Chapter 6.
SOME ADVERSE IMPACTS OF CLASSIFICATION

INTRODUCTION

A government must classify certain information for national-security reasons, as was established in Chapter 1 of this document. However, one of our nation's fundamental principles is the right of its citizens to be informed. We place a high value on open, informed discussion about governmental matters. Therefore, when the U.S. Government keeps secrets from its citizens, that action conflicts with a basic, constitutional right of citizens to be informed of their government's actions so that they can intelligently participate in governmental processes. A democracy's requirement for openness in government is in conflict with a government's need to keep some information secret for reasons of national security. When a government keeps secrets in peacetime, national security has historically been narrowly defined. In wartime, national security is broader than in peacetime. President George W. Bush's February 2001 description of national security as including "the defense of the United States of America, protection of our constitutional system of government, and the advancement of United States interests around the globe" *and* as dependent on "America's opportunity to prosper in the world economy"[1] seems overly broad for peacetime. A similar comment might apply to President Clinton's 1993 decision that "environmental issues are significant factors in U.S. national security policy."[2]

The conflict between secrecy and openness in our government is sharpest when citizens want to have informed influence on governmental decisions that concern national-security matters and that have important, long-term implications. It is frequently too easy for government officials (usually in the executive branch of government) to claim special, inside knowledge about a matter and, for alleged national-security reasons, not to share that knowledge with all citizens (or even with most members of Congress). Then, citizens (or Congress) are put into a position of having to accept the decision of the governmental official who has the knowledge, the insider's rationale being that, if others knew what the insider knows, they would agree with the insider's judgment.[*] The use of secrecy to limit debate and citizen control of government can undermine the government's credibility, legitimacy, and efficiency. Unnecessary secrecy about radioactive fallout from nuclear-weapon tests in the 1950s and 1960s probably contributed significantly to the loss of credibility of the Atomic Energy Commission (AEC) with the American public.

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[*]National Security Decision Directive (NSDD) 145, "National Policy on Telecommunications and Automated Information Systems Security," signed by President Reagan on Sept. 17, 1984, would establish Department of Defense control over sensitive but unclassified information transfer from unclassified civilian databases. Such control of unclassified information in nongovernmental databases would raise significant constitutional questions. The person said to be the principal author of NSDD 145 stated that "the threat to national security by hostile foreign agencies is why we wrote NSDD 145," and "I can't reveal the particulars of that threat, but it is expanding daily" [C. L. Howe and R. Rosenberg, "Government Plans for Data Security Spill Over to Civilian Networks," *Data Communications* **16** (3), 136-144 (Mar. 1987), p. 139].

Problems of secrecy even affect enforcement of federal laws. Criminal charges are sometimes not brought against alleged lawbreakers because our legal system requires an open trial, and in prosecutions concerning national-security matters, the prosecutor may need to rely on classified information as evidence. In such instances, criminal charges against alleged lawbreakers may have to be dropped rather than risking damage to national security by revealing the classified evidence. An example of this situation occurred in 1988 and 1989 when some charges against Oliver North (in the "Iran-Contra scandal") were dropped because some of the documents necessary for the prosecution's case were classified.

With respect to atomic-energy information matters, the government declassified some Restricted Data (RD) when prosecuting Ethel and Julius Rosenberg in early 1951. Certain RD concerning nuclear weapons was also declassified during the 1964 U.S. District Court trial of George John Gessner for unauthorized disclosure of atomic-energy information.

Another important aspect of classification is the effect of governmental secrecy on our national character. Congressman Moss, one of the congressional leaders who spearheaded the effort to establish the Freedom of Information Act (FOIA), stated in 1967, "The strength of our nation is not derived from any policy negative in character."[3] David Lilienthal, first chairman of the Atomic Energy Commission, expressed similar thoughts: "Traditionally, democracy has been an affirmative doctrine rather than merely a negative one."[*] W. Gelhorn has characterized security programs as "marked by apprehensive and backward glances over one's shoulder" that may retard progress.[4] Further, the strength of an organization generally lies in a dynamic, rather than a static, use of resources.[5] Thus, to the extent that secrecy in government erodes our traditionally open, positive, confident approach to matters, then one of our salutary historical national characteristics has been diminished.

There are other adverse impacts of classification. Economic costs associated with classification of information include salaries of personnel who classify and declassify information, documents, and materials; costs for physical security and personnel clearance investigations; "extra" costs of preparing classified documents and manufacturing classified hardware in secure areas; costs of classified procurements; and storage and inventorying costs for classified documents and material. Costs are incurred when wrong decisions are made because pertinent information was kept secret from decision makers, either because of need-to-know restrictions or clearance requirements.[†]

Classification of certain information possibly affected the outcome of the 1960 U.S. presidential election. The challenger to the incumbent political party alleged that there was a "missile gap" between the United States and the Soviet Union, with the United States at a disadvantage. This "missile gap" was a major campaign issue. U.S. intelligence gathered from

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[*] Statement by David E. Lilienthal, first chairman of the Atomic Energy Commission, during the course of hearings on his appointment to that chairmanship (*The Annals of America*, Vol. 16, Encyclopedia Britannica, Chicago, 1976, p. 464).

[†] One example of a secrecy-induced error occurred in Britain in 1912 to 1913. The British navy selected a gun-fire control system for naval warships under conditions of secrecy with respect to the systems under consideration and the selection process. The imposition of secrecy was a major factor in leading the British Navy to select an inferior system. This bad decision was to later cost them severely in the World War I Battle of Jutland (W. H. McNeil, *The Pursuit of Power: Technology, Armed Force, and Society Since A.D. 1000*, University of Chicago Press, Chicago, 1982, pp. 294-299).

unacknowledged overflights of the Soviet Union provided information to the contrary, but because such information was classified, the fact (or likelihood) that there was no missile gap could not be revealed by the incumbent party's candidate. The challenger won the election by a very narrow margin.

Classification also creates barriers to the accessibility of knowledge, to friend as well as to foe, and thereby slows down the advance of civilization. The latter effect is of particular concern with respect to science and technology, because much of our technical information has a "dual use": commercial as well as military applications.

