appropriate coordination with their supervisor and public affairs office. It also states the need to comply with limits on the disclosure of classified information. The 2010 OSTP Memorandum further states that public affairs officers may not ask or direct Federal scientists to alter their scientific findings and requires that a dispute resolution process exist regarding decisions on proceeding with proposed interviews and information-related activities.

While scientists who do not want to talk with the media should not be required to do so, agencies can support those who decide to proceed with media engagements. Effective interaction allows the media to have access to scientists based upon their official scientific work and area of scientific expertise, which contributes to the accurate reporting and public communication of science. Agency processes often operate on slower timelines than those of reporters, who sometimes desire rapid access to Federal experts for tight deadlines. Good practices for agencies to consider to encourage openness and transparency in communicating with the media include:

- *Develop specific media communication policies and procedures that apply to practicing scientists.* These policies and practices are aimed at scientists working in research positions in their agencies and reflect the guidance contained in the 2010 OSTP Memorandum and 2021 Presidential Memorandum. They allow media access in coordination with supervisors and public affairs officials. They should provide clear guidance on scientists' engagement with the media, limitations on the

types of information that may be communicated (e.g., protecting security and privacy) and the role of communications offices in supporting these interactions.

- *Provide clear guidance on the role of communication professionals in scientific media engagements.* To promote transparency and trust, communications professionals should work collaboratively with scientists being interviewed, helping scientists effectively navigate media interviews, and supporting—not censoring—the flow of scientific information.
- *Establish clear timelines on coordination processes for media engagement* to ensure timely responses to media interview requests and to establish expectations for reporters, scientists, and communication staff consistent with agency mission. Such an approach can be accompanied by a presumption of agency approval or agreement if no response is received in a reasonable, specified timeline.
- *Accelerate responsiveness by pre-clearing talking points and scientific spokespeople.* Periodically updated talking points or "desk statements" provide communications professionals with up-to-date information for timely response to press queries. Some agencies create both "evergreen," top-line communications messages about frequently raised issues and reactive, "hot button issue" messages in advance of anticipated media inquiries. Pre-cleared spokespeople can be given latitude to respond rapidly to the media on a broad set of scientific issues related to the agency in an objective, non-partisan, and knowledgeable fashion.
- *Train scientists to interact with the media.* Such training prepares scientists for different types of media interactions, such as for print media, live media, and on-camera interviews. It can help scientists use terminology that is accessible to diverse audiences and prepare them to comment on the work of other scientists, as they are often asked to do. Ensuring that scientists are ready for media success through coaching or other methods is important.

Using Social Media for Enhancing Science Communications

Agencies recognize that social media communication of scientific information can play an important role in external science communications. It is also used increasingly as a form of communication between and among practicing scientists. A number of agencies actively encourage interested Federal scientists to interact with scientific peers and the broader public community through digital and social media. It is important that scientists are supported and trained in public and social media communication, as well as in Federal ethics rules and agency social media policies. Social media guidance should be clear, formalized, easily available, and known to employees.

Good practices for agencies to consider regarding the use of social media to communicate scientific information include:

- *Provide training to scientific and communications staff about social media*. Effective training focuses not only on translation of scientific information into public communications, but also on limitations and expectations in the use of personal social media accounts, e.g., reinforcing that scientists may not announce results of Federal research that have not yet been reviewed and approved and must avoid engaging in discussion of agency policy.
- *Clarify guidance on allowable use of personal social media accounts by Federal scientists to communicate scientific information to the public.* Several agencies have found that personal social media accounts can be an effective mechanism for Federal scientists to complement other agency

communication channels in disseminating the results of scientific research. While use of social media can enable scientists to engage with the broader scientific community and improve public outreach, it must be done in ways that are consistent with Federal records requirements, ethics rules, and other agency guidelines and regulations (e.g., security, privacy). Successful use of personal social media accounts requires that agencies provide scientists with clear written guidance and expectations on social media interactions.

- *Engage scientific subject matter experts to assist with official agency social media efforts.* Engagement of Federal scientists and other knowledgeable staff to work with public affairs offices improves the accuracy and objectivity of their science communications via official agency social media channels. Some agencies employ full time staff or use time-limited assignments to engage subject matter experts in translating complex scientific information into meaningful, reliable, and useful social media information.

Clearing Written Communications and Reports

Agencies employ a range of review and clearance processes to ensure the quality, accuracy, clarity, consistency, objectivity, and transparency of scientific findings reported in scientific, technical, and policy publications. Review and clearance processes are tailored to different types of communication products, including research manuscripts and presentations, Federal statistical products, press releases, policy documents, regulatory documents, and other external communications.

Written policies for clearance and review need to indicate clearly expectations and requirements for independence from political interference, suppression, and undue delay (see Box 5-1). Effective review and clearance procedures for scientific products must protect the process from interference (including

Box 5-1. USGS Fundamental Science Practices

Since 1879, the USGS has used internal and external reviews to ensure the quality and integrity of science reported in its products. In 2006, the USGS formalized these practices into a comprehensive set of principles, policies, and procedures called "Fundamental Science Practices." These practices aim to ensure the quality and integrity of all USGS science and uphold the USGS's reputation and mission to provide reliable science for pressing societal issues. The practices apply to all aspects of USGS's science efforts, from planning studies through dissemination of results, with a focus on extensive peer review requirements for checking all USGS information products (e.g., journal articles, book chapters, USGS series publications, interpretive maps) before dissemination to the public. All products, for example, must have at least two documented and tracked peer reviews in addition to a final check from another set of career scientists. These requirements apply to any product for which a USGS scientist is an author or co-author.

Designated Approving Officials within the USGS Office of Science Quality and Integrity—career scientists outside of authors' supervisory structure—confer final approval on new interpretive scientific information products. These career scientists ensure that all USGS publications receive rigorous technical peer reviews, that authors adequately address the peer reviewer comments, that information is clear and understandable for the intended audiences, that related data and software are made available, and that the products, consistent with the USGS mission, inform policy but do not prescribe or advocate for policies. These Approving Officials work closely and collaboratively with authors throughout the review process so that most reviews are completed within a few days. An appeals process exists to resolve any disputes. Once approved, the science product carries the full backing of the USGS. Other science agencies have developed similar internal review processes (e.g., NOAA's Framework for Internal Review of Fundamental Research Communications).

For additional information about USGS Fundamental Science Practices, see http://www.usgs.gov/fsp.

political interference) and outright suppression. Clearance procedures for policy documents need to ensure that policies reflect the appropriate and accurate use of science.

