MEANINGFUL TRANSPARENCY AT EPA:

A Framework for Rationalizing Approaches to Promote Open Science and Data Sharing for Evidence-Based Policymaking

Technical Paper

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Executive Summary

In modern society, transparency about how government agencies operate facilitates accountability and oversight, thereby encouraging not just effective governance but also public trust in agency decisions. Within the scientific enterprise, transparency supports new knowledge creation as well as the use of scientific research in policy decisions.

While the Environmental Protection Agency (EPA) has taken significant steps to operate transparently throughout its history, like most federal agencies, more work is needed for EPA to develop a holistic approach for applying transparency throughout agency activities. With the growing prevalence of the open-science and open-data movements, policymakers must give further attention to how EPA can and should advance as the agency plans for the future.

Recognizing the array of laws, policies, and priorities implemented by EPA to take into consideration, this paper considers the extent to which EPA makes information accessible and useful. Whether scientific evidence for a scientific community or open data for the broad American public, EPA has an ever-evolving information-management role.

This report presents a landscape summary of the various policies implemented by EPA, covering science-integrity, data-quality, and information-management policies as well as a discussion of EPA efforts to improve access to both EPA-funded research and non-EPA-funded research used in policy decisions. This report also applies government-wide initiatives and new mandates for evidence-based policymaking to EPA.

This report offers a conceptual framework for applying EPA's existing policies related to transparency to examine how policymakers might consider further modifications to the agency's transparency approaches in the coming years. The framework describes how different types of transparency affect stages of evidence building and use at EPA.

Over the next 50 years, those applying meaningful transparency at EPA might consider four themes:

1. **Prioritize Actions that Will Maximize Public Trust.** EPA operates in a unique regulatory environment where nearly every action is under scrutiny by stakeholders. Maximizing public trust requires the agency to routinely renew and refresh its approaches. Full implementation of the new Foundations for Evidence-Based Policymaking Act at EPA would likely be a productive step.

2. **Incentivize Unparalleled Transparency.** Rationalizing transparency approaches will allow for active engagement in open-science and -data initiatives while protecting privacy and confidential data. EPA policymakers must recognize that what is relevant for scientists may differ from what is relevant for the general American public—thus, policymakers should consider additional steps to improve communication around EPA activities.

3. **Articulate Distinctions Between Science and Policy.** EPA staff must take the necessary steps to clearly articulate when decisions are science-relevant and when they are policy-relevant to efficiently implement the agency's science-integrity policy.

4. **Enable Public Interpretation of Complex Information.** EPA staff should support efforts to engage the public through trusted intermediaries to help translate and convey key operational, scientific, and regulatory concepts to the average member of the American public.

As EPA's work to protect human health and the environment continues, high-quality and reliable information will be vital to fulfilling the agency's mission. Ensuring that the agency has an infrastructure to manage and use high-quality data is essential to EPA's future success.

Introduction

As the Environmental Protection Agency (EPA) nears its 50th anniversary, intentional focus on how the agency can best prepare for the next generation of environmental protection likely means increased attention to how the agency collects, manages, shares, and uses information to operate effectively and transparently. Historically, transparency has been a core principle for the agency's operations, though planning for changing technologies, societal interests, and decision-making processes requires a renewed attention to what transparency means and how to apply it in modern society.

Notwithstanding an array of policies, practices, and procedures in place today, EPA—like most federal agencies—has yet to develop and implement a cohesive strategy that recognizes the value of data and capitalizes on the value of information assets. Every year, EPA collects 365 million responses on hundreds of forms, estimated to take the American public and regulated entities nearly 175 million hours to complete.[1] Valued at $2.8 billion each year, these primary data collections generate a trove of data to describe how regulated entities comply with federal environmental laws, how organizations support voluntary initiatives, and generally what the state of the environment is in the country.

EPA manages much of the information it collects in dozens of systems.[2] This information is often subject to public release or eventually becomes transformed into "open data," information that is freely and publicly available. EPA shares over 3,700 of its datasets on the federal government's open-data website.[3] Historically, EPA has also publicly provided information about the location of regulated entities and sites, as well as attributes related to emissions and measures of quality.

While EPA-collected information often results in open data, the agency also manages sensitive records—that is, information legally protected as confidential business information under respective environmental laws or as data that includes personally identifiable attributes. For example, EPA uses sensitive health information and data about proprietary business practices to inform how the agency promulgates regulations by providing insights about the likely impacts on fulfilling environmental or public health goals relative to the economic effects.

An array of federal laws and policies, EPA-specific policies and practices, and the priorities of EPA stakeholders and the American public all affect how EPA manages both open data and sensitive information. Two core questions arise from this collection of laws, policies, and priorities. The first core question and topic of this white paper is: **To what extent should EPA make its data accessible and useful to the American public, and for what purpose?** Explanation of this question begins with an inventory of the processes, procedures, and systems in place for EPA's broad information-management role.

Data access and use impose tangible costs on the government to develop and maintain the infrastructure for managing and sharing data. The task of supplying the government with data is also a burden for the American public. Weighing these costs on the American public with the limited resources allocated to EPA in its budget provides some bounding conditions for the level of information that can be realistically acquired. Therefore, policymakers must give consideration to what information is a priority—and whether EPA makes the highest-priority information accessible today.

Are the data useful for achieving accountability, and if so, what level of informational transparency is necessary? The benefits of better using information for decision-making are clear and the American public will rightfully want and need to assess the information to achieve accountability. Promoting transparency and open science facilitates accessibility and knowledge sharing among policymakers, the public, and the scientific community. Benefits include more rapid dissemination of knowledge, validation of existing research, public engagement in the research process, and greater efficiency in the scientific field.

Recognizing the agency is accountable for achieving its mission, past EPA administrators, appointed by both Democratic and Republican presidents, committed EPA to operating with transparency and openness. Bipartisan stakeholder groups have similarly called for increased attention to this issue,[4] including over the past decade with encouragement for EPA to develop new processes to support transparency.[5] Throughout this decade, EPA announced new plans, described below, to enhance

transparency at the agency. The agency's leadership has also routinely affirmed a sustained commitment to scientific integrity—which includes establishing procedures to ensure employees' work is honest, fair, and accurate. Leadership also typically conducts these processes in a manner that encourages broad public participation, recently including efforts to promote citizen science projects.

Determining the thresholds for which EPA should make its data available is a value-based policy determination. These are not empirical questions. The conclusions about those thresholds drive a second-order issue, which will be addressed in a future white paper: **How should EPA go about making its data accessible and useful to the American public and ensuring that the best available science is used for decision-making?** This question reflects the potential solutions that may exist for EPA's approaches to managing, sharing, and using its data for a variety of analytical purposes.

As EPA's work to protect human health and the environment continues, high-quality and reliable information will be key to fulfilling the agency's mission. Therefore, ensuring that the agency has an infrastructure to manage and use high-quality data is essential to EPA's future success.

Understanding how to make improvements in the policy framework also requires knowledge about the existing framework. Unfortunately, the absence of a holistic approach means the operational framework today is not well understood. This technical paper aims to set the stage for identifying the current suite of policies that delineate how EPA goes about making the information used in agency decision-making available to the American public today. This paper explains various policies and concludes by presenting a conceptual framework to consider for how the policies align with the goals of evidence-based policymaking and the challenges in doing so. A final section offers suggested themes for EPA in pursuing transparency through information sharing and use over the next 50 years.

EPA'S APPROACH FOR ACHIEVING STRATEGIC GOALS

Established in 1970, EPA's charge is to protect human health and the environment.[6] Throughout its history, the agency has faced complex and ever-changing systems for achieving statutory requirements related to clean air, water, and land. Over the decades, Congress added new statutory requirements, steadily expanding EPA's roles and responsibilities.