This chapter discusses the principal adverse impacts of classification, focussing mainly on the negative effects of classification on scientific and technical progress.

CLASSIFICATION OF INFORMATION IMPAIRS CONSTITUTIONAL VALUES

The First Amendment to the Constitution established the principle of an informed public.[*] When information is classified, the public's knowledge of the government's activities is reduced, thereby impeding an informed public evaluation of governmental policies and government officials.[†,‡] Thus, the national-security advantages gained by the classification of information are *always* counterbalanced, to some extent, by the infringement upon our constitutional right to be informed of our government's activities. This dichotomy was recognized by Justice Black in *New York Times v. United States*, when he stated, "The guarding of military and diplomatic secrets at the expense of informed representative government provides no real security for our Republic."[6]

Although the Constitution guarantees freedom of speech, it is well-established case law that the public does not have a First Amendment or statutory right to classified information. In *Near v. Minnesota*, the Supreme Court indicated that the government could prevent publication of U.S. troop movements in time of war without violating the First Amendment.[7] In *Houchins v. KQED, Inc.*, Chief Justice Burger stated that the First Amendment does not guarantee public access to all sources of information within govermental control.[8] In *United States v. Progressive, Inc.*, a U.S. District Court enjoined publication of an article describing hydrogen-bomb manufacture because such publication would harm the national interest.[9]

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[*] "Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; or abridging the freedom of speech, or of the press; or of the right of the people peaceably to assemble, and to petition the Government for a redress of grievances" (U.S. Constitution, Amendment I).

[†] The following James Madison quote is frequently mentioned in support of public access to governmental information: "A popular Government, without popular information, or the means of acquiring it, is but a Prologue to a Farce or a Tragedy; or, perhaps both. Knowledge will forever govern ignorance: and a people who mean to be their own Governors, must arm themselves with the power which Knowledge gives" [letter to W. J. Barry, August 4, 1822, in *James Madison Papers* (microfilm), The Library of Congress, Washington, D.C., 1964, Reel 20].

[‡] "A democracy cannot afford to keep secrets from itself" (H. L. Ickes, Secretary of the Interior, in *Atomic Energy Act of 1946*, Hearings Before the Special Committee on Atomic Energy, U.S. Senate, 79th Cong., 2nd Sess., on S. 1717, A Bill for the Development and Control of Atomic Energy, Part 1, Jan. 22 and 23, 1946, U.S. Government Printing Office, Washington, D.C., 1946, p. 90).

Most of the court decisions on First Amendment rights to information have involved freedom of the press and prior restraints on publication. Although the First Amendment provides a strong presumption against prior restraint on publication of information,[10] some situations may arise in which the government might prevent publication of information, especially in time of war.[11] Further, publication may result in criminal sanctions against the one who published the information, and there is no constitutional prohibition against such sanctions.[12]

FREEDOM OF INFORMATION ACT AND CLASSIFICATION

The FOIA,[13] enacted in 1966, provides to any person a statutory right of access to government information. "The basic principle of [the] FOIA is to ensure an informed citizenry, vital to the functioning of a democratic society, needed to check against corruption and to hold the governors accountable to the governed."[14] However, Congress recognized that there were valid reasons for not allowing some governmental information to be made available to the public and therefore included in the FOIA nine exemptions permitting the government to withhold information. Two of those exemptions concern classified information.

The first of those FOIA exemptions concerned with classified information, Exemption 1, states that the FOIA does not apply to matters that are "(A) specifically authorized under criteria established by Executive order to be kept secret in the interest of national defense or foreign policy and (B) are in fact properly classified pursuant to such Executive order."[15] Thus, classified national-security information that is "properly classified" by Executive Order 12958 may be withheld from disclosure under this FOIA exemption.

The second of the FOIA's exemptions that deals with classified information, Exemption 3, authorizes the withholding of matters that are "specifically exempted from disclosure by statute (other than section 552b of this title), provided that such statute (A) requires that the matters be withheld from the public in such a manner as to leave no discretion on the issue, or (B) establishes particular criteria for withholding or refers to particular types of matter to be withheld."[16] This Exemption 3 provides a basis for withholding RD or Formerly Restricted Data (FRD), which are classified by the Atomic Energy Act, from FOIA requests. Note that information that can be withheld from an FOIA request under Exemption 3 is not limited to classified information; the only requirement is that a statute provide the agency with authority to withhold the information. Thus, information other than classified information can also be withheld under Exemption 3.*

To date, most of the court decisions concerning denial of FOIA requests for classified information have concerned information classified by Executive Order rather than RD or FRD. Where courts have ruled on FOIA requests for classified information denied by Exemption 3, based on statutes other than the Atomic Energy Act, the standards for judicial review have been said to be "less probing" than under Exemption 1.[17] That is, the courts are less willing to examine critically an

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*Another statute that exempts information from disclosure under the FOIA is the National Security Act of 1947, which provides that "the Director of Central Intelligence shall be responsible for protecting intelligence sources and methods from unauthorized disclosure" [50 U.S.C. §403(d)(3)]. Information in applications for patents that have been declared secret under the Invention Secrecy Act of 1951 [35 U.S.C. §§181-188 (1994)] is also exempt from disclosure under the FOIA.

agency's basis for withholding information under Exemption 3 than under Exemption 1. The Department of Justice's *Freedom of Information Guide, May 2000*, stated that once the FOIA judicial review has determined that the statute is an Exemption 3 statute and the records fall within that statute's scope, further judicial review should not be within the FOIA's jurisdiction.[18] However, courts have reportedly begun to develop a single standard of review for both exemptions.[19] The D.C. Circuit Court has established a standard for judicial review of classified national-security information claims under Exemptions 1 and 3, "finding that summary judgment is entirely proper if an agency's affidavits are reasonably specific and there is no evidence of bad faith."[20] Other Circuit courts have adopted the D.C. Circuit's standard. Also pertinent is a 1996 D.C. Circuit Court decision that indicated that a federal district court's decision to not review certain classified documents in camera was a "wise decision" because limiting the number of documents examined would "make it less likely that sensitive information will be disclosed."[21]