Good practices for agency consideration for review and clearance of scientific documents and policy documents, including those subject to review by multiple agencies include:

- *Use distinct approval processes for scientific documents and policy documents*. Differentiation of approval processes can help ensure that the approval of scientific products is based on the strength of the data, methods, and appropriate conclusions, not the potential policy implications of the studies. Reviews of policy documents can focus on the policy while ensuring the accuracy of the science that is referenced.
- *Minimize opportunities for interference during agency reviews of scientific manuscripts prior to publication*. Decisions to approve scientific manuscripts should be based on scientific and technical quality considerations, and denial decisions should be documented and provide an appeals mechanism with timely adjudication.
- *Limit non-scientific reviews to non-technical content*. Agencies need to clearly define the roles of non-scientific staff in review and clearance processes for agency scientific products. For example, policy officials may be included for awareness and to review policy implications of the work; communication officials may improve, clarify, and approve press materials developed around scientific results. Otherwise, they should refrain from commenting on the science itself. Similarly, reviews of science reports to Congress and through interagency processes need to ensure that changes by non-scientific staff do not alter scientific results.
- *Include scientific experts in review of policy documents that make use of scientific information.* Scientific experts can be instructed to limit their review to ensure that referenced scientific information is complete and accurate, rather than focusing on policy implications or recommendations.
- *Include scientific experts in the clearance and review of public communications based on scientific work.* Communications offices can consult with relevant scientific staff within the agency and work with writers and editors to convert technical writing into plain language to enhance communication with the public (Box 5-2).
- *Ensure timely release of scientific products to avoid real or perceived suppression*. Agencies can establish clear expectations for the timeliness of internal review and approval processes, as well as appeal processes, to prevent inappropriate delay of publication. Timelines can account for variations in the length and complexity of products (e.g., manuscripts). Although this approach cannot reduce delays in external peer reviews where agencies cannot control the timeline, it can prevent unjustified delays in getting agency documents published.
- *Permit scientific manuscripts to be posted as preprints after they have cleared agency review.* Scientists in some disciplines use preprint servers to accelerate public accessibility of scientific manuscripts prior to external peer review and publication. To balance public interest in rapid access to new research findings and the widescale accessibility of papers posted on preprint servers, agencies are wise to complete internal scientific reviews prior to posting to ensure the quality of the information disseminated by agency scientists.

- *Clearly differentiate between scientific results and agency positions*. The results of scientific work from an agency scientist (e.g., scientific publications and presentations) do not necessarily reflect agency policy. Agencies can avoid potential confusion by including disclaimers stating that the findings and conclusions are those of the author(s) and not of the agency. Use of such disclaimers should not serve as a substitute for careful, thoughtful internal review of agency science publications and other outputs. Agencies can also avoid potential confusion by ensuring scientific publications do not contain markings or content that might be misinterpreted as agency endorsement. For example, the USGS removed the names of senior political leadership from the inside cover of its USGS series publications to avoid the appearance of political influence on the science.

Box 5-2. COVID-19 Guidance at CDC

The Centers for Disease Control and Prevention (CDC) is a leader of the Federal response to public health emergencies, including the COVID-19 pandemic. CDC is responsible for providing timely, evidence-based, and accurate public health advice to public health professionals, decision-makers, and the public based on the latest scientific findings, including those from domestic and international public health investigations, research, case reports, surveillance data, and other scientific sources.

To this end, for the COVID-19 pandemic, CDC regularly develops and publishes COVID-19 public health guidance documents targeted to the needs of specific audiences, providing information on everything from infection control (masking, physical distancing, isolation, and quarantine), diagnostic testing, returning to school, vaccination, and operating businesses more safely. It is important that these materials are based on the highest quality and current scientific information and are carefully reviewed and updated as more is learned about SARS-CoV-2 (the virus that causes COVID-19) and the effectiveness of the public health measures implemented to contain and end the pandemic.

In January 2021, at the request of the CDC director, a thorough review of all COVID-19 guidance was initiated to ensure that CDC's public health guidance was evidenced-based and free from political interference. In February 2021, CDC identified and remove d a guidance document, "Opening up America Again," that had been posted to the CDC website on April 16, 2020, without CDC authorship, scientific review, or approval.

Following this review process and its findings, CDC published a table of the COVID-19 guidance documents that were removed from the CDC website and developed several recommendations to protect the scientific integrity and quality of CDC's guidance. These include:

- Accompanying major guidance documents with scientific briefs on evolving scientific topics (i.e., masking, testing, and vaccine recommendations from the Advisory Committee on Immunization Practices) that provide the scientific evidence for the guidance;
- Ensuring transparent communications with media and communication channels for each new major guidance; and
- Reviewing major guidance areas and related documents regularly.

For additional information, see:
https://www.cdc.gov/coronavirus/2019-ncov/communication/guidance.html
https://www.cdc.gov/coronavirus/2019-ncov/downloads/communication/Guidance-Review.pdf.

Building Trust between Scientists and Communications Professionals

Foundational to supporting effective communication of scientific information is building collaborative working relationships between agency scientists and communications staff. Scientists and communications staff have a shared responsibility for effectively communicating scientific information to the public in ways that are accessible to diverse audiences. They benefit from clearly defined roles and responsibilities and effective collaboration. Good practices for agencies to consider in building this foundational relationship include:

- *Periodic joint training in scientific communication and public engagement*. Agencies can encourage the critical building of trust between Federal scientists and communications staff through periodic training. At agencies with such practices, Federal scientists and communications professionals learn to recognize the mutually beneficial nature of the relationship and the value added by close collaboration. Scientists learn more about what information is and is not appropriate for different audiences, and communications staff learn to recognize the nuance and importance of presenting scientific information effectively.
- *Coordinate within organizational structures*. Especially in large agencies, scientific expertise often resides in subordinate units rather than at headquarters. Agencies need to adapt communications policies and practices to address these distinctions. For example, communications professionals in subordinate units may be more familiar with appropriate practices for handling scientific information than are headquarters staff who frequently handle other types of communications.
- *Assist scientists in translating scientific and technical work for the public.* This can be accomplished by training scientists in scientific communication for the public and by engaging communications experts to work with scientists in the objective and accurate translation of their technical work into plain language that is accessible to members of the public from all races, ethnicities, backgrounds, abilities, cultures, and beliefs (Box 5-3). Training for early-, mid- and late-career scientists on how to speak to the media and translate scientific information for general audiences can be helpful. Role-based training can address differences between speaking on behalf of the Federal Government, speaking about a researcher's science, and speaking on personal opinions, to enhance the effective communication of information to all.