Under the major federal environmental statutes, EPA responds to environmental risks, including polluted air and water, contaminated land, and toxic chemicals, by using the "best available scientific information."[7] How this is applied varies based on the individual statutory requirement for standards that may be risk-based, technology-based, or determined on other criteria.

With a workforce of approximately 14,000 full-time equivalent employees in 2019, EPA manages information, policy implementation, and oversight across 12 program offices and 10 regional offices.[8,9] This information and the regulatory approaches are managed in partnership with state and local governments, many of which operate with delegated authorities to implement federal environmental laws.

EPA's 2018-2022 strategic plan established three goals for achieving its mission in the upcoming years: refocusing the agency on its core mission, restoring state powers through cooperative federalism, and improving agency processes to comply with authorizing statutes.[10] While the goals in EPA's strategic plan periodically shift to reflect changing political realities, the agency's focus on transparency in implementing these goals has been consistent over the past 40 years.

Following controversies at EPA in the 1980s, Administrator William Ruckelshaus issued a memorandum that described how the agency operates "in a fishbowl."[11] Ruckelshaus meant that EPA actions are reasonably and legitimately scrutinized given the agency's important decisions, thus EPA should be transparent in all that it does to foster trust and enable accountability.

Ruckelshaus specifically encouraged EPA employees to promote public trust by exercising "common sense and good judgement" and completing their work openly and with integrity. Additionally, he encouraged employees to consider a range of arguments and any information that is publicly available when developing regulations.[12]

Decades later, the framing used by Ruckelshaus still persists. It has provided the platform for subsequent administrators to rearticulate his calls for open communication with the American public, including both environmental advocacy organizations and industry.[13,14,15,16]

In 2018, the current administrator, Andrew Wheeler, pledged that "open and robust public participation" will guide EPA's mission and activities.[17] While the original Ruckelshaus memo and the Wheeler memo were separated by more than three decades, the sentiments expressed in each iteration offered consistent goals: supporting EPA's mission through openness and maintaining trust and integrity in the agency actions.

Landscape of Scientific Integrity and Data Transparency Policies at EPA

Initiatives to prioritize science integrity, data quality, open government, and access to information greatly affect transparency policies at EPA. This landscape involves both EPA-specific and government-wide initiatives.

PROMOTING A CULTURE OF SCIENTIFIC AND DATA INTEGRITY

Over the years, EPA developed written policies and procedures about safeguarding scientific integrity and data integrity in line with the sentiments expressed in the fishbowl memos. Below, this paper describes the respective policies in turn.

Scientific Integrity Policy

EPA's formal Scientific Integrity Policy is the backbone of EPA's articulated efforts to use the best available science in decision-making and specifies how both individual EPA employee actions and the organization's collective actions can uphold scientific integrity. The policy comes from the "Principles of Scientific Integrity" that reflect the idea that scientific activities should be of the highest quality and credibility to achieve EPA's mission and maintain the public's confidence and trust.[18] The seven stated principles are:

1. Ensure that work is of the highest integrity;

2. Represent work fairly and accurately;

3. Represent and acknowledge others' intellectual contributions;

4. Avoid financial conflicts of interest and ensure impartiality;

5. Be cognizant of and understand the specific programmatic statutes;

6. Accept the affirmative responsibility to report any breach; and

7. Welcome differing views and opinions on scientific and technical matters.

EPA's Scientific Integrity Policy, published in 2012, notes EPA's commitment to distribute timely, uncompromised, and unfiltered scientific information to the American public, Congress, media, and the scientific community.[19] Key provisions in the policy include:

- Prohibiting employees from altering, impeding, or suppressing the timely release of scientific conclusions or findings.

- Ensuring that EPA produces and distributes scientific findings in a timely and transparent manner.

- Expecting employees to clearly explain underlying assumptions and accurately describe uncertainties when presenting scientific findings.

- Increasing access to open and timely scientific information, including nonproprietary models that underlie policy decisions, on EPA's website. When possible, EPA should encourage access to nonproprietary data and models.

- Requiring EPA to select members for scientific federal advisory committees based on their expertise, knowledge, contribution to relevant subject area, the committee balance of scientific and technical points of view, and absence of conflicts of interest.

A 2015-2016 survey of EPA employees about the policy identified that among respondents, 90 percent were aware of the policy and had some exposure to its content, but just 7 percent perceived that they were not permitted to make corrections to the scientific content of agency documents when the information relied on their scientific research or opinions.[20] Implementation of EPA's scientific-integrity policy at the time was generally viewed favorably. Perhaps alarmingly, however, only 41 percent of participants responded that they knew how to submit an allegation of a policy violation. After this survey, the agency increased employee training, expanded outreach initiatives, released a *Best Practices for Clearance of Scientific Products* at EPA, and is currently creating an electronic clearance system for all offices in support of the agency's public access plan.[21,22]

One key feature of the integrity policy relates to the role of expertise in identifying and interpreting the best available science. EPA, like many federal agencies, relies on federal advisory committees to bolster its own expertise and engage formally with expert stakeholders ahead of major policy actions. A 2018 survey of federal employees identified that EPA employees were uncertain about how the agency's advisory committees were gathering expert advice.[23]

In April 2019, the Government Accountability Office (GAO) concluded that EPA, among other agencies, achieved success in reaching scientific-integrity policy objectives and having procedures to identify and address alleged losses of scientific integrity. EPA was one of only three agencies that GAO did not have recommendations for in terms of improving the implementation of its scientific-integrity policy.[24] EPA's Office of Inspector General is conducting an audit in 2019 to determine if the scientific-integrity policy is being implemented as intended.[25] Members of Congress have also praised the implementation of EPA's policy as one of the best in the federal government.[26]

Data Quality and Peer Review

"Data quality" refers to the features that affect the ability to achieve the expectations and needs of those using the information.[27] EPA's formal data-quality system includes efforts to promote quality assurance and control. In the 1990s, an independent panel concluded that EPA was not operating at a level that minimally assured quality for the scientific products used in agency decisions.[28] In response, EPA issued a peer-review policy in 1993 that required all technically based products to be peer reviewed.[29] A year later, GAO criticized the policy for being ill-defined and lacking guidance on specific actions in the peer-review process.[30] EPA subsequently published the *EPA Peer Review Handbook*, updated in 2015, which:

- Defines staff responsibilities;

- Details how to categorize products for appropriate peer review;

- Provides guidance for selecting peer reviewers;

- Outlines EPA's peer-review process; and

- Offers advice for making the peer review transparent through public participation.[31]

The handbook is complemented by other guidance, including the *Quality Manual for Environmental Programs*.[32] Additionally, guidance from the White House Office of Management and Budget (OMB) requires agencies to establish basic quality standards, apply quality-assurance processes prior to dissemination, and develop mechanisms for the public to request and correct low-quality information.[33] OMB established information quality standards that are based on objectivity, utility, and integrity. OMB defined "objectivity" as occurring when "disseminated information is accurate, reliable, and unbiased and presented clearly and completely."[34] OMB further defines "utility" as a measure of how useful information is to its target audience. OMB's use of "integrity" refers to information that the agency has shielded from corruption or falsification. EPA issued corresponding guidelines that require publicly communicated agency information to meet these quality standards at every stage, including data creation, collection, maintenance, and dissemination.[35]

Open Government Initiatives

EPA's Open Government Plan outlines the role of transparency, participation, and collaboration as guiding principles for how the agency operates.[36] Updated in 2018, the plan features information management and the prioritization of publicly releasing some EPA-collected information in open and machine-readable formats. EPA provides knowledge about these data systems through the Environmental Data Gateway, the agency's open-data catalog, and its system of registries.[37] EPA also established a data-quality program, and uses data-quality standards, produces metadata, and assists the public in using data with relevant tools.[38,39,40] While open data can support the open-government goals of transparency and fostering trust, other confidential records and information-management systems may also be relevant for various analytical purposes.