The 1966 FOIA was construed by the Supreme Court, in 1973, to mean that records classified under proper agency procedures were exempt, per se, from disclosure, without need for any further judicial review.[22] This situation was changed by 1974 amendments to the FOIA that expressly provide for de novo review by the courts and for in camera review of classified documents where appropriate.[*] However, courts have been reluctant to substitute their judgment for an agency's expertise in national-security matters.[†,23] Agency affidavits are generally given much deference. For example, the Supreme Court stated that the decisions of the Director of the Central Intelligence Agency to withhold information on intelligence sources "are worthy of great deference given the magnitude of the national-security interests and potential risks at stake."[24] As of 1986, no federal appellate court had upheld, on the substantive merits of the case, a lower court's decision to reject an agency's claim that certain documents were classified.[25] A 1986 decision compelling the Federal Bureau of Investigation (FBI) to release information classified by the FBI was settled prior to an appellate decision and is considered to have little precedential value.[26] However, a 1995 Court of Appeals decision affirmed a federal district court disclosure order for information claimed by the FBI to be classified.[27] The latter decision was unique, and the conflict between freedom of information, as expressed in the FOIA, and "properly classified" information has so far been clearly resolved in favor of information properly classified by agency procedures, with the courts giving much deference to agencies' substantive classification determinations.

The question of what is "substantively" properly classified information, which can be withheld from the public, is sometimes difficult to answer. Information is classified in the interest of "national security," but that term is ambiguous. "The word 'security' is a broad, vague generality whose contours should not be invoked to abrogate the fundamental law embodied in the First Amendment."[28] Although the term "national defense" is narrower in definition than the term

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[*] "The court shall determine the matter de novo, and may examine the contents of such agency records in camera to determine whether such records or any part thereof shall be withheld under any of the exemptions set forth in subsection (b) of this section, and the burden is on the agency to sustain its action" [5 U.S.C. Sect. 552(a)(4)(B)].

[†] One reason for the reluctance of courts to substitute their judgment for an agency's expertise is the courts' "recognition of the inherently speculative nature of predicting the degree of harm to the national security which may result from the disclosure of certain information" [S. A. Faust, "National Security Information Disclosure Under the FOIA: The Need for Effective Judicial Enforcement," *Boston Coll. Law Rev.* **25**, 611-643 (1984) p. 636]. "The courts have noted that to demand more than a plausible demonstration that the predicted danger is a reasonable expectation would be 'overstepping by large measure the proper role of a court in a national security FOIA case' " [S. A. Faust, supra, citing *Halperin v. CIA*, 629 F.2d 144, 148 (D.C. Cir. 1980)].

"national security," the former term is still fairly broad in scope. "National defense" was defined by the Supreme Court with respect to the Espionage Act as follows: "National defense . . . is a generic concept of broad connotations, referring to the military and naval establishments and the related activities of national preparedness."[29] Even if the narrower interests of "national defense" indicate that information meets the test for classification, perhaps a consideration of broader national interests (e.g., the adverse impacts of classification) would lead to a decision that the information should not be classified. This "balancing" is discussed in Chapter 6 of *Security Classification of Information: Volume 2, Principles for Classification of Information*.

CLASSIFICATION AND SCIENTIFIC AND TECHNICAL PROGRESS

General and Historical

This document is primarily concerned with classification of information in the Department of Energy (DOE). Within DOE, the major classification problems arise with respect to scientific and technical information concerned with uranium enrichment; nuclear-weapon design, testing, and production; naval nuclear reactors; and related matters. Also, in recent years, DOE has also used its scientific and technical expertise in classified work for other federal agencies. Therefore, it is of particular interest to an Authorized Classifier, within DOE or its contractors, to be aware of the impact of classification on science and technology, particularly on scientific progress. Before discussing this subject, the history of classification of scientific information in the United States will be briefly mentioned.

Prior to 1940, the United States had almost no restrictions on the free exchange of scientific and technical information. Probably the only classified scientific or technical information was that relatively small amount originated and classified by the armed services. It has been suggested that the first major scientific effort to be classified by the U.S. armed services was research and development in the 1930s on radar.[30] The only other restrictions on the flow of scientific information were those concerning proprietary information (trade secrets) imposed by private companies and the "temporary restrictions" imposed by individual scientists (on their own research) to prevent premature release of their research findings so that they would not get "scooped."[*] However, that situation changed significantly in early 1940, near the beginning of World War II (WWII).

In early 1940, a few U.S. scientists started to withhold nuclear-fission research results voluntarily from journal publication because they feared that publication of this information would aid Nazi Germany in developing an atomic weapon (see Chapter 4). This practice became well established by mid-1940. Significant emphasis began to be placed on secrecy in research and development in areas other than nuclear fission in mid-to-late 1940 after the National Defense Research Council was established. This organization [and its successor Office of Scientific Research and Development (OSRD)] was formed to apply the latest scientific and technical developments to

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[*] See, e.g., E. G. Campbell et al., "Data Withholding in Academic Genetics," *J. Amer. Med. Assoc.*, **287**(4), 473-480, January 23/30 (2002), concerning authors withholding data about which papers had been published, in part to protect further ability to publish papers based on those results. Those authors also report that commercialization of university-based research was significantly associated with increased likelihood of data withholding. Thus, "openness" in some areas of academic science seems to be decreasing.

weapons of war and other defense applications (e.g., radar and the proximity fuse). Many university scientists and engineers worked on these programs during WWII. These programs were generally carried out in university laboratories or in laboratories operated by universities. Many of these programs were conducted under conditions of secrecy, some of which were very stringent.