Box 5-3. Communicating Science to the Public

The Department of Energy (DOE) has a unique partnership with a private philanthropic organization to: foster scholarship about communicating discovery science to the broader public, identify communication best practices for engaging the public about basic science, and use this scholarship and analysis to develop training and tools for science communication to enhance public engagement around basic research. This partnership, the Science Public Engagement Partnership (SciPEP), focuses on ensuring that basic science engagement with the public is effective and sustained. The partnership is also committed to DEIA in its work. See: https://scipep.org/about/.

The National Institutes of Health (NIH) has also created useful tools and provided resources to improve communication of scientific information. See: https://www.nih.gov/about-nih/what-we-do/science-health-public-trust/tools).

- *Provide scientists the right of last review of scientific content in communication releases* based primarily on their research. Doing so can ensure the accuracy of scientific statements and build trust

in the communication process, even if scientists are restricted from commenting on policy-related content.

The effective communication of Federal Government science benefits decision-makers and the public at large. Strong scientific integrity policies and practices help to ensure the accurate dissemination of the information. Reinforcing communications guidelines in scientific integrity policies can ensure appropriate communication guidance that specifically addresses the expectations for integrity in science communications and practices found in the 2010 OSTP Memorandum.

6. Procedures for Safeguarding Scientific Integrity

Procedures to safeguard against violations of scientific integrity are key to successful implementation of scientific integrity policies. The 2009 Presidential Memorandum directs each agency to "have in place procedures to identify and address instances in which the scientific process or the integrity of scientific and technological information may [have been] compromised." While procedures and practices may be implemented and managed differently in different agencies, they are fundamental to all agencies that conduct, manage, communicate, or use science in decision-making.

This chapter summarizes good practices for safeguarding scientific integrity, including procedures to encourage reporting of concerns and potential violations; address reported concerns; and restore scientific integrity and enforce consequences when violations of scientific integrity policy have been established. As illustrated, transparency and documentation in the conduct, management, communication, and utilization of science in decision-making are essential to safeguard against scientific integrity policy violations and in allowing them to be detected or adjudicated when they occur.

Easy, Early, and Safe Reporting of Concerns and Violations

Safeguarding begins with framing scientific integrity as the responsibility of all who are involved in the scientific enterprise and reinforcing it as a fundamental agency value. Mechanisms that allow early, easy, and safe reporting and protect those who report allegations are key to early detection. Early detection can prevent issues from becoming more serious and polarized. Early awareness of situations at high risk for possible lapses of scientific integrity, such as those with added time pressures or concerning controversial issues, may make it possible to institute measures to preemptively advise and support staff as necessary. Many of the concerns reported to SIOs can result in negative consequences for those reporting; thus, confidentiality is of the utmost importance to protect the integrity of the process and to create a willingness in submitters to come forward.

Facilitating easy and early reporting

Agencies can take several steps to simplify the reporting of scientific integrity concerns and promote early interaction with the SIO through informal and formal channels:

- *Establish channels for informal early consultations.* Staff often desire an informal conversation with an SIO to seek advice on preventing a situation of concern, addressing one before it gets worse, or to determine whether it falls under the scientific integrity policy. SIOs often play the role of an ombudsperson, directing concerns not covered by scientific integrity policies to other organizational units (e.g., offices of human resources, offices of civil rights, offices of the inspector general, ethics officials) and providing advice on how to formally report an allegation, if necessary. Early engagement can also be helpful in raising awareness of situations that may be at higher risk of unintentional or intentional violations, such as challenging work environments, staffing situations, high-profile or controversial scientific topics, and urgent, fast-paced activities.
- *Provide clear guidance on how to formally report scientific integrity violations*. Basic instructions about how to submit a formal allegation of a scientific integrity infraction and what information needs to be included are essential elements of such guidance. Instructions should make clear that someone need not have a scientific role, be directly involved, or witness a potential violation to file a report. Guidance can also make clear that concerns about scientific integrity can be submitted by those outside the agency and individuals not covered by the scientific integrity policy.

- *Reinforce messaging on formal and informal approaches.* Messaging from leadership and supervisors at all levels can increase the visibility of informal consulting and formal reporting mechanisms and the likelihood that people will come forward. SIOs and agency leadership can amplify and endorse messaging about reporting and indicate that anyone can report. Other useful mechanisms include using signage, giving prominence to scientific integrity reporting information on websites, and including scientific integrity in townhall meetings.

Protecting those who report

Equally important as providing avenues for reporting is providing clear protections for those who report allegations of scientific integrity violations. Standing up for scientific integrity comes with a risk to the submitter's career. Those who report need to be confident that their rights are protected and that making an allegation will not be a basis for discipline or other adverse action, absent other compelling reasons for such. Many agencies report that fear of retaliation, retribution, and reprisal prevents scientists or other staff from reporting scientific integrity concerns or alleged violations of scientific integrity policies. While whistleblower protections exist, they do not necessarily apply to all types of scientific integrity violations. Federal scientists may choose to keep silent, move to another position, or leave public service altogether in the face of interference they fear reporting. As first steps, agencies can adopt the good practices below:

- *Communicate that confidentiality for submitters, informants, witnesses, and subjects during a formal investigation will be protected to the extent allowable by law* and that if identities are shared, submitters will be notified and their identity will be shared only on a need-to-know basis. Anonymous reporting may afford the most protection for submitters, but it can hamper efforts to pursue allegations because it precludes asking additional questions to obtain information the submitter may be best positioned to supply.
- *Extend additional explicit protections to employees who uncover or report alleged violations of scientific integrity in good faith*. The protections should build upon the Whistleblower Protections Enhancement Act of 2012, which prohibits retaliation against Federal scientists who challenge censorship or make disclosures related to the integrity of the scientific process.[53]
- *Establish easy, safe ways to report retribution, reprisal, or retaliation and support employees.* Anonymous staff surveys, for example, can be used not only to monitor overall policy awareness and implementation but also to notify SIOs early of possible problem areas. Anonymous surveys with open-ended questions provide valuable opportunities to safely share descriptions of putative wrongdoing. Open "office hours," telephone hotlines, secure mailboxes, and webforms can also be used to protect the identify of those raising concerns.
- *Anonymize tracking and reporting of scientific integrity concerns.* Attention is needed to ensure that agencies track only broad summary statistics and information related to informal consultations and advising. Limiting information to dates, keyword descriptions, and where in the agency it occurred can help maintain anonymity.

[53] The WPEA defines censorship as "any effort to distort, misrepresent, or suppress research, analysis, or technical information." In addition, the WPEA requires the designation of a whistleblower ombudsperson in Federal agency offices of Inspectors General who are tasked with educating employees about prohibitions against retaliating against Federal whistleblowers and their specific rights and remedies. See https://www.govinfo.gov/content/pkg/PLAW-112publ199/pdf/PLAW-112publ199.pdf.