Further understanding how EPA generates or analyzes information offers additional insights for the American public. EPA's architectural roadmap and digital-services strategy include producing an open-source code repository and implementing open-source code and tools.[41] The agency has adopted GitHub as its open-source code repository.[42,43] EPA's repository publicly releases custom-developed software code as open-source software, which supports peer review and security testing of the software.[44,45] EPA also enables external developers to build applications from agency data and web services, through application programming interfaces, or "APIs."[46]

Integrity, Quality, and Openness

In April 2019, OMB directed agencies to make targeted updates to their guidelines for disseminating information to address the innovative changes in communicating information and best practices that have emerged since the original guidance was issued.[47] EPA was already on track to comply with the new guidance because of proactive steps included in its peer-review handbook, scientific-integrity policy, and open-government plan.

One notable change that EPA will need to make as a result of the guidance is updating the definition of "influential scientific information." Previous OMB and EPA guidance defined "influential scientific information" as "information the agency reasonably can determine will have or does have a clear and substantial impact on important public policies or private-sector decisions."[48,49] The updated OMB guidance asks agencies to be more specific so that program managers can identify influential information early in the life-cycle process and apply appropriate control measures.

PROVIDING ACCESS TO ENVIRONMENTAL DATA, INFORMATION, AND SCIENTIFIC RESEARCH

How EPA actually goes about providing data, information, and scientific research to the American public, policymakers, and the scientific community is a widely varied suite of systems and processes. The law expressly mandates some of the systems; others rely on public requests. Other systems offer limited access that may require an application and approval process.

Current Practices for Public, Open-Access Information

Since the 1980s, EPA has published information about toxic chemical releases and other waste-management data through its Toxics Release Inventory.[50] In the late 1990s, EPA launched public access to information on air and water quality, hazardous waste, and toxic chemicals for every zip code.[51,52] Open-access information is now accessible through MyEnvironment[53] and Envirofacts,[54] along with additional details about local air quality, facilities of environmental interest, radiation, water quality, greenhouse gas emissions, cancer risks from pollutants, hazardous wastes, energy production and consumption, chemical substances, violations of environmental regulations, and grants awarded by the agency.[55] EPA's Enforcement and Compliance History Online website also provides compliance and enforcement data for over 800,000 facilities regulated by EPA or state environmental agencies.[56,57]

EPA's System of Registries provide additional information to the public.[58] The agency's Registry of EPA Applications, Models, and Data Warehouses hosts 2,100 information systems and environmental models.[59] The Environmental Dataset Gateway (EDG) is EPA's epicenter of datasets and geospatial tools.[60] Data that appears on EDG is also available on Data.gov,[61] the federal government's repository for open data.[62] Through EDG, users can search for datasets and analyze data in more than 4,600 datasets as of July 2019.[63] Other registries include the Facility Registry Services,[64] the Substance Registry Services,[65] and the Data Element Registry Services.[66]

Since 2013, EPA has made health and safety information and data from over 13,000 Toxic Substances Control Act chemicals publicly available through its ChemView database.[67,68] In 2018, EPA launched EJSCREEN, an environmental-justice mapping and screening tool that provides users with access to demographic and environmental indicators.[69] That same year, EPA created the CompTox Dashboard, a website that provides information on over 760,000 chemicals.[70,71]

There are many existing databases available from EPA to provide information to the public and researchers about a wide range of environmental and public health attributes. Over the last decade, EPA has also increased its efforts to engage with the public through social media and targeted mobile apps that provide information in high demand, including EPA's SunWise UV Index,[72] EPA AIRNow,[73] and EPA Smoke Sense.[74]

While EPA makes much information public, it also has systems designed for operational and administrative responsibilities that deliberately delay public data. For example, the hazardous-waste electronic manifest system releases public data, but only after a 90-day delay. According to the rationale outlined in a 2014 rulemaking, the delay is intended to permit data submitters adequate time to correct discrepancies and address reporting errors before the information is made public.[75]

Public Access to EPA's Decision-Making Process and Records Requests

EPA engages with the public throughout the agency's decision-making process, particularly for regulatory actions. EPA's action-development plan and the agency's public-participation guide outline this formal process. This guide can also shape the conversations that other agencies, in the United States and abroad, have with stakeholders regarding environmental decision-making to ensure decisions are transparent and satisfy appropriate standards.[76]

The American public can also request information from EPA, even when it's not readily available, through the Freedom of Information Act (FOIA). EPA receives more than 10,000 FOIA requests a year, about half of which are typically approved.[77] While many of these records are public, a large amount of information in the regulatory process remains undisclosed—denoted as pre-deliberative information. FOIA can be useful for obtaining documents about decisions, though it is less useful in capturing gaps in existing knowledge that policy processes may not acknowledge. For example, EPA may not explicitly disclose a lack of impact evaluations or formal regulatory reviews, even when known, because the agency has not historically had incentives to develop such documentation.[78]

Public Access to EPA-Funded Research

In 2016, EPA released a plan to increase access to the results of research that it funds.[79] The plan aims to prospectively increase public access to EPA-funded digital-research data and peer-reviewed research that was published in scholarly journals, reflective of a larger initiative related to open science. EPA outlines the goals of the plan to include:

- Supporting and increasing EPA's public-access and transparency commitment;

- Facilitating access to and consistent archiving of EPA-funded scientific research;

- Encouraging innovation and cross-disciplinary scientific collaborations;

- Improving scientific discovery rates and effective research data management; and

- Expanding public access to data while also providing safeguards for privacy.

EPA's Office of Research and Development (ORD) launched EPA's ScienceHub to provide intramural researchers with a catalog and repository for datasets that underlie their publications.[80] These publications are available on the National Institute of Health's PubMed Central within one year of their release, and the metadata is publicly available on the Environmental Data Gateway within one month of the publication's availability on PubMed Central.[81] EPA chose PubMed Central since the website hosts content from 1,500 journals, provides publications that are publicly available for free, and strengthens the agency's commitment to collaborate with other federal agencies and the private sector.

Providing public access to publications and underlying data for all non-ORD publications began in January 2018. While ORD has an existing office-wide clearance system, Scientific and Technical Information Clearance System, EPA will soon have an agency-wide electronic-clearance system for use by all other offices. A final implementation phase related to extramurally funded research remains in progress.[82]

Access to Non-EPA-Funded Research and Data

Increasingly, a vast amount of information that the agency does not directly fund is available to support EPA decisions. This includes research funded by other federal agencies, non-profit foundations, research institutions, for-profit businesses, and data collected directly by citizens.

The growth of citizen science, for example, means that members of the public are increasingly contributing to scientific projects by collecting data, analyzing information, and even developing technologies that are relevant to the agency's mission.[83] Historically, EPA supported some efforts for self-reported information, including the STORET water-quality database that the agency maintained for decades.[84,85] In November 2019, CitizenScience.gov lists EPA as managing more than 40 citizen-science projects.[86] Naturally these projects pose unique challenges for managing data quality and scientific integrity because of how the information is collected.[87] An EPA Office of Inspector General survey identified that EPA program officers were concerned about data quality, in addition to resource limitations, for applying citizen science in their decision-making processes.[88] In 2016, the National Advisory Council for Environmental Policy and Technology concluded that citizen science is EPA's "best approach to connect with the public."[89] But in addition to connection, EPA maintains a role in considering data quality related to information collected in citizen-science projects that are used for policymaking.