The outstanding success of many of those WWII scientific and technical projects, with the resulting national defense advantage for the United States, led to much greater governmental funding of defense-related scientific research after WWII as compared with prewar years. In many cases, this research was classified. Through participation in WWII's classified projects, a substantial number of U.S. scientists became accustomed to classification of their research, including some basic research, and accepted this situation, even though it was contrary to past practices regarding the dissemination of scientific information.[*,†]

Effects of Classification on Scientific and Technical Progress

Reduced Progress in the Same Field of Science. Scientific advances are based, to a greater or lesser extent as determined by circumstances, upon an extensive base of information provided by others. Scientists of many nations contribute to the information base in most scientific fields.[‡] The scientific advances in a field, the contributions to the information base, are generally incremental. Each increment is thoroughly reviewed and evaluated (usually repeated to verify the results) by peers in that field of work before it is accepted as a reliable part of the database. Therefore, much discussion and the interplay of many minds contribute to each small advance. No one can predict when or by whom the next important advance will be made. However, information from the same field of science always provides the foundation, the knowledge base, from which the scientific advance springs.[31] Sometimes this information also provides a "missing link," a key part of the advance.[32] Classification of information, which keeps others ignorant of information already discovered, results in needless duplication of effort[§] and delays scientific and technological

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[*] The development of science in the western world was accompanied by, or perhaps was a result of, a tradition of free exchange of scientific information, even in times of war. During the French Revolution and the Napoleonic Wars, when France and England were engaged in bitter warfare, British scientists traveled freely on the continent and were hospitably treated by French scientists (B. and F. M. Brodie, *From Crossbow to H-Bomb*, Indiana University Press, Bloomington, Ind., 1973, p. 123). In 1813, the British chemist Sir Humphrey Davy was allowed to visit Paris to receive from the French Institute a scientific award sponsored by Napoleon, even though France was then at war with England [G. Hartcup, *The War of Invention*, Brassey's Defence Publishers, London, 1988, p. 1].

[†] "It has never been the habit of scientists of this country or the policy of this Government to withhold from the world scientific knowledge. Normally, therefore, everything about the work with atomic energy would be made public.

"But under present circumstances it is not intended to divulge the technical processes of production or all the military applications, pending further examination of possible methods of protecting us and the rest of the world from the danger of sudden destruction" [Harry S. Truman, President of the United States, news release after the first atomic bomb was dropped on Hiroshima, Japan, as reported in *Science* **102** (2642), 163-165 (Aug. 17, 1945)].

[‡]The international nature of science is another of its distinguishing characteristics. Basic scientific information is published widely, both domestically and internationally, and U.S. scientists frequently make use of foreign sources of information. A 1984 study found that 44% of the citations found in U.S. scientific and technological publications were from foreign sources (P. Hernon and C. R. McClure, *Federal Information Policies in the 1980s: Conflicts and Issues*, Ablex Publishing, Norwood, N.J., 1987, p. 219, citing the Congressional Research Service as the source of this information). In 1980 about 63% of the world's most important scientific and technical information was produced outside the United States, compared with about 25% in the 1950s and 1960s (P. Hernon and C. R. McClure, ibid.).

[§] Not only will there be duplication of effort, but opportunities will be lost with respect to what might have been accomplished if new problems were being solved, rather than the work of others being duplicated (W. Gelhorn, *Security, Loyalty, and Science*, Cornell University Press, Ithaca, N.Y., 1950, p. 44). However, it must be remembered that one of the reasons information is classified is to advances.[*,†] The United States' lead in microwave electronics and computer technology was said to be significantly increased after a 1946 decision to release the results of wartime research in those fields.[33]

Reduced Progress in Other Fields of Science. Information from other fields of science often provides new insights, a "cross-fertilization" of ideas, which may contribute significantly to a scientific breakthrough. Information acquired for one purpose may influence wholly different fields in unexpected ways. Examples of such advances include use of X-rays to treat cancer and long-distance communication technology that ultimately sprang from Galvani's experiments with frogs' legs.[34] Loss of the beneficial interaction and insights from information produced in classified fields will probably have an adverse effect on progress in other, unclassified fields.[‡] The hindrance of this cross-fertilization process within the Soviet Union is said to be one of the factors that impedes Soviet progress in science and technology.[35]

Reduced Information Transfer. In addition to depending upon an "information foundation" provided by others, rapid and efficient progress in science depends upon full and free discussion of experimental results and proposed theories. The importance of open exchange of information within the scientific professions was stated in a 1965 report by the American Association for the Advancement of Science:

> Free dissemination of information and open discussion is an essential part of the scientific process. Each separate study of nature yields an approximate result and inevitably contains some errors and omissions. Science gets at the process of truth by a continuous process of self-examination which remedies omissions and corrects errors. The process requires free disclosure of results, general dissemination of findings, interpretations, conclusions, and widespread verification and criticism of results and conclusions.[36,37]

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make the adversary spend *its* resources to get the same information.

[*] A 1986 article discussed technical data rights in government contracts and the government's interest in having technical data, developed by business when under contract to the government, made public so that other companies could use this data. The author stated that "technological breakthroughs occur more rapidly when one designer has access to another's technical data and can build upon it. The military's interest is in sharing technology to keep costs down and promote further breakthroughs" [D. C. Maizel, "Trade Secrets and Technical Data Rights in Government Contracts," *Military Law Rev.* **114**, 227-298 (1986), p. 228].

[†] It is interesting to note a chapter in a recent book that describes "trade secret trading" between technical employees in competing businesses. E. von Hippel reports that engineers in one firm, needing to solve a technical problem, will sometimes contact their professional colleagues in rival firms to get help in solving that problem. An informal "trading network" develops, where an engineer will provide help to his "competitor" engineer if he does not think that the help will be "crucial" [to reducing the competitive advantage] and if he can expect help in return sometime in the future ("The Sources of Innovation," Chap. 6 in *Cooperation Between Rivals: The Informal Trading of Technical Know-How*, Oxford University Press, New York, 1988, pp. 76-92). He defines "know-how" as "the accumulated practical skill or expertise that allows one to do something smoothly and efficiently" and is often considered to be a trade secret. See also E. Von Hippel, "Trading Trade Secrets," in *Technology Review* **91** (2), 58-64 (Feb./Mar. 1988).

[‡] Even General Groves believed that a scientist benefits greatly from information from fields of science other than his or her own. "The more that a scientist knows in his own field and related fields, the better job he can do. But I think that in this case [atomic energy research] the military security overrides that, so that we are in effect decreasing, perhaps in some instances, his ability to do his best work in his scientific research, because there are certain things he doesn't know that if he did know he would be able to do better" (Gen. L. R. Groves, in *Atomic Energy Act of 1946*, Hearings before the Special Subcommittee on Atomic Energy, U.S. Senate, on S. 1717, "A Bill for the Development and Control of Atomic Energy," Feb. 18, 19, and 27, 1946, 79th Cong., 2nd Sess., p. 494, U.S. Government Printing Office, Washington, D.C., 1946).