Addressing Scientific Integrity Policy Violations

Although terminology differs across agencies, addressing allegations generally includes several steps. *Screening* determines whether a reported allegation has merit and could be considered a violation of scientific integrity policy; *fact-finding* includes a thorough and systematic search for the facts of a case to develop a factual record; *reviewing evidence* seeks to determine the extent to which scientific integrity has been compromised and how it occurred; *making determinations* is based on an evidentiary standard; *crafting recommendations* involves outlining ways to safeguard the science in the present and prevent similar problems in the future; and *handling appeals* involves procedures for re-review of cases. Good practices for consideration across agencies include:

- *Develop consistent screening procedures*. Consistent criteria and procedures are needed to screen informal queries and formal allegations that come from sources inside or outside the agency. An initial examination of the readily available information can help determine whether an allegation falls within the scope of scientific integrity, is sufficiently credible and specific to allow further fact-finding, and has sufficient substance to warrant an investigation.
- *Provide tools, resources, and authority for screening and fact-finding* so SIOs can gather initial information, use it to identify and plan to gather additional information, conduct interviews, consult subject matter experts, and examine evidence to determine the extent to which scientific integrity has been compromised.
- *Eliminate conflicts of interest for all staff involved in the screening, fact-finding, review of evidence, adjudication, and recommendations* with respect to the issue in question, the respondent, the informant, and other key witnesses. Organizational separation of functions, to the extent possible, can support the integrity of the process by helping prevent outcomes of one step from inappropriately influencing another.
- *Give SIOs discretion to determine how to proceed with examination of individual cases.* SIOs need flexibility to determine whether to engage subject matter experts or review panels in addressing specific cases. Some violations are sufficiently clear and straightforward to be adjudicated by the SIO, but more complex cases may benefit from input of outside experts or panels of experts. Panels can be helpful in cases involving high-ranking officials but are more time-consuming.
- *Seek specificity and clarity in recommendations and/or corrective scientific actions.* To facilitate their implementation, recommendations need to specify roles and responsibilities to allow for ongoing monitoring to ensure compliance. Consideration should be given to actions to prevent similar issues in the future.
- *Establish formal procedures for appeals.* Effective procedures specify who can appeal and how. They allow subjects of allegations to appeal determinations and may allow both subjects and submitters to appeal screening decisions. They also call for written appeals that provide a clear rationale for the appeal and consider criteria such as significant new evidence.
- *Provide timely notification to all parties* at key points in the process, describing access to data and evidence used in the case and opportunities to respond at the onset of screening, outcome of screening, completion of the determination, and at the end of the process.
- *Develop instructions on record keeping and reporting outcomes.* Reports, record keeping, and notifications are necessary to increase transparency and trust in the adjudication process. At the same time, lack of confidentiality protections for SIO records can dissuade people from coming

forward. Protections are needed for records SIOs compile in the course of investigating allegations of scientific integrity violations.

Enforcing Consequences

Scientific integrity policies need adequate mechanisms to implement both corrective scientific actions (i.e., to correct the scientific record) and administrative actions (i.e., to hold violators accountable) when allegations are substantiated. Coordination and communication are essential among various officials responsible for taking such actions, including SIOs, CSOs, managers and supervisors, human resource officials, Inspectors General, and Special Counsels. Good practices for agencies to consider include:

- *Establish clear consequences for violations of scientific integrity.* While SIOs are not responsible for administrative actions regarding violation of scientific integrity policies, agencies should ensure actions are defined, enforceable, consistent with other work-related infractions, and aligned with existing human resource policies (including due-process protections for employees) as appropriate. Consequences may need to be spelled out in scientific integrity and/or human resources policies.
- *Designate responsibility for each aspect of accountability.* Clarifying responsibilities among SIOs, Inspectors General, and human resources officials for enforcement actions is especially important. SIOs need clear authority and delegations to compel cooperation with investigations and enforce corrective scientific actions.
- *Develop clear procedures for coordination between SIOs and Inspectors General*. Inspectors General may be responsible for some elements of investigation and corrective action. Coordination can serve as a means of sharing information on mutual concerns, seeking advice on conducting investigations and whistleblower protections, and obtaining independent assistance for scientific integrity allegations directed against high-level officials. It is essential to build trust between SIOs and Inspectors General.

The good practices identified in this chapter can help agencies safeguard scientific integrity, but they fall short of comprehensive solutions. Complementary efforts are needed at a government-wide level to establish additional and enforceable protections for those who report allegations of scientific integrity violations and to establish clear consequences for senior officials who knowingly violate scientific integrity policies and undermine the integrity of government science.

7. Institutionalizing Scientific Integrity

Beyond strengthening policies and implementing the good practices identified in this report, agencies need to demonstrate a commitment to scientific integrity and put in place the organizational structures that support it. Central to these efforts will be SIOs and CSOs. As noted, the 2021 Presidential Memorandum instructs all Federal agencies—not only those that fund, conduct, or oversee scientific research—to designate a senior career employee as agency SIO, with responsibility to oversee implementation and improvement of scientific integrity policies and processes. It further instructs agencies that fund, conduct, or oversee scientific research to designate a senior agency employee as CSO. To be successful, SIOs and CSOs will need to be sufficiently empowered and resourced to carry out a broad set of responsibilities. This chapter identifies elements of authority and independence that agency leadership will need to address in order to succeed in protecting scientific integrity.

Ensuring Authority and Independence of SIOs and CSOs

Institutionalizing scientific integrity means empowering SIOs and CSOs through proper positioning within the agency and supporting their work across the agency. Agencies need to position the SIO and CSO to enable them to have both influence over the range of activities associated with scientific integrity and to engage in the full scope of policymaking related to scientific integrity. The 2021 Presidential Memorandum instructs agencies with a CSO to have the SIO report directly to the CSO for matters involving scientific integrity policies. The CSO is a high-ranking official, who may or may not be a career official. While SIOs themselves are career employees, it is important to minimize opportunities for and perceptions of conflict of interest and political interference, protect their position and role within the agency, and maximize their independence. Equally essential is ensuring they have sufficient authority to carry out their roles. This can include designating them as chair of agency-wide scientific integrity committees with senior officials from across the agency. SIOs need the ability to gather and protect information to support the review and assessment of situations brought to their attention (e.g., as potential violations of scientific integrity) and to implement corrective action to head off or respond to concerns. In conjunction with the CSO, they also need to ensure the appropriate engagement of scientific leadership in decision-making processes that are guided by science.