In 2018, EPA announced the "Strengthening Transparency in Regulatory Science" notice of proposed rulemaking, which outlined an expectation that research and evidence used in EPA's decision-making process would need to increase support in certain open-science concepts and be available for "independent validation."[90] While EPA did not provide the full implementation details for the regulation, it sought to require full transparency of research used in EPA actions. During the executive branch's internal review of the regulation, OMB required EPA to clarify that "publicly available" should be interpreted as accessible, including restricted access through secure enclaves or other appropriate mechanisms.[91]

The proposed regulation garnered a range of feedback from industry, non-profits, the scientific community, and elected officials.[92] The Bipartisan Policy Center submitted comments applauding the broad goal of the rulemaking, including the intent to improve the transparency of scientific and research evidence, while also raising concerns about some aspects of the proposal.[93] BPC also offered 18 pages of detailed comments with suggestions for improving the regulation, particularly with respect to appropriately managing confidential data as envisioned by the rule. One particular concern expressed in public comments and by other federal agencies was the rationale for requiring non-federally funded researchers to comply with the regulation in order for EPA to use their research in decision-making.[94] While EPA was expected to issue the regulation in December 2019,[95] EPA's administrator informed Congress the rule would be published as a "supplemental proposal" in 2020, which suggests a new draft of the proposed rule will likely emerge before a plan is finalized.[96]

OTHER GOVERNMENT-WIDE INITIATIVES

Multiple government-wide initiatives will likely influence EPA's approaches for managing and sharing data and information in the coming years, although details about how EPA will implement these initiatives are not yet readily available.

Revised Common Rule

In 2017, the U.S. Department of Health and Human Services issued a new final rule for protecting human subjects in research. Known as the "Common Rule," the regulation specifically envisioned the increased use of existing administrative records collected by agencies to conduct research activities.[97] The revised Common Rule provides for reduced burden and oversight of projects that are considered "low-risk," meaning that they ensure appropriate privacy and confidentiality safeguards without introducing new risks to data subjects.

Once the Department of Health and Human Services fully implements the revised Common Rule, it will only apply to research that involves human subjects and receives federal funds; many other institutions use the same approach to guide implementation of much of their research. In short, the new requirements of the Common Rule offer new opportunities for envisioning how informed consent is applied prospectively, how data can be linked and used to address policy-relevant questions, and how it may limit the role of certain oversight bodies (i.e. institutional review boards) for secondary uses of administrative records.

For EPA, the full implications of the revised Common Rule are not immediately clear, though certain public health and environmental information will likely be affected for future implementation activities related to the regulation and corresponding research approvals.

U.S. Commission on Evidence-Based Policymaking

Amid the various activities underway at EPA to manage and use information, Congress created the U.S. Commission on Evidence-Based Policymaking in 2016. Congress specifically charged the Evidence Commission with determining a strategy for increasingly using government-collected data to inform policy decisions.[98] Notably, the commission's work focused on government data, not on information collected and managed by the private sector or academic institutions.

Over the course of a year, the commission studied the challenges facing federal agencies and collected its own data from experts and federal agencies.[99] Among the federal offices that responded to the commission's survey, two units at EPA provided descriptions of their challenges in managing and sharing data. Both the Office of Land and Emergency Management and the Office of Water identified major barriers related to resources and the requirements of federal information-management laws.[100] The commission also received testimony about emerging privacy risks for federal agencies to consider in the coming years.

In September 2017, the commission submitted a unanimous set of recommendations to Congress and the president, outlining a comprehensive strategy for federal agencies to responsibly and transparently use both confidential and open data to support policymaking activities. The commission's recommendations included specific proposals to strengthen privacy protections, increase access to administrative records, and to ensure that the government has the capacity to manage and use data.[101] The comprehensive recommendations from the commission were applauded and endorsed by a wide range of privacy, good-government, non-profit, and academic stakeholders.[102]

Specifically, the commission identified recommendations relevant to EPA, several of which BPC expressly articulated to the agency in comments on the "Strengthening Transparency in Regulatory Science" proposed rule.[103] First, the commission described a role for new senior leaders at the agency to ensure responsible stewardship and use of information. The commission recommended new leadership roles for focusing on data quality, program evaluation, and statistical expertise. While EPA has various positions that relate to the concepts articulated by the commission, it has historically not had the senior leadership roles that the commission specifically identified. For example, EPA has twice eliminated the agency-wide program-evaluation unit; as of 2019, no such unit as imagined by the Evidence Commission exists at EPA.[104]

Second, the commission endorsed a strong privacy-protective framework for managing confidential records, through the Confidential Information Protection and Statistical Efficiency Act (CIPSEA). EPA does not currently use the available CIPSEA authorities, and no records are known of EPA requesting approval for a CIPSEA-recognized statistical unit. The authorities available under CIPSEA enable certain data-sharing activities that support the production of summary statistics and improved data quality, so long as they do not disclose individual personally identifiable information. The agencies that use CIPSEA, however, can reliably produce and publish de-identified datasets and statistics as open data.

Third, the commission appealed to federal agencies to take greater care and attention in managing confidential data, specifically the risks of re-identifying publicly released data. The commission discussed several approaches to such management, including an improved risk assessment, the deployment of new privacy-preserving technologies, and the adoption of "tiered-access" models that provide access to the public based on different needs and approvals.

EPA's work in promoting access to environmental and public health data is at a clear intersection with the Evidence Commission's recommendations. While EPA has some approaches in place that support implementation of the commission's vision for federal agencies, EPA lacks much of the infrastructure and capacity described by the commission as essential for agencies.

Foundations for Evidence-Based Policymaking Act of 2018 (Evidence Act)

Weeks after the Evidence Commission issued its final report, then-House Speaker Paul Ryan (R) and Senator Patty Murray (D) co-filed legislation to advance half of the Evidence Commission's recommendations. The Foundations for Evidence-Based Policymaking Act of 2018 (Evidence Act) addressed all three of the commission's themes and went further in promoting transparent, open data when possible, while also advocating for stronger privacy and confidentiality safeguards for sensitive data. The legislation rapidly advanced through Congress, receiving final bipartisan approval in 2018 and the president's signature in January 2019.[105]

The Evidence Act requires federal agencies to take steps to identify new leadership positions, including an evaluation officer, a chief data officer, and a statistical official. It reauthorizes CIPSEA, establishing a strong privacy-protective framework in federal law for managing confidential records. Moreover, it requires agencies to promote open data. In July 2019, OMB issued initial implementation guidance that prioritizes the establishment of new leadership positions in federal agencies, including EPA.[106]

The Evidence Act also includes explicit language about agency responsibilities for protecting public trust in government data and statistics. This provision codifies guidance that OMB issued in 2014 and applies broadly to agency administrators. Ensuring public trust in EPA's work—as well as in the information it manages—is likely essential to future success in fulfilling the agency mission. While about three-quarters of the American public perceive a major role in protecting the environment, only 59 percent believe that the government is doing a good job of protecting the environment.[107] Nearly one-third of the country has an unfavorable view of EPA.[108] While information is not readily accessible about what this means for EPA's data activities, research on the federal statistical system suggests that the more individuals actually use government data, the likelier they are to believe it is credible and trustworthy.[109] Therefore, improving access to EPA data likely has positive implications for public trust.

White House Federal Data Strategy

In parallel with the congressional consideration of the Evidence Commission's recommendations and the Evidence Act, the Trump administration worked to develop a Federal Data Strategy as part of the President's Management Agenda. The final strategy outlines a 10-year plan for better managing and using government data.[110] OMB outlined 40 practices for managing information that agencies are expected to adhere to in the coming years, such as ethical data governance, conscious design of data and information policies, and investing in learning cultures in government that can be held accountable. While EPA could be well-positioned to implement many of these practices, there is much room for targeted improvements for increased data sharing, assessing disclosure risks, coordinating data assets, and prioritizing data-governance processes at the agency.

In fall 2019, OMB is expected to issue an action plan for agencies to take discrete actions over the next year. Actions include developing an agency-wide data-governance process, producing an ethical framework for managing and using information, and publishing open-data plans that articulate what datasets will be freely and openly accessible to the American public.[111]

Framework for Transparency in Evidence-Based Policymaking at EPA

Navigating the maze of existing EPA policies that affect open-data and open-science initiatives is further complicated by new and emerging government-wide initiatives. When taken together, the web of EPA policies and government-wide initiatives offers real promise for reforming and improving the existing EPA approaches for managing information. Yet, EPA needs an articulated conceptual framework to realistically execute the range of potential policies and for stakeholders to understand and rationalize the adopted approaches. The framework must consider how transparency applies to different types of activities, including evidence generation and the future use or application of analysis and scientific evidence.