The information on which scientific advances depend may be obtained by formal means (e.g., publications and conference presentations) or by informal means (e.g., face-to-face meetings, telephone calls, and private correspondence). Informal communications apparently play a large role in research and development.[38,39] Ideas are rapidly communicated and evaluated through the direct interactions of informal communication. Direct person-to-person meetings, such as discussions and demonstrations of equipment or techniques, have been mentioned as the best method to transmit detailed information about particular research and development techniques.[40] Classification of information in a field of science reduces the opportunity for those direct, beneficial interactions between scientists in that field.

For laboratories involved in unclassified fields of research, the informal mode of communication frequently occurs via a two-step information-flow process that involves a "technological gatekeeper."[41,42] In those situations, information flows from outside a laboratory through a gatekeeper to the gatekeeper's colleagues within the laboratory.[39,41] However, for classified fields of research, the information transfer is most frequently via written, classified reports; no gatekeeper mechanism is apparent.[43] This situation may be the result of constraints on informal communications in classified fields of research, for example, a consequence of the "need to know" policy regarding access to classified information. A scientist in one group may be prevented by the need-to-know policy (compartmentalization) from fully discussing research results or problems with a gatekeeper colleague, who has an equal security clearance but not a need to know, in another group in the same organization.[44] Therefore, classification of a field of research may severely restrict its progress within the organization that classifies the research as well as delaying the progress of researchers outside that organization.

Diminished Motivation of Scientists. Another factor in scientific progress is the motivation of scientists. Gaining the respect of professional peers has been a major incentive to scientific achievement.[45] Professional motivation is enhanced by free and open communication within a peer group.[46] For a researcher at the forefront of a field, that peer group includes scientists in other organizations and in other countries. Restricting opportunities for scientific discussions because of classification constraints could diminish the motivation of individual scientists, thereby reducing productivity.

Inadequate Peer Review. Errors that result from inadequate peer review may be some of the most expensive consequences of classification of scientific and technical information. The constraints of classification do not usually permit the most objective appraisal possible of work in progress.* Publishing scientific work in the open literature subjects it to the scrutiny of the world's scientists, experts in that field. Constraining the publication of scientific and technical information to classified reports limits the peer review of this information to a small number of persons, none of whom may have the expertise in that scientific field necessary for an exacting review. Thus, there may be more errors in classified scientific and reports than in unclassified reports and journal publications. It has been said that highly classified major technical programs at the forefront of

* "Classification of research and development projects often means that the only people who have any expertise on complex new weapons systems are those who have a vested interest in the project. This may leave Congress no choice but to accept the assessments offered by the military experts as to the necessity for the the effectiveness of the new equipment." "The National Security Interest and Civil Liberties," *Harvard L. Rev.*, **85**, 1130-1326 (1972) p. 1211.

science and which are “engaged in instant application and reduction to practice” will “stand a very high chance of going wrong, because they don’t have the public scrutiny and argument and challenge that is the essence of the best in science and new technology.”[47] Lack of adequate internal peer review (because of compartmentalization) and external peer review (because of classification) is said to increase the probability that “dead-end” research paths may be followed and to decrease the opportunity for cross-fertilization of ideas.[48] Lack of “world class” peer review may also result in a gradual lessening of scientific and technical standards on the part of the workers in a classified field.[*,49]

Recruitment Difficulties. The adverse effect that secrecy restraints have on recruitment of scientists for work in DOE’s highly classified weapons laboratories has been noted more than once. In 1949, the AEC stated, in connection with the advantages of designating broad areas of research and development as unclassified:

> Staffing of atomic energy projects is hampered so long as there is feeling on the part of many scientists that employment in the atomic energy program precludes their working on any but “classified” research projects with consequent denial of general publication.[50]

That problem was mentioned again in 1966.[51] It is interesting to note that AEC Chairman Lewis Strauss alleged, in the 1950s with respect to cessation of nuclear-weapon testing, that the best scientists would leave the AEC’s weapon laboratories if they could not continue to test nuclear weapons.[52]

A 1970 Department of Defense report evaluated the effects of classification of scientific and technical information on research, development, production, and deployment related to weapon systems. That report observed that “the laboratories in which highly classified work is carried out have been encountering more and more difficulty in recruiting the most brilliant and capable minds.”[53] Difficulties in recruiting scientists for classified research within the armed services has also been noted by another author.[54]

Ineffectiveness of Classifying Basic Research. Significant discoveries or breakthroughs in basic research generally occur under circumstances where there is worldwide activity in a scientific field. Researchers in several countries may be at the forefront of that field. In those circumstances, progress in that field can be likened to a “ripening vine.”[55] The field of nuclear fission was in that situation in the late 1930s. That field was “ripe,” with “pickers” ready in several nations, when Hahn and Strassman reported their discovery of uranium fission in December 1938.[56] The Hahn-Strassman discovery was immediately recognized as a significant breakthrough. It provided a key piece of information, a “missing link,” which was rapidly and vigorously exploited by researchers in many countries. Shortly thereafter, there were several instances of nearly identical experiments and results concerned with uranium fission, at essentially the same time, in laboratories in different countries. As one example, the approximate number of neutrons produced by the fission of a uranium nucleus

[*] “In one country there is always a certain inbreeding of ideas” [J. von Neuman, in *Atomic Energy Act of 1946*, Hearings before the Special Committee on Atomic Energy, U.S. Senate, on S. 1717, A Bill for the Development and Control of Atomic Energy, Part 2, 79th Cong., 2nd Sess., Jan. 25, 28-31, and Feb. 1, 1946, U.S. Government Printing Office, Washington, D.C., pp. 210-211 (1946)].

was independently discovered by three groups of scientists in three nations within a few weeks of each other in March-April 1939.*

The example of nearly simultaneous discovery, by three independent groups, of the number of neutrons released during uranium fission is not unique. It frequently happens that significant discoveries in a scientific field are duplicated by others, more or less independently, within a few months. Other specific examples include the "Compton Effect," discovered independently and almost simultaneously by Compton and Debye, and the discovery of the principle of radar by scientists, and its subsequent development, in several countries at about the same time.[57] Thus, for truly important discoveries at the forefront of science, other persons in other countries are probably soon going to make the same discovery.[58]

Also, military implications of scientific discoveries are frequently recognized at about the same time in different countries. Thus, some scientists working on nuclear fission in early 1939 brought its military possibilities to the attention of their national governments. Consequently, groups were soon established in most major countries to investigate military applications of uranium fission. The dates when those committees were established are shown in Table 6.1. The fact that those committees were established at about the same time indicates that most countries with advanced technologies recognized the military applications of uranium fission at substantially the same time.