Improving Coordination of Agency Functions

As they build up their scientific integrity functions, agencies will need to clarify the authorities of SIOs in relation to those of other agency officials with related responsibilities. Many agencies rely on human resource departments to impose penalties for violating scientific integrity policies, ethics officials to clarify various issues, and an Office of Research Integrity or Office of the Inspector General (OIG) to adjudicate claims. While some issues, such as alleged censorship of scientists or suppression of science, fall within the domain of the SIO, other concerns, such as falsification or fabrication, may be addressed by other officials. Clarifying who has responsibility and authority for handling different types of allegations or different parts of the administrative process is key to the success of scientific integrity policies. So is promoting effective communication and coordination among related officials, e.g., so the SIO knows if the OIG is pursuing an alleged violation and the outcome of any investigation. Greater clarity of roles helps SIOs fulfill their mandated responsibilities and ensures that Federal staff and the public know who to approach with concerns related to scientific integrity.

Advancing Related Policy Development

Scientific integrity is part of a broad framework of policies and procedures that guide agency actions in areas related to the conduct, management, communication, and use of science. The concepts of research misconduct, research integrity, and research security are essential to the integrity of science but may be addressed in separate policies with separate mechanisms for monitoring and compliance. Harmonizing policies and ensuring needed coordination is essential to effective protection of scientific integrity. Future interagency coordination could help identify and promulgate effective practices for doing so. Equally important to promoting scientific integrity are policies to promote DEIA and create safe workspaces that are free from harassment. Open science policies and practices provide transparency to help ensure that publications, data, and other outputs of Federally funded research are readily available to other researchers, innovators, students, and the public (taking into consideration legal and ethical limitations on access, such as national security and privacy). Broader scientific issues related to peer review, Federal Advisory Committees, and laboratory accreditation are also relevant. Agencies need to advance policy development in all these areas in coordination with their scientific integrity programs. An effective approach is to engage SIOs and CSOs in the development or revision of this broader set of policies and practices that affect science and scientists. Doing so will help provide needed scientific integrity perspectives before such policies are issued and better ensure they support the needs of scientific integrity.

Establishing Scientific Integrity as a Career Path

The establishment of SIOs and CSOs in Federal agencies will create not just new positions but also new job functions within some Federal agencies. As such, particular attention will need to be devoted to building the capacity of newly designated SIOs, CSOs, and other scientific integrity staff, and to creating career paths for developing and enhancing talent over time. Internal and cross-agency rotations and other short-term or part-time shared assignments can act as apprenticeships, effectively building key skills in individuals across agencies and raising awareness of scientific integrity as a career option. Other steps agencies can take include development of creative scientific integrity training programs, short-term career development opportunities for early career scientists, and refresher training over time. Training and career development options should be inclusive of members from underserved communities and diverse voices within the scientific integrity community. In addition, agencies may need to work together and with the Office of Personnel Management to develop consistent roles and responsibilities for positions at different levels to support a scientific integrity career pathway for Federal employees. Experience as an SIO can be an important qualification for other scientific or leadership positions within Federal agencies, including potentially as CSO. Since the number of experienced candidates for these positions will be limited, attention needs to be paid to succession planning within agencies as well. Designating deputy SIOs is another avenue to increase the number of people within agencies who can take up these responsibilities.

Promoting Interagency Communication and Coordination

Critical to building or improving successful scientific integrity programs in Federal agencies and empowering SIOs will be sharing experiences, ideas, best practices, and innovative approaches across agencies. An active interagency working group has focused for many years on research misconduct issues and recently expanded its scope to include a broader set of scientific integrity issues. Establishing this or another group as a formal interagency Scientific Integrity Council, similar in nature to the Chief Financial Officers Council, Chief Information Officers Council, and Council of Inspectors General on

Integrity and Efficiency (CIGIE), would be an important step in highlighting the importance of scientific integrity not just in science agencies but across the Federal Government—especially at this point in time when agencies are appointing new scientific integrity officers and developing new policies. Such a council could be charged to adopt and share best practices, optimize resources, share experiences and innovative approaches, and align activities across agencies, where feasible. Such a group could also complement OSTP's role in monitoring regular performance and improvement of scientific integrity across agencies and host a scientific integrity web portal with documents from and links to agencies and their scientific integrity pages. It could also serve a role in supporting oversight of scientific integrity in interagency programs or committees in assessment, investigation, and adjudication of allegations and enforcement of remedies that need to be elevated beyond an individual agency, such as when the allegations involve high-ranking officials or the SIO. It could also serve as a focal point for multi-agency coordination with other relevant councils, including CIGIE.

Providing Needed Resources

Institutionalizing scientific integrity entails providing SIOs and CSOs the resources necessary to carry out their full portfolio of responsibilities across an agency. Beyond establishing and updating scientific integrity policies and procedures, the SIO plays a critical role in training, communication, and raising the visibility of scientific integrity; promoting the use of good scientific practices; assessing levels of satisfaction with the culture of scientific integrity at their agencies; investigating and adjudicating complaints; and managing remediation efforts—efforts that can have significant effects on the careers of scientists and other agency officials, in addition to protecting the public interest. As noted, SIOs also have important roles to play in improving alignment among a range of other policies that support scientific integrity. Many agencies have an individual scientific integrity officer who acts alone and often has other responsibilities. The 2021 Presidential Memorandum envisions a more robust scientific integrity workforce, explicitly permitting agencies to designate additional scientific integrity points-of-contact in different offices and components to coordinate with or report to the SIO in implementing the agency's scientific integrity policies and processes. This is already a highly successful practice in several agencies. Cross-agency benchmarking could be helpful in establishing baseline needs for scientific integrity functions. Given the stakes of protecting scientific integrity, a robust program is needed within and across agencies.

8. Conclusion and Next Steps

This report represents the first step in the Task Force response to the 2021 Presidential Memorandum. It reviews the effectiveness of agency scientific integrity policies and their ability to prevent political interference in the conduct, management, communication, and use of science, and it identifies good practices for building a culture of scientific integrity, protecting the integrity of the research process, communicating science with integrity, and responding to allegations of violations. The report concludes that while Federal science is fundamentally sound, it remains subject to political and other forms of interference that can undermine Federal decision-making and erode public trust in science.

To protect the integrity of Federal science, scientific integrity policies need to be put in place at all Federal agencies and include all staff engaged in the conduct, management, communication, and use of science. Additional efforts are needed to foster good practices for policy implementation across Federal agencies, institutionalize scientific integrity within and across agencies, and improve accountability for violations of scientific integrity. Fundamental to these efforts is sustaining the professionalism of the Federal scientific workforce: protecting the ability of Federal scientists to disagree and engage in vigorous debate about scientific methodologies, findings, and conclusions; and ensuring Federal scientists can communicate their science to various audiences without censorship or other interference. Policies and practices identified in this report provide building blocks for protecting these important tenets, which are important for the Federal Government to attract talented scientists.