At a practical level, many of the existing policies neatly fit together to address a variety of needs and niche purposes in achieving transparency for EPA's data-user community. Importantly, the policy reasons for achieving transparency can differ from those of the user community. For example, what a policymaker in Congress considers transparent may reasonably and practically differ from the transparency needs of a scientist, which may differ still from a general member of the American public.

ROLE OF TRANSPARENCY ACROSS THE FRAMEWORK

Because using the best available science has been reaffirmed by EPA throughout its history, EPA must have processes and protocols to accommodate this philosophy and to reasonably determine what it entails. EPA's task is a tall order: Identify and use the best available science. This requires finding, acquiring, developing, and synthesizing information to determine what is best. Even then, applying a normative value judgment on integrity introduces opportunities to challenge such a rating and classification.

The logical approach to satisfying the criteria while also enabling input on what is truly "best" is through transparency. This requires doing so at all steps of the conceptual framework to maximize capabilities, information, and credibility. But even then, EPA may need multiple transparency types to satisfy demands, which necessarily vary by audience.
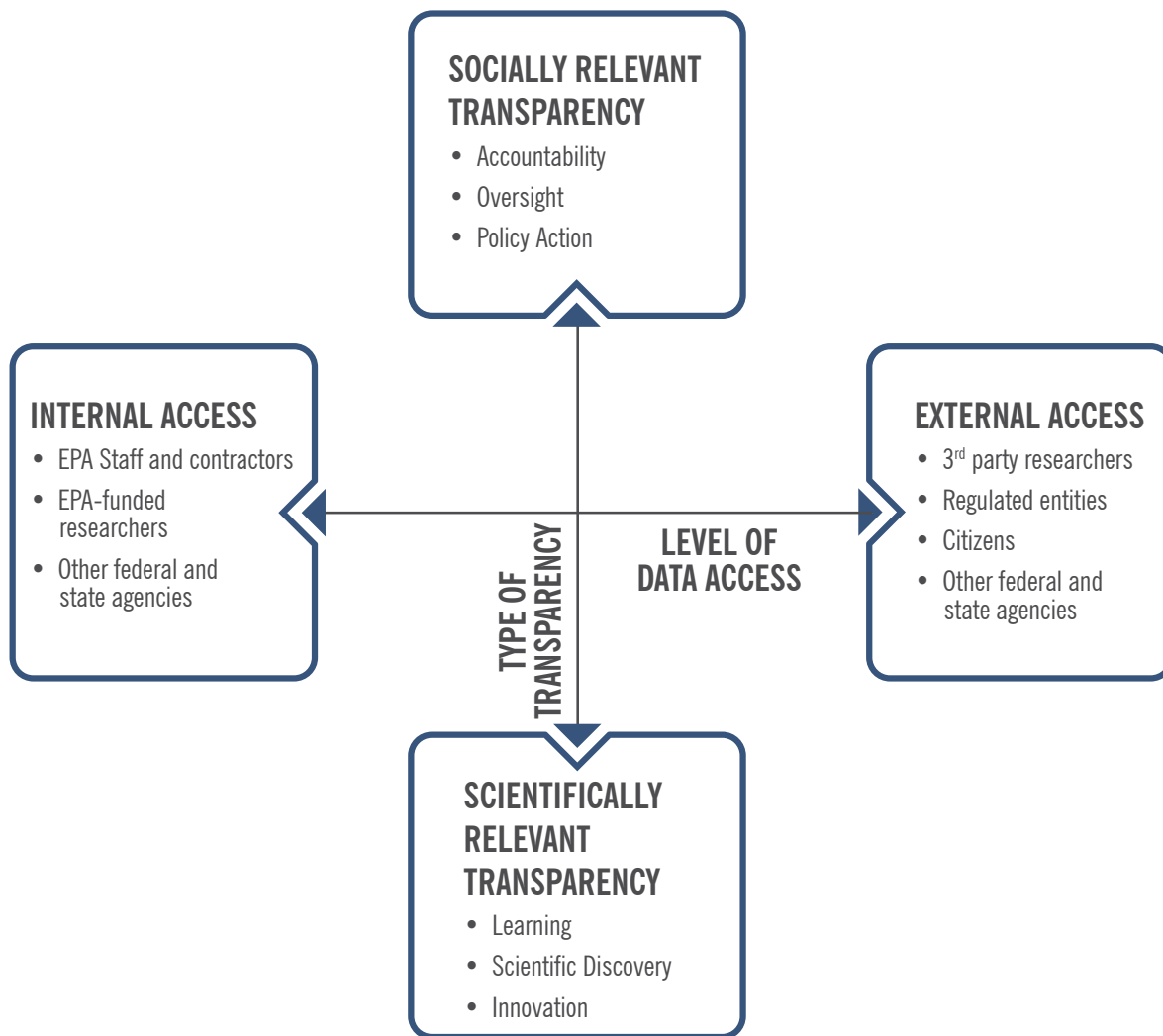
As a broad concept, transparency means information is available to facilitate accountability, which an agency like EPA can achieve through replication, review, or other means. To achieve such accountability, insights into the process must be available to understand how the agency made its decisions, how it compiled analyses, what assumptions it made, and what underlying data it used.

Achieving transparency for the scientific community, and supporting replication and learning from existing science, typically requires detailed knowledge for individual studies about modeling, data, assumptions, etc. In these cases, the motivation for more data and information is to advance scientific knowledge and discovery, including studying the reliability of existing studies and methods. This type of transparency differs from socially relevant transparency, wherein individuals want insights related to the decision-making processes in a policy environment.[112] However, the mechanisms for facilitating scientifically relevant and socially relevant transparency may be comparable and even overlap. Both the open-science and open-data movements reflect aspects of each transparency type for respective users and acknowledge that different users may benefit from either direct or indirect access to information.

While scientifically relevant transparency has been a focus within the scientific community for years, practices related to socially relevant transparency are relatively newer. Even then, some confusion appears to exist regarding what is necessary to achieve the goals for both transparency types without overburdening users and decision-makers alike.

For an agency like EPA, with a strong scientific underpinning and operating in the context of environmental quality and public health, a holistic approach to transparency can satisfy varying goals. This likely includes the transparency of processes for collecting and reviewing information, processes for interpreting analyses to make decisions, and a robust understanding of data, models, and analytical assumptions applied at every stage.

Figure 1. Relationship Between Transparency Type and Level of Information Access

```
                    ┌─────────────────────────┐
                    │ SOCIALLY RELEVANT       │
                    │ TRANSPARENCY            │
                    │  • Accountability       │
                    │  • Oversight            │
                    │  • Policy Action        │
                    └─────────────────────────┘
                               ▲
┌──────────────────────┐       │       ┌──────────────────────┐
│ INTERNAL ACCESS      │       │       │ EXTERNAL ACCESS      │
│  • EPA Staff and     │◄──────┼──────►│  • 3rd party         │
│    contractors       │       │       │    researchers       │
│  • EPA-funded        │  LEVEL OF     │  • Regulated entities│
│    researchers       │  DATA ACCESS  │  • Citizens          │
│  • Other federal and │       │       │  • Other federal and │
│    state agencies    │       │       │    state agencies    │
└──────────────────────┘       │       └──────────────────────┘
                               ▼
                    ┌─────────────────────────┐
                    │ SCIENTIFICALLY          │
                    │ RELEVANT                │
                    │ TRANSPARENCY            │
                    │  • Learning             │
                    │  • Scientific Discovery │
                    │  • Innovation           │
                    └─────────────────────────┘
```