Classification of basic research is probably not going to keep others from obtaining essentially the same information, although its acquisition may be delayed. If the Hahn-Strassman results had been kept secret within Germany, then Germany might have exploited that breakthrough to its sole advantage or at least might have had some "lead time." However, others had narrowly missed discovering uranium fission,† and this discovery probably would have been independently made in other countries within a few months.‡

Classification During Wartime. It may sometimes (rarely) be advisable for national-security reasons to classify even the most basic scientific discoveries, particularly during wartime or when war is imminent.§ As has been discussed previously, the implications of uranium fission on

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* E. Fermi's group at Columbia University, New York, had, by mid-March 1939, concluded from preliminary experiments that the average number of neutrons released per fission was two (R. G. Hewlett and O. E. Anderson, Jr., *The New World, 1939/1946*, The Pennsylvania State University Press, University Park, Pa., 1962, p. 14). On April 7, 1939, F. Joliot-Curie, H. von Halban, and L. Kowarski reported that an average of 3.5 neutrons were released per uranium fission (D. Irving, *The German Atomic Bomb*, Simon and Schuster, New York, 1967, p. 34). In April 1939, two Soviet physicists reported that a nuclear chain reaction was possible with uranium, based on their measurements of two to four neutrons released per uranium fission (A. Kramish, *Atomic Energy in the Soviet Union*, Stanford University Press, Stanford, Calif., 1959, p. 22). The same, important conclusion was derived from all three "preliminary" experiments—that a chain reaction was possible with uranium fission.

† See, for example, R. Rhodes, *The Making of the Atomic Bomb*, Simon and Schuster, New York, 1986, pp. 234-235, 247, 271, 274. Groups at Paris and Berkeley were very close to the same discovery in early 1939. The discovery of fission had also earlier been missed several times (M. Gowing, *Britain and Atomic Energy 1939-1945*, St. Martins Press, New York, 1964, pp. 25-26).

‡ Another "however" is the fact that that Paul Rosbaud, the editor of *Naturwissenschaften* (the journal in which Hahn and Strassman published the news of their breakthrough) who made a special trip to Hahn's laboratory late one evening to pick up the Hahn-Strassman manuscript (D. Irving, *The German Atomic Bomb*, Simon and Schuster, New York, 1967, pp. 28-29), was a British scientific-intelligence agent (Arnold Kramish, *The Griffin*, Houghton Mifflin, Boston, 1986; R. C. Williams, *Klaus Fuchs, Atom Spy*, Harvard University Press, Cambridge, Mass., 1987, p. 46). Therefore, even if the Germans had wanted to keep the news of the Hahn-Strassman discovery a secret, it appears that the information would have been quickly sent to Britain.

§ The early progress in uranium fission research provides several examples of the value of classifying basic research in some national security were recognized by some U.S. scientists conducting basic research in this field well before the government was convinced of the potential of atomic weapons. In that situation, the scientists voluntarily withheld publication of their results for national-security reasons, although those results were concurrently distributed to other U.S. researchers in that same field (see Chapter 4).* It was probably beneficial to our national security that those basic research results were not published.

In spite of the occasional circumstances when classification of scientific information is justified, the authoritative opinion is that, even in time of war, it is not clear that classification of scientific information always has a net positive result. A 1946 report concerning our wartime scientific efforts stated:

> In the midst of war, it is clear that the best security lies in speed, in achievement, rather than in secrecy. That this secrecy can defeat its own purpose is shown by the frequency with which enemy scientists independently discovered techniques zealously guarded by us. Our secrecy merely slowed down our own production and decreased our time advantage.[59]

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instances. As mentioned in Chapter 4, the Germans inaccurately measured the neutron capture cross section of carbon and therefore did not further seriously consider it for a moderator in a nuclear reactor. Accurate measurements were made by U.S. scientists, and the United States then used graphite as a moderator for the first nuclear reactors, including the plutonium production reactors at Hanford, Wash. Those U.S. measurements were withheld from publication, and therefore the Germans never learned of them during WWII. If they had learned of a different, correct value for the neutron-capture cross-section of carbon, the course of their research would probably have been much different and more successful.

*Later, in the U.S. development of atomic energy during WWII, the Manhattan Project classified most of the atomic-energy information, had a highly compartmentalized security system, and yet produced excellent results. However, it must be remembered that this project included most of the top nuclear physicists and chemists of the United States (including recent émigrés from Italy, Austria, and Germany), Britain, Canada, and some from Denmark and other countries. Thus, most U.S. and allied experts in that field (which also included most world experts in that field) were an integral part of the project, so there was information flow among those who were best equipped to use this information to advance science and technology.