As its next step, the Task Force plans to develop the framework called for in the 2021 Presidential Memorandum to "inform and support the regular assessment and iterative improvement of agency scientific integrity policies and practices." The framework will include assessment criteria that OSTP and agencies can use to inform, review, and improve the design and implementation of scientific integrity policies. The Task Force intends to begin developing the framework immediately and views it as a mechanism to improve the consistency of scientific integrity policies across Federal agencies and establish baseline standards, while allowing sufficient flexibility to accommodate the differing missions and needs of agencies. Greater consistency can help agencies share effective practices and promote a culture of scientific integrity across the scientific community. An important element of this work will be agreement on a definition of scientific integrity to apply across Federal agencies.

In addition, the Task Force aims to contribute to ongoing efforts to deliver an equitable and inclusive scientific enterprise. The Task Force's listening sessions underscored the need for meaningful community engagement that allows those who are most vulnerable, underrepresented, and impacted by science-guided policymaking to have a voice in ongoing scientific integrity and policymaking processes. Members of the public emphasized the importance of scientific integrity to the equitable delivery of Federal programs and the need for increased representation from groups that are historically underrepresented. To address such concerns, the Task Force intends to include in its approaches an evaluation of the efficacy of programs in serving the full breadth of the American public in terms of gender, race, ethnicity, ability, geography, and other characteristics. It will seek ways to enhance community engagement and inclusion by communicating with and hearing from underrepresented and marginalized communities through social media, town halls, learning exchanges, and other avenues and by making interactions more accessible to all public voices.

With these steps and continued efforts to develop, refine, and implement scientific integrity policies, agencies can strengthen the integrity of Federal science and, in so doing, help enhance Federal decision-making and restore the trust of the American public in government.

Appendix A. Summary of OSTP Guidance on Scientific Integrity, 2010

I. Foundations of Scientific Integrity in Government

1. Ensure a culture of scientific integrity in which political officials do not suppress or alter scientific or technological findings.

2. Strengthen credibility of government research by: selecting candidates for scientific positions based on knowledge, experience, and integrity; ensuring data and research undergo independent peer review; setting clear standards for conflicts of interest; and adopting appropriate whistle blower protections.

3. Facilitate free flow of scientific and technological information, by availability online in open formats and, where appropriate, including data and models underlying regulatory proposals and policy decisions.

4. Establish principles for conveying scientific and technological information to the public that includes clear description of underlying assumptions, uncertainties; and probabilities associated with projections.

II. Public Communications

1. Offer articulate and knowledgeable spokespersons for media requests who can describe and explain scientific and technological dimensions of their work in an objective and nonpartisan fashion.

2. Enable Federal scientists to speak to media and the public about their official work, coordinating with their supervisor and public affairs office and without altering scientific findings.

3. Put in place mechanisms to resolve disputes that arise from decisions to proceed or not to proceed with proposed interviews or other public information-related activities.

III. Use of Federal Advisory Committees

1. Use transparent recruitment processes for new Federal Advisory Committee members that announce vacancies widely and invite the public to recommend individuals for consideration.

2. Make professional biographical information for appointed committee members widely available to the public subject to the Privacy Act and clearly illustrate the individuals' qualifications for serving on the committee.

3. Select members based on expertise, knowledge, and contribution to the relevant subject area and fairly balance points of view represented with respect to the functions to be performed by the Committee. Additional factors to consider include availability of member to serve, diversity of members, and ability to work effectively.

4. Make Conflict of Interest waivers granted to committee members publicly available.

5. Treat reports, recommendations, and products as the findings of such committees rather than of the U.S. Government, and thus not subject to intra- or inter-agency revision.

IV. Professional Development of Government Scientists and Engineers

1. Encourage publication of research findings in peer-reviewed, professional or scholarly journals.

2. Encourage presentation of research findings at professional meetings.

3. Allow government scientists and engineers to become editors or editorial board members of professional or scholarly journals.

4. Allow full participation in professional or scholarly societies, committees, task forces, and other specialized bodies of professional societies, including removing barriers for serving as officers or on governing boards.

5. Allow government scientists and engineers to receive honors and awards for their research and discoveries with the goal of minimizing, to the extent practicable, disparities in the potential for private-sector and public-sector scientists and engineers to accrue the professional benefits of such honors or awards.

Appendix B. Scientific Integrity Policies of Federal Agencies

Table B-1 lists publicly available agency scientific integrity policies. Table B-2 list agency scientific integrity websites that contain additional information about policies and their implementation. In some cases, agencies may have complementary policies that address specific issues related to scientific integrity, such as media engagement or research integrity. Such policies are not listed below but may be specifically referenced in the listed scientific integrity policy.

Table B-1. Agency Scientific Integrity Policies

Department, Agency, Commission	URL for Scientific Integrity Policy
Department of Agriculture	https://www.ocio.usda.gov/document/departmental-regulation-1074-001
Department of Commerce	Currently being updated
• National Institute of Standards and Technology	https://www.nist.gov/summary-report-scientific-integrity
• National Oceanic and Atmospheric Administration	https://www.noaa.gov/organization/administration/nao-202-735d-2-scientific-integrity
Department of Defense	https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/320020p.pdf
Department of Education	https://ies.ed.gov/pdf/EDScientificIntegrityPolicy.pdf
Department of Energy	https://www.energy.gov/sites/default/files/2017/01/f34/DOE Scientific Integrity Policy 01112017.PDF
Department of the Interior	https://www.doi.gov/sites/doi.gov/files/uploads/305_dm_3_final_revised_si_policy_12-16-14.pdf
• United States Geological Survey	https://www.usgs.gov/about/organization/science-support/office-science-quality-and-integrity/scientific-integrity
Department of Health and Human Services	https://aspe.hhs.gov/reports/policies-principles-assuring-scientific-integrity
• Centers for Disease Control and Prevention	https://www.cdc.gov/os/integrity/docs/CDCSIGuide_042516.pdf
• Food and Drug Administration	https://www.fda.gov/media/82932/download
• National Institutes of Health	https://www.nih.gov/sites/default/files/about-nih/nih-director/testimonies/nih-policies-procedures-promoting-scientific-integrity-2012.pdf
Department of Homeland Security	https://www.dhs.gov/xlibrary/assets/foia/dhs-directive-026-07-scientific-integrity.pdf
Department of Justice	https://www.justice.gov/sites/default/files/open/legacy/2013/07/29/doj-scientific-integrity-policy.pdf
Department of Labor	https://www.dol.gov/sites/dolgov/files/OASP/files/DOL_Final_SIP.pdf
Department of State	https://fam.state.gov/fam/11fam/11fam0820.html