TYPE OF TRANSPARENCY

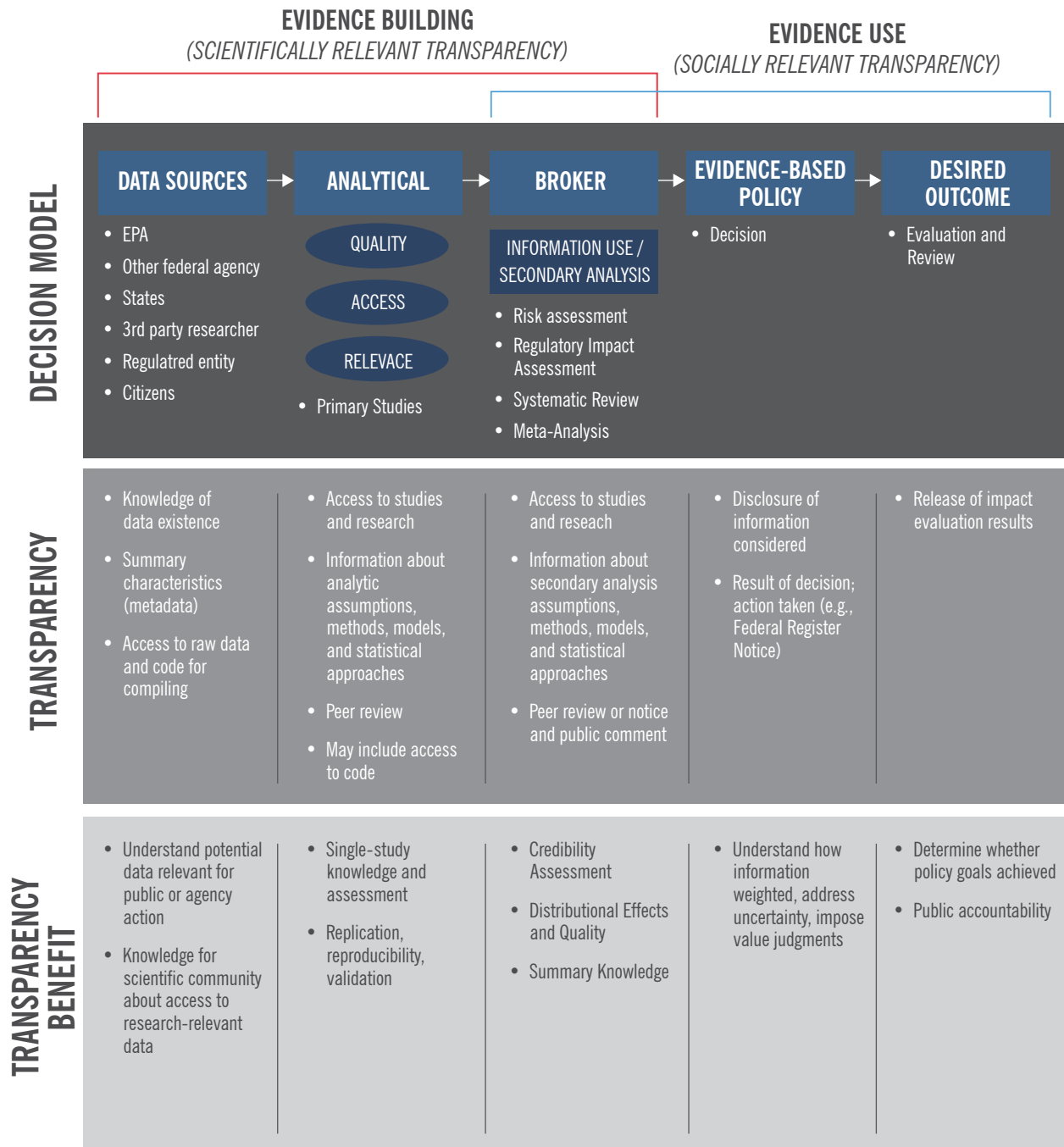## EXPLAINING THE STAGES OF THE CONCEPTUAL FRAMEWORK

A conceptual framework for transparency at EPA must accommodate the range of these interests and needs. The following section presents a simplified conceptual model with consideration of how transparency applies in each stage of evidence building and use. Taken together, these components offer a conceptual framework for considering actions and benefits for transparency at each stage of the evidence pipeline. Information about each stage or access to the information inputs for each stage represent what is sought for oversight, accountability, or knowledge extension or creation at each stage.

Data: EPA uses data from a wide range of sources

The starting point for the framework is data, which a variety of sources provide to EPA. This comprises the range of information in EPA's control that falls within scope of a discussion about what EPA can reasonably influence for transparency. Scientists may collect data independently or in concert with EPA staff, other federal agencies, international organizations, third-party research-ers, EPA-funded researchers, regulated entities, or citizen-science initiatives.

Where data originate are important pieces of the transparency puzzle, particularly in contemporaneous society, because the orig-inating source may affect the level of trust in the data. For example, some members of the American public may inherently trust government-collected data more than industry-collected data, or vice versa. Thus, the approaches and validation techniques for

Figure 2. Conceptual Framework For Transparency At EPA

EVIDENCE BUILDING
(SCIENTIFICALLY RELEVANT TRANSPARENCY)

EVIDENCE USE
(SOCIALLY RELEVANT TRANSPARENCY)

DECISION MODEL

DATA SOURCES	ANALYTICAL	BROKER	EVIDENCE-BASED POLICY	DESIRED OUTCOME
• EPA • Other federal agency • States • 3rd party researcher • Regulatred entity • Citizens	QUALITY ACCESS RELEVACE • Primary Studies	**INFORMATION USE / SECONDARY ANALYSIS** • Risk assessment • Regulatory Impact Assessment • Systematic Review • Meta-Analysis	• Decision	• Evaluation and Review

TRANSPARENCY

• Knowledge of data existence • Summary characteristics (metadata) • Access to raw data and code for compiling	• Access to studies and research • Information about analytic assumptions, methods, models, and statistical approaches • Peer review • May include access to code	• Access to studies and reseach • Information about secondary analysis assumptions, methods, models, and statistical approaches • Peer review or notice and public comment	• Disclosure of information considered • Result of decision; action taken (e.g., Federal Register Notice)	• Release of impact evaluation results

TRANSPARENCY BENEFIT

• Understand potential data relevant for public or agency action • Knowledge for scientific community about access to research-relevant data	• Single-study knowledge and assessment • Replication, reproducibility, validation	• Credibility Assessment • Distributional Effects and Quality • Summary Knowledge	• Understand how information weighted, address uncertainty, impose value judgments	• Determine whether policy goals achieved • Public accountability

these data may need to necessarily vary when the government uses the data to make decisions. Yet, providing this information to EPA or passing it through EPA systems or analytical processes suggests it has been validated in some way to justify use.

Transparency related to data collected or accessed by EPA can present a type of transparency, because it exposes potential users to the existence of information accessible to EPA decision-makers. Transparency mechanisms related to this stage include data inventories and metadata that describe core characteristics of datasets.

Analysis: EPA Relies on a Variety of Policy- and Science-Relevant Analysis

Data by themselves are not a useful construct for providing insights. Some form of analysis is necessary to transform data into useable information that can guide and inform policy decisions and science. Before researchers can credibly and reliably use data, there are generally at least three criteria that must be fulfilled: relevance, access, and quality.

1. **Data relevance** is a subjective framework that is determined by a data user. Generally, relevance is an assessment of whether data can address a given research question based on contextual parameters like timeliness and geography. Relevant data in the modern computing environment are also machine-readable and generally structured.

2. **Data access** is a precondition for analysis to occur. Analysts cannot use inaccessible data for relevant purposes. Access does not necessarily mean free and publicly available data; it could instead mean restricted use in a secure data enclave that enables limited data analysis and protection of confidential elements for qualified and approved individuals. Even in such cases, some form of access can be enabled.