Table 6.1. Approximate dates when committees concerned with the military use of uranium were formed in several countries

Country	Committee name	Date established
United States	Advisory Committee on Uranium	October 1939[a]
Soviet Union	Committee on the Uranium Problem	July 1940[b]
Germany	Nuclear Physics Research Group	Summer 1939[c]
France	["Joliot-Curie Group"]	Spring 1939[d]
England	M.A.U.D. Committee	March 1940[e]
Japan	[Army-Air Force Study]	September-December 1940[f]

[a]R. G. Hewlett and O. E. Anderson, Jr., *The New World, 1939/1946*, The Pennsylvania State University Press, University Park, Pa., 1962, pp. 17-20. The first direct contact between "the physicists of nuclear fission" and the U.S. Government concerning uranium as an explosive was on March 16, 1939, via a telephone call from G. Pegram, Dean of Columbia University, and Adm. S. C. Hooper, Technical Assistant to the Chief of Naval Operations (R. Rhodes, *The Making of the Atomic Bomb*, Simon and Schuster, N.Y., 1986, pp. 292-293). On March 17, E. Fermi described uranium fission to representatives from the Army and Navy. Shortly thereafter, the Naval Research Laboratory allocated $l500 to the Carnegie Institution of Washington, D.C., for research in this area. For reasons of internal policy, the Carnegie Institution did not accept the grant (R. G. Hewlett and O. E. Anderson, Jr., ibid, p. 15).

[b]David Holloway, *Stalin and the Bomb*, (The Soviet Union and Atomic Energy, 1939-1956), Yale University Press, New Haven, Conn., 1994, p. 62. See also P. Kelly, "How the USSR Broke into the Nuclear Club," *New Scientist* **110**, 32-35 (May 8, 1986), p. 33. The initial Soviet committee's purpose was not specifically militarily oriented (P. Kelly, *ibid.*). The Soviet government established a research project on the use of atomic energy (production of an atomic bomb) in February 1943 and I. V. Kurchatov was appointed its scientific director on March 10, 1943 (Holloway, p. 88).

[c]The first government-sponsored (by the Reich Ministry of Education) German conference on the use of uranium in weapons was held in Berlin on April 29, 1939, under "secrecy" (R. Rhodes, *The Making of the Atomic Bomb*, Simon and Schuster, New York, 1986, p. 296; D. Irving, *The German Atomic Bomb*, Simon and Schuster, New York, 1967, p. 35). Shortly thereafter, the German War Office, in an independent effort, started its own research program, stimulated by recommendations by P. Harteck and W. Groth of Hamburg (Ibid., p. 36). Army funding began in the summer of 1939 (ibid., p. 41). Later a formal group, the "Nuclear Physics Research Group," was established in the Ordnance Department of the War Office (ibid., p. 45).

[d]Although no formal governmental committee on uranium appears to have ever been established in France prior to the end of WWII, French nuclear efforts led by F. Joliot-Curie were in the forefront of research in nuclear fission in early 1939. By May 4, 1939, F. Joliot-Curie had registered a secret patent concerning nuclear explosives in the name of the Caisse Nationale de la Recherche Scientifique, which had supported his research (B. Goldschmidt, *The Atomic Complex*, American Nuclear Society, La Grange, Ill., 1982, p. 29). Support from the French minister for armaments was received by Joliot-Curie in September 1939.

[e]G. Thomson, "Anglo-U.S. Cooperation on Atomic Energy," *Bull. At. Sci.* **9**, 46-48 (1953), p. 46. In about May 1939, G. Thomson thought of the possibility of using uranium fission to produce a weapon and was loaned a ton of uranium oxide by the British Air Ministry for experiments in that field (R. Rhodes, *The Making of the Atomic Bomb*, Simon and Schuster, New York, 1986, p. 327). It would seem that the ultimate purpose of the experiments would have been told to the British Air Ministry when that request was made and would therefore have been the first governmental sponsorship or contact in Great Britain with respect to use of uranium fission for military purposes.

[f]D. Shapely, "Nuclear Weapons History: Japan's Wartime Bomb Project Revealed," *Science* **199**, 152-157 (January 13, 1978), p. 153. The first reported military-sponsored study concerning atomic energy was initiated in April 1940 by the Japanese Army's Aviation Technology Research Institute (R. Rhodes, *The Making of the Atomic Bomb,* Simon and Schuster, New York, 1986, p. 327). Army funds were provided to Y. Nishina's Riken Laboratory, Tokyo, in September 1940, for atomic bomb research. The first "committee" was the "Physics Colloquium" established by the Riken Laboratory for the Japanese Navy. This colloquium held ten meetings between December 1942 and March 1943.

Dr. Vannevar Bush, the President's science advisor and Director of the Office of Scientific Research and Development during WWII, stated the following in 1945:

> Our ability to overcome possible future enemies depends upon scientific advances which will proceed more rapidly with diffusion of knowledge than under a policy of continued restriction of knowledge now in our possession.[60]

A policy of "security by achievement," by rapidly developing the fruits of basic research into weapons systems and other components of our national security, rather than "security by secrecy," is a recurrent theme emphasized by many scientific and technical leaders since the end of WWII.*

> Our position is that you will get the greatest security by the greatest scientific freedom, because this country, with its resources and its technological ability, can make the most of any scientific ideas that appear anywhere in the world.[61]

> The Nation's safety is not safeguarded by retaining these secrets. The Nation's safety is safeguarded primarily by building up our own strength, and it is really only a very minor part of our safety that is concerned with giving away some of this information.[62]

However, as Frederick Seitz and Eugene P. Wigner noted, after the (First) International Conference on the Peaceful Uses of Atomic Energy, that "We must bear in mind the fact that if the other side learns all that we know, but we remain ignorant of what they discover, we will find it very hard to stay ahead in the game."[63] Drs. Seitz and Wigner were commenting on the relative exchange of atomic-energy information between Russian and U.S. scientists and engineers during that 1955 conference in Geneva, Switzerland.

Recognition of the adverse effects of classification upon scientific and technical progress, and consequently on our nation's strength, was mentioned by the Tolman Committee in 1945 as discussed in Chapter 5. That committee was established to recommend a policy for the declassification of Manhattan Project scientific and technical information. In its first report, the Tolman Committee stated its general philosophy:

> It is not the conviction of the Committee that the concealment of scientific information can in any long term contribute to the national security of the United States. It is recognized that at the present time it may be inevitable that the policy of the Government will be to conceal certain information in the interest of national security. Even within this limitation there are many matters whose declassification would greatly help the progress of science without violating that policy. If we are looking to the national welfare or national security as they may be two decades from now the Committee has no doubt that the greatest strength in both fields would come from a completely free and open development of science.