Department, Agency, Commission	URL for Scientific Integrity Policy
Department of Transportation	https://www.transportation.gov/sites/dot.gov/files/docs/mission/administrations/assistant-secretary-research-and-technology/282391/scientificintegritypolicy.pdf
Department of Veterans Affairs	Currently being updated
Agency for International Development	https://www.usaid.gov/policy/scientific-integrity
Environmental Protection Agency	https://www.epa.gov/scientific-integrity/epas-scientific-integrity-policy
Marine Mammals Commission	https://www.mmc.gov/wp-content/uploads/sci_integrity_policy.pdf
National Aeronautics and Space Administration[54]	https://nodis3.gsfc.nasa.gov/npg_img/N_PD_1920_0001_/N_PD_1920_0001__main.pdf
National Science Foundation	https://www.nsf.gov/bfa/dias/policy/si/sipolicy_2010.pdfhttps://www.nsf.gov/bfa/dias/policy/si/index.jsp
Office of the Director of National Intelligence	https://legacy-assets.eenews.net/open_files/assets/2011/12/23/document_gw_01.pdf

[54] NASA issued Policy Directive 1920.1 in 2017 that expanded upon but did not replace the 2011 policy. The agency also issued guidelines for promoting scientific and research integrity in 2018: https://www.nasa.gov/sites/default/files/atoms/files/nasa_guidelines_for_promoting_scientific_and_research_integrity-july_2018.pdf.

Table B-2. Examples of Federal Agency Scientific Integrity Websites

Department, Agency, or Commission	Website	URL
Department of Agriculture	Scientific Integrity and Research Misconduct	https://www.usda.gov/our-agency/staff-offices/office-chief-scientist-ocs/scientific-integrity-and-research-misconduct https://www.usda.gov/our-agency/staff-offices/office-chief-scientist-ocs/scientific-integrity-and-research-misconduct https://www.usda.gov/our-agency/staff-offices/office-chief-scientist-ocs/scientific-integrity-and-research-misconduct
National Oceanic and Atmospheric Administration, DOC	Scientific Integrity Commons	https://sciencecouncil.noaa.gov/Scientific-Integrity-Commons
Department of Energy	Office of Science: Scientific Integrity	https://science.osti.gov/sc-2/Research-and-Conduct-Policies/Scientific-Integrity
Department of Health and Human Services	Office of Research Integrity	https://ori.hhs.gov/
Centers for Disease Control and Prevention, HHS	Office of Science: Scientific Integrity	https://www.cdc.gov/os/integrity/index.htm
Food and Drug Administration, HHS	Scientific Integrity at FDA	https://www.fda.gov/science-research/about-science-research-fda/scientific-integrity-fda
National Institutes of Health, HHS	Research Integrity	https://grants.nih.gov/policy/research_integrity/index.htm
Department of the Interior	Integrity of Scientific and Scholarly Activities	https://www.doi.gov/scientificintegrity
United States Geological Survey, DOI	Office of Science Quality and Integrity	https://www.usgs.gov/about/organization/science-support/office-science-quality-and-integrity/scientific-integrity
DOJ, National Institute of Justice	National Institute of Justice: Research Validity and Integrity	https://nij.ojp.gov/about/research-validity-and-integrity
Environmental Protection Agency	Scientific Integrity	https://www.epa.gov/scientific-integrity
National Aeronautics and Space Administration	Office of the Chief Scientist: Scientific Integrity	https://www.nasa.gov/offices/ocs/scientific-integrity

Appendix C. Ways in Which Scientific Integrity Policies Can Be Violated

Table C-1 presents a taxonomy developed by the Task Force to illustrate different ways in which scientific integrity policies can be violated.

Table C-1. Violations of Scientific Integrity Policies

Type of Violation	Description
Research Misconduct	*In proposing, performing, or reviewing research or in reporting research results:* • Fabrication: Making up data or results and recording or reporting them. • Falsification: Manipulating research materials, equipment or processes, or changing or omitting data or results such that the research is not accurately represented in the research record. • Plagiarism: Appropriation of another person's ideas, processes, results, or words without giving appropriate credit.
Flawed Scientific Practice	• Use of improper or inappropriate methods or processes in conducting research. • Lack of adherence to practices for research quality, such as laboratory facility accreditation, quality assurance systems, and methods validation.
Flawed Review	• Undue influence or inadequate technical or peer review, including errors introduced within the review or clearance process, limiting scope of a review or peer review charge. • Untenable timelines for review that result in flawed or incomplete reviews. • Changing membership or structure of Federal Advisory Committees in ways that compromise their independence or eliminate needed expertise. • Failing to respond to reviewers' comments and/or selecting specific reviewers to influence the outcome of a review. • Denying scientists the opportunity to review descriptions of their scientific work included in other documentation, e.g., decision documents, policy reports.
Undermining the Scientific Workforce	• Selection or appointment of scientific staff based on non-science qualifications (e.g., to influence science in order to affect a particular policy outcome, reduce the overall quality of research findings, or diminish the public view and understanding of the science). • Undermining the expertise of Federal scientists by re-assignment to other duties or denying career advancement.
Suppression, Delay, or Censorship	• Preventing or delaying the release of a scientific product without scientific justification. • Failure to allow the inclusion of research, analysis, or technological information that well-established practices would consider necessary for decision-making.
Mischaracterization of Science	• Downplaying or exaggerating results. • Exaggerating uncertainty and/or not including or misrepresenting assumptions.
Manipulation of Science	• Altering, distorting, or changing science or scientific documents or documents derived from them without scientific justification.

Figure C-1 illustrates where these violations most commonly occur across the spectrum of scientific activities, from the conduct of science through the use of science in decision-making.

Figure C-1. Scientific Integrity Violations by Scientific Activity

<table>
<tr><th>Conduct of Science</th><th>Management of Science</th><th>Communication of Science</th><th>Use of Science</th></tr>
<tr><td>Flawed Scientific Practice</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Falsification</td><td></td><td></td></tr>
<tr><td colspan="2">Fabrication</td><td></td><td></td></tr>
<tr><td colspan="2">Lack of Adherence to Research Practices</td><td></td><td></td></tr>
<tr><td colspan="3">Flawed Review</td><td></td></tr>
<tr><td colspan="3">Plagiarism</td><td></td></tr>
<tr><td colspan="4">Undermining the Scientific Workforce</td></tr>
<tr><td colspan="4">Suppression, Delay, Censorship</td></tr>
<tr><td colspan="4">Mischaracterization of Science</td></tr>
<tr><td colspan="4">Manipulation, Alteration, Distortion</td></tr>
</table>

Appendix D. Terminology Used in This Report

This appendix describes terms and phrases as used in the report. Unless otherwise indicated, they reflect usage of the terms and phrases within the Task Force and the report and are not intended to define the terms for broader usage.