3. **Data quality** means the underlying data are fit for use; trustworthy, even if there are gaps and uncertainties; and collected in a manner that satisfies ethical and integrity policies. Individual users who are performing analysis, who have a responsibility to properly use the data, and who have a responsibility to disclose assumptions, models, and criteria are the same individuals who generally assess the data quality.

When relevant data are accessible and of sufficient quality, data are usable for analysis. Once scientists use the data, they can identify and improve on gaps in data quality over time. Such analyses could manifest as scientific papers, performance reviews, or formal program evaluations. Each type of analysis is relevant information for policy consideration.

For EPA, an obvious challenge in this framework is that the described data that leads to analysis or information may originate from numerous sources, potentially converging in linked data files—making reasonable quality assessments difficult or even constraining access. What then is EPA's responsibility for curating, stewarding, or even collecting this information?

Is it a scientist's obligation to make data available to EPA for general decision-making, even when EPA did not fund the science? Should lawmakers compel industry to share data with EPA as either a regulated or nonregulated entity, even when relevant to a policy decision? These questions are not matters of science; they are policy choices. In fact, existing laws obligate industry to share some data with EPA when there are incentives to do so, such as in exchange for licensing or permitting decisions.[113] Such incentives do not appear readily available for the scientific community writ large.

When it comes to transparency, whether EPA or not, sound practice suggests enough information should be available to support replication or reproducibility analyses as well as assessments of the validity and reliability of the conclusions in a research paper. The open-science movement has put a lot of focus on key practices and principles that relate to enabling such transparency.

Brokering: EPA Considers Information from Intermediaries and Compiled Analyses

After scientists have assessed data and contributed it to an analytical product, a variety of actors—who may apply further analytics—use the information. In the context of EPA's decision-making, this could include reviewing single studies to make decisions or compiling analyses generated from a broad cross-section of the scientific and regulatory community into a regulatory impact assessment, a comprehensive risk assessment, a meta-analysis, or a systematic review. These analytical decision-making constructs extend the capabilities of the scientific community to help interpret uncertainty, weigh decision trade-offs, and provide policymakers with additional contextual information to consider the "best available science" in practice. Importantly, the brokers must also assess the analysis of validity and reliability.

In the conceptual framework, information and knowledge brokering are essential constructs for translating complex scientific information into a useable and policy-relevant format. Often the knowledge transformation is conducted directly by EPA staff or contractors, informed by volunteers and scientific advisory panels, or offered as third-party analysis in a formal regulatory action through public comments.

Typically, transparency for this stage involves formally sharing regulatory impact assessments, risk assessments, systematic reviews, and other summary analyses, along with underlying assumptions and models. EPA may even release these documents as drafts in regulatory actions for feedback and comment prior to a final decision.

Evidence-Based Policymaking: EPA Weighs Available Information to Set Policy

For decisions to result in evidence-based policies, credible, valid, and reliable analysis is imperative before EPA can reach a decision. Considering the other stages in the conceptual framework, policymakers have a difficult task of interpreting available information and choosing the best decision based on that evidence, even when the information has been distilled.

For regulatory actions, EPA decision-makers must make a compelling case and present the information used to reach a policy decision as part of the formal rulemaking record. This evidence is required to satisfy the legal standards established under the Administrative Procedure Act and individual authorizing statutes.

In practice, relatively little research exists on the use of evidence, even though applying evidence to make decisions is common practice in government agencies.[114] What is known about the use of research evidence is that the processes in this stage often include nonlinear decision-making, organizational leaders who are interested in meaningfully applying evidence, and the use of evidence when organizational culture can accommodate the practice.[115]

From a transparency perspective, this stage is perhaps societally most important because it is likely to garner the most critique with how EPA makes decisions, including how it weighs the potential costs and benefits for segments of society. Yet, government's decision-making processes tend to be opaque and may even include information not disclosed publicly or in compiled analyses. This may be further complicated in practice by EPA commitments to use the "best available science."

Cooperative Federalism as a Third Dimension

Because federal environmental laws are implemented in partnership with states, local governments, and other entities, an additional dimension to the framework is realized when the decision tree must accommodate multiple interpretations of the same information for decisions that occur at the federal, state, and local levels of government, in addition to those within the scientific community. Ideally, the individual decision-makers within each system level could reach similar conclusions based on the presented information, but, in reality, criteria and value judgments will vary by individual decision-maker. For example, different interpretations of the same information may lead to inherent conflict and disagreement among system users. This dynamic means system-wide transparency offers a mechanism for holding various decision-makers accountable through the oversight of policy choices and the use of evidence in decision-making.

APPLYING EXISTING EPA POLICIES TO THE CONCEPTUAL FRAMEWORK

In some ways, EPA's ongoing efforts to satisfy both socially relevant and scientifically relevant transparency expectations fall short of both societal and scientific needs. The contemporaneous environment at EPA, including alleged activities to reduce expert advisors as well as to limit the ability of EPA scientists to communicate directly with the American public may raise concerns about transparency.[116,117] In general, actions that move away from classic transparency practices should offer articulated reasons or alternative strategies to meaningfully bolster transparency and public trust.

Figure 3. How Existing Policies Relate to Stages of the Conceptual Framework

Policy	Data	Analysis	Broker	Policy
Scientific Integrity Policy	●	●	●	
Data Quality	●	●		
Peer Review	●	●	●	
Open Government	●			
Open-Data Directive	●	●		
Decision-Making Records			●	●
EPA Research	●	●		
Non-EPA Research	●	●		
Evidence Act	●	●	●	●
Federal Data Strategy	●	●	●	●

Historically, EPA has developed extensive protocols for maximizing scientifically relevant transparency. The existing scientific integrity policy and the training that occurs across the agency for effective implementation provides some evidence of this. Efforts to promote access to EPA-funded research and data produced from that research further suggest meaningful efforts to support open science.

In contrast, EPA's efforts to address socially relevant transparency fall short. While EPA developed large repositories of open data about environmental and public health measures, the socially relevant actions are intermittent, inconsistently implemented across the agency, and large gaps remain in meeting the complex and ever-evolving needs of decision-makers and the American public.

The American public's lack of general knowledge about complex scientific issues poses challenges to EPA's strategies for developing meaningful and useful mechanisms for socially relevant transparency. The average member of the American public likely does not have access to or interest in reading peer-reviewed journal articles, plans and policies, regulatory analyses, or open datasets made available online. Simply put, EPA's existing efforts to develop APIs, increase open-data portals, and otherwise conduct analysis that the general American public can use fall short; this role may also not be essential for establishing appropriate transparency mechanisms. Trusted intermediaries can relay the information to the American public through third-party trusted publications and news sources, thereby conveying confidence that someone else is providing due diligence. In doing so, these outlets can give attention to fairly and accurately describing concepts about risk perception and hazards.

One practical challenge for EPA, however, is that the agency's transparency efforts have largely been in response to directives in law or guidance rather than a concerted, cohesive policy framework. Complying with the individual environmental laws, the Administrative Procedure Act, and Executive Order 12866 are relevant for transparency, but these efforts do not help the American public or the scientific community understand the meaning or intent of policy actions. EPA political appointees and staff should be sure to address what the purpose of the agency's transparency efforts is. It's simply not enough to follow the law or policies—EPA must be able to articulate to stakeholders, regulated entities, and the American public why transparency matters and in what context, how transparency practices are meaningfully applied at the agency, and whether changes to transparency and information-sharing policies result in better decisions or agency outcomes. The absence of these features will likely undermine public trust in EPA during any administration in modern society.

Transparency at EPA in the Next 50 Years

EPA made notable progress over the past 50 years in developing a suite of effective environmental programs that substantially improved environmental quality and public health.[118] For the next 50 years, EPA must further refine its capabilities to collect, synthesize, and use increasingly complex information to make the best possible decisions.