> Thus, the Committee is inclined to the view that there are probably good reasons for keeping close control of much scientific information if it is believed that there is a likelihood of war

* Louis N. Ridenour used the terms "security by achievement" and "security by concealment." Louis N. Ridenour, "Military Security and the Atomic Bomb," *Fortune*, **32**, 170-223, 170 (Nov. 1945).

> within the next five or ten years. It is also their view, however, that this would weaken us disastrously for the future—perhaps twenty years hence.[64]

H. D. Smyth, while a member of the AEC, expressed a philosophy similar to that of V. Bush and of the Tolman Committee. He stated that more publication of nuclear research would not only increase progress in that area but, "incidentally, would strengthen our long-term military position."[65] The AEC also stated the following in 1950:

> Secrecy, if unwisely applied, can go far beyond its objective of safeguarding vital information—it can stifle and smother freedom of research and freedom of inquiry in nonrestricted areas, and from this the Nation could only suffer a net loss.[66]

More recently, a research manager at one of the DOE weapons laboratories has stated, "Far more progress is actually evidenced in the unclassified fields of research than the classified ones."[67] A recent report by a national panel on the effect of national-security controls on international technology transfer summarized the adverse impacts of the Soviet's system of secrecy on scientific and technical progress within the Soviet Union. The isolation of scientific entities within the Soviet Union system is said to cause "reduced cooperation among scientists, duplication of effort despite central planning, slow diffusion of new ideas and technologies, and errors due to inadequate peer review."[68]

Summary. It is generally accepted that efficient progress in science depends upon free and open communication among scientists, especially in the area of basic research. This judgment is reflected in a recent report by the National Academy of Sciences, *Scientific Communication and National Security* (popularly known as *The Corson Report*), which discussed secrecy and scientific communication.[69,*] A relevant excerpt from that report follows:

> Free communication among scientists is viewed as an essential factor in scientific advance. Such communication enables critical new findings or new theories to be readily and systematically subjected to the scrutiny of others and thereby verified or debunked. Moreover, because science is a cumulative activity—each scientist builds on the work of others—the free availability of information both provides the foundations for further scientific advance and prevents needlessly redundant work. Such communications also serve to stimulate creativity, both because scientists compete keenly for the respect of their peers by attempting to be first in publishing the answers to difficult problems and because communication can inspire new lines of investigation. Finally, free communication helps to build the necessary willingness to confront any idea, no matter how eccentric, and to assess it on its merits.[70]

Therefore, classification of scientific and technical information will slow scientific and technical progress in all areas of science and technology. Slowing the progress of basic research will also slow the progress of applied research, which has its roots in basic research and cannot proceed beyond the limits set by those roots.[71]

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[*] That report also concluded that "the best way to ensure long-term national security lies in a strategy of security by accomplishment." The risk occasioned by communicating new scientific findings to adversaries was said to be acceptable. *The Corson Report,* p. 47.

However, it should be remembered that one purpose of classifying information is to delay an adversary in the acquisition of that information, so one must always (1) balance the benefits of that delay against the costs of delaying our advances and (2) note the special circumstances with respect to weapons of mass destruction and lead time (see Chapter 1).

ECONOMIC COSTS OF CLASSIFICATION

The economic costs of classification include the following direct costs:

- salaries for classification office personnel;
- extra costs to transmit and transport classified documents and materials (e.g., special modes of transport and receipting requirements);
- costs of document storage, including periodic inventories;[*] and
- costs of reviewing classified documents for declassification or downgrading.

Although salaries for classification office personnel are easily determined, some of the other direct economic costs have not been well quantified. The Department of Defense estimated in 1971-1972 that it cost about $0.36 for each annual inventory of a Top Secret document and about $2.57 to handle a Top Secret document in transit.[72] Those costs are certainly substantially greater now.

The Information Security Oversight Office (ISOO) has been reporting classification costs for both government and industry for about six years. For Fiscal Year 2000, those costs were about $5.2 billion, with about $4.3 billion attributed to government and about $0.9 billion to industry.[73] Government classification-management costs were estimated at $213 million, or about 5.0% of the total costs. It is interesting that classification-management costs, which include the costs of making the initial classification determination (said to be the most important part of the classification process), are such a small percentage of the total classification costs. It might be postulated that spending more money "up front" ensuring that the initial classification decision is correct might significantly reduce total classification (and declassification) costs.

The costs of declassification (or downgrading) are frequently overlooked. Declassification costs can be particularly expensive for technical documents many years old, when the reasons for initial classification may not be well understood. Much time and effort may be required of declassifiers to determine the reasons for the initial classification decision, which they must understand before they can reach a sound declassification (or downgrading) decision. Those "hidden" costs of classification are somewhat analogous to waste disposal or decontamination or decommissioning costs. Chemical manufacturers for many years did not consider, or were not required to consider, the costs of ultimately disposing of their process wastes. Those costs are now included in the cost of a product, just as high-level radioactive waste disposal costs are included in the cost of electric power generated from nuclear power stations. Classified programs should include

[*] Once documents or materials are classified, subsequent declassification and downgrading of those documents will probably not reduce storage costs. They probably will be stored in the same place after declassification or downgrading. However, declassification will eliminate costs of periodic inventories [A. F. Van Cook, "Downgrading and Declassification-Some Observations," *J. Natl. Class. Mgmt. Soc.* **3** (1), 11-18 (1967), pp. 15-16]. [Note added in 2002: Periodic inventories are no longer generally required for most Secret and Confidential documents.]

the costs of periodic classification reviews of classified documents as a part of those programs. ISOO reported that Fiscal Year 2000 government declassification-management costs were about $231 million, or about 5.4% of the total government classification costs (and slightly more than the classification-management costs).[74]

As an example of costs of reviewing classified documents for declassification, the Department of Defense reported (in about 1971 and 1972) that 175 man-months were required to review 1,800,000 pages contained in 240,000 classified documents (100,000 of which were declassified) at a cost of $0.66 per document.[75,56] At 173.3 hours per man-month, this represents 30,300 hours of effort (59.4 pages per hour; 7.9 documents per hour). In 1996, some federal government agencies estimated a cost of a dollar or more per page for a line-by-line review of classified documents.[76] In 1999, the U.S. Army reported reviewing