Chief Science Officer refers to a designated senior agency employee who: serves as the principal advisor to the head of the agency on scientific issues and ensures that the agency's research programs are scientifically and technologically well-founded and conducted with integrity; and oversees the implementation and iterative improvement of policies and processes affecting the integrity of research funded, conducted, or overseen by the agency, as well as policies affecting the Federal and non-Federal scientists who support the research activities of the agency, including scientific integrity policies consistent with the provisions of the 2021 Presidential Memorandum.

Citizen science refers to the voluntary participation of the public in the scientific process to address real-world problems in ways that may include formulating research questions, conducting scientific experiments, collecting and analyzing data, interpreting results, making new discoveries, developing technologies and applications, and solving complex problems.[55]

Community-engaged research refers to research conducted collaboratively with groups of people affiliated by geographic proximity, special interests, or similar situations with respect to issues affecting their well-being. Researchers engage with a community to develop research questions, design a study, and collect data.[56]

Decision-making/policymaking refers to the (1) development of policies or making determinations about policy or management; (2) making determinations about expenditures of Federal agency funds; (3) implementing or managing activities that involve, or rely on, scientific activities.[57]

Diversity, equity, inclusion and accessibility refers to terms defined in the Executive Order on Diversity, Equity, Inclusion, and Accessibility in the Federal Workforce:[58]

- *Diversity* means the practice of including the many communities, identities, races, ethnicities, backgrounds, abilities, cultures, and beliefs of the American people, including underserved communities.
- *Equity* means the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment.
- *Inclusion* means the recognition, appreciation, and use of the talents and skills of employees of all backgrounds.

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[55] This definition is consistent with that in Memorandum on Addressing Societal and Scientific Challenges through Citizen Science and Crowdsourcing." Office of Science and Technology Policy. Sept. 30, 2015. Available at: https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/holdren_citizen_science_memo_092915_0.pdf.

[56] This definition includes elements used by the National Institute of Environmental Health Sciences at NIH. See https://www.niehs.nih.gov/research/supported/translational/community/index.cfm.

[57] Adapted from the definition of "Decision-makers" in NOAA's scientific integrity policy. See https://www.noaa.gov/organization/administration/nao-202-735d-2-scientific-integrity.

[58] Executive Order on Diversity, Equity, Inclusion, and Accessibility in the Federal Workforce. June 25, 2021. Available at: https://www.whitehouse.gov/briefing-room/presidential-actions/2021/06/25/executive-order-on-diversity-equity-inclusion-and-accessibility-in-the-federal-workforce/.

- *Accessibility* means the design, construction, development, and maintenance of facilities, information and communication technology, programs, and services so that all people, including people with disabilities, can fully and independently use them.

Equitable delivery of Federal Government programs refers to the delivery and availability of government programs (including funding of government programs) to serve all communities, identities, races, ethnicities, backgrounds, abilities, cultures, and beliefs.

Evidence-based policymaking refers to the requirements in the 2021 Presidential Memorandum, which states that agency scientific integrity policies shall consider, supplement, and support their plans for forming evidence-based policies, including the evidence-building plans required by 5 U.S.C. 312(a) and the annual evaluation plans required by 5 U.S.C. 312(b).

Federal agency refers to Federal departments, independent agencies, commissions, and other entities including the Executive Office of the President.

Federal science refers to science conducted by Federal scientists or contractors to the Federal Government.

Federal science agency refers to a Federal agency that conducts intramural research and/or funds extramural research activities.

Federal scientist refers to a scientist (as defined in this report) who is a Federal employee.

Good practice refers to a practice the Task Force considers worthy of further review and potential adoption by Federal agencies based on expert opinion and contextual evidence from implementing agencies. A good practice is not a recommendation for all agencies to adopt but an example for agencies to consider, adapt, and adopt as appropriate to differing missions and needs.

Interference refers to inappropriate, scientifically unjustified intervention in the conduct, management, communication, or use of science. It includes censorship, suppression, or distortion of scientific or technological findings, data, information, or conclusions; inhibiting scientific independence during clearance and review; scientifically unjustified intervention in research and data collection; and inappropriate engagement or participation in peer review processes or on Federal advisory committees.

Policy refers to laws, regulations, procedures, administrative actions, incentives, or voluntary practices of governments and other institutions.[59]

Political interference refers to interference conducted by political officials and/or motivated by political considerations.

Research refers to systematic investigation, including research development, testing, and evaluation, designed to develop or contribute to generalizable knowledge. Activities can meet this definition whether or not they are conducted or supported under a program that is considered research.[60]

[59] This definition is consistent with that used by the CDC.
See https://www.cdc.gov/policy/analysis/process/definition.html.

[60] This definition is consistent with that used by HHS.
See https://www.hhs.gov/ohrp/sites/default/files/ohrp/policy/ohrpregulations.pdf.

Research integrity refers to the use of honest and verifiable methods in proposing, performing, and evaluating research; reporting research results with particular attention to adherence to rules, regulations, and guidelines; and following commonly accepted professional codes or norms.[61]

Research misconduct refers to fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results.[62]

Research security refers to safeguarding the research enterprise against the misappropriation of research and development to the detriment of national or economic security, related violations of research integrity, and foreign government interference.

Science refers to the full spectrum of scientific endeavors, including basic science, applied science, evaluation science, engineering, technology, economics, social sciences, and statistics, as well as the scientific and technical information derived from these endeavors.

Scientific enterprise refers to the broad community of individuals and institutions that support or conduct scientific research.

Scientific integrity is not specifically defined in this report but will be addressed in future work of the Task Force. In general, scientific integrity policies aim to make sure that science is conducted, managed, communicated, and used in ways that preserve its accuracy and objectivity and protect it from suppression, manipulation, and inappropriate influence, including political interference.

Scientific Integrity Official refers to a senior career employee designated as an agency's lead to oversee implementation and iterative improvement of scientific integrity policies and processes consistent with the provisions of the 2021 Presidential Memorandum.

Scientist refers to an individual whose responsibilities include collection, generation, use, or evaluation of scientific and technical data, analyses, or products. It does not refer to individuals with scientific and technical training whose primary job functions are in non-scientific roles (e.g., policymakers, communicators).

[61] This definition is consistent with that used by NIH. See NIH, "What is Research Integrity?" November 29, 2018. See https://grants.nih.gov/policy/research_integrity/what-is.htm.

[62] This definition is consistent with that contained in OSTP, Federal Policy on Research Misconduct, Dec. 6, 2000. See https://www.govinfo.gov/content/pkg/FR-2000-12-06/pdf/00-30852.pdf.