PROMISE OF THE EVIDENCE ACT FOR EPA

The bipartisan Evidence Act offers substantial promise for EPA's efforts to promote multiple types of transparency for varying audiences. While the law itself is not a "transparency law," it was built on a transparency principle outlined by the Evidence Commission.

As EPA pursues implementation of the law across the core titles of the legislation, EPA could realize substantial improvements in data access and sharing, privacy protections, and the capacity to engage in evidence-based decision-making that results in socially relevant transparency.

- **Title 1: Evidence-Building Capacity.** Under the first section of the Evidence Act, the authorities provided for EPA's use support planning and capacity-building activities for the agency. While EPA does not currently have a central program evaluation unit, the Evidence Act requires agencies to designate an evaluation officer to support formal evaluation activities, to establish agency evaluation policies, and to make the results of evaluations available. In tandem, the evaluation officer must produce and publish an evidence-building plan (that is, a learning agenda) outlining expectations for improving the evidence available for decision-makers. The Evidence Act also requires EPA to designate a new statistical official to support the implementation of certain statistical and privacy activities. Together, the new positions and planning process can promote the informational needs for a cohesive transparency framework. Title 1 most closely aligns with the Brokering and Evidence-Based Policy stages in the conceptual framework.

- **Title 2: Open Government Data.** The second part of the Evidence Act, called the Open Government Data Act, requires EPA to establish a new chief data officer position to support the agency's efforts to manage data quality and promote data access and use. Additionally, the law requires agencies to make government-collected data open and available, when possible. One likely strategy for complying with this law is known as "tiered access," whereby the agency makes different levels of sensitive data accessible and available using different levels of access based on the needs and qualifications of users. These requirements align with the Data and Analytical stage, and also primarily affect government-collected data.

- **Title 3: Confidential Information.** While EPA does not currently have a CIPSEA-designated unit, the agency could choose to pursue new privacy, confidentiality, and data-sharing capabilities that would enhance the agency's ability to produce statistical insights by using both government-collected and third-party-submitted data, similar to applications in the existing federal statistical agencies. EPA can make underlying data accessible to qualified individuals, and it can also release statistics or de-identified datasets that do not violate the pledge of confidentiality. CIPSEA implementation, should EPA choose to pursue it, could affect every stage in the described transparency framework for evidence-based policymaking, while also supporting both socially relevant and scientifically relevant transparency.

While the Evidence Act holds substantial promise, EPA's initial implementation of the new provisions and authorities leaves some room for concern. For example, as of November 2019, EPA has yet to designate the required evaluation officer under the Evidence Act. Time will tell as to how EPA's leadership will prioritize the new provisions, but it is clear that an improved relationship between transparency and information sharing could emerge if EPA implements the law effectively.

NEXT STEPS FOR MEANINGFUL TRANSPARENCY AT EPA

To further adopt meaningful transparency that satisfies the equally important goals related to accountability and scientific discovery, data, and information policies—with or without implementation of the Evidence Act—EPA might consider the following themes:

1. **Prioritize Actions that Will Maximize Public Trust.** Harkening back to the initial fishbowl memo and the subsequent calls for transparency—EPA officials must recognize that the agency operates in a unique regulatory environment where nearly every action is under scrutiny by stakeholders. Maximizing public trust requires the agency to routinely renew and refresh its approaches to serving the American public with information that is relevant and useful, as well as communicating clearly how science and evidence informed decisions. Full implementation of the Evidence Act at EPA would likely be a productive step.

2. **Incentivize Unparalleled Transparency.** Taking steps to rationalize transparency approaches for EPA and engage with key stakeholders in relevant ways will help ensure reasonable transparency is in place. EPA should develop meaningful incentives for the science community, EPA staff, and decision-makers to proactively engage in open-science and open-data initiatives, even prior to mandating that such efforts be conducted before information can be considered in regulatory or other policymaking activities. Importantly, EPA policymakers must recognize that information and transparency that is relevant for scientists may differ from the general American public, thus the agency should consider additional steps to improve communication around EPA activities and policy decisions.

3. **Articulate Distinctions Between Science and Policy.** As a scientific policymaking agency, EPA staff operate at the nexus of science and policy. EPA staff must take steps to clearly articulate when decisions are science-relevant and when they are policy-relevant to efficiently implement the agency scientific integrity policy. In 2009, a bipartisan task force recommended guidelines be established to distinguish between science and policy matters; more attention is needed to this issue.[119] Similarly, stakeholders must take care in criticizing EPA policy decisions as being inconsistent with science when in fact those decisions are discrete policy choices that take into consideration a host of information, including the best available science, uncertainty factors, potential benefits, and costs.

4. **Enable Public Interpretation of Complex Information.** The agency should not expect nor require the general American public to interpret complex scientific information embodied in EPA policy decisions without formal training. Instead, EPA should support additional efforts to engage the public with knowledge brokers and trusted intermediaries to help translate and convey key operational, scientific, and regulatory concepts to the average member of the American public. EPA scientists and staff have a critical role to play in supporting public engagement and understanding of complex scientific and science-policy concepts. Additionally, EPA could support other citizen-science initiatives to incentivize the American public to participate more in vital science, environmental, and public health efforts.

As EPA proceeds with its efforts to expand the availability of open data and transparent science, the agency must consider the unique, individual, and distinct needs of scientists, policymakers, and the public. EPA must develop transparency strategies that recognize the motivation for releasing information, the target audience, and how to best convey a meaningful and useful message. Determining a realistic strategy for adoption will likely mean considering the many users, stakeholders, and beneficiaries of EPA policies that necessarily relate to how transparency becomes relevant in practice. Thus, EPA should weigh multiple options and approaches for promoting meaningful transparency at the agency through information-sharing and open-science initiatives.

Open data and open science are essential for EPA to fulfill its important mission of protecting human health and the environment. While much of EPA's work has focused on scientifically relevant transparency, the agency can do more to institute policies and procedures that encourage socially relevant transparency. EPA's success in meeting its mission in the 21st century and beyond will depend on how the agency addresses transparency today.

Endnotes

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Appendix

In August 2019, the Bipartisan Policy Center hosted a private roundtable discussion to discuss the core data and information issues discussed in this paper. Participants represented a broad cross-section of stakeholders involved in EPA processes and involved with those affected by EPA decisions, including former EPA employees, citizen representatives, and environmental, business, and research equities.

During the roundtable, participants provided insights about existing EPA efforts to promote open science, data integrity, and open data at the agency. The roundtable used Chatham House rules, so the information provided cannot be publicly linked to an individual, nor are the names of participants disclosed.

Throughout the discussion, participants used the following framing questions to guide the dialogue:

Need for Information Sharing and Open Science

1. What other policy efforts are instrumental to EPA open science, data integrity, and open data that this draft white paper does not address?

2. To what extent have existing policies and efforts helped shape, address, or improve EPA's information-sharing needs?

3. Are there particular program offices at EPA that serve as models for open science and data sharing to consider further? Which offices?

4. To what extent should EPA be making more information accessible than it already is?

5. What residual concerns exist for open science and data sharing that EPA has not fully addressed?

Challenges and Risks

6. What are the gaps in EPA's existing data infrastructure that may limit fulfillment of the agency's mission?

7. Are there areas where EPA's information-access mechanisms exceed expectations—and the public's needs? What areas may need further improvement or refinement?

8. What are the potential areas facing EPA's management of information that pose the greatest risks to public trust in EPA and its information? What are the greatest benefits and opportunities for public trust?

Opportunities and Priorities Moving Forward

9. Are there other government agencies on which EPA should model its open-science, data-integrity, and open-data policies and initiatives?

10. With increasing methods for disseminating information, how can EPA best communicate with and inform the public?

11. How does EPA seize the opportunity of citizen science while maintaining data integrity?

12. How can EPA improve public participation in the decision-making process?

13. How can EPA both fulfill the requirements of the Evidence Act and serve as a model agency for evidence-based policy-making?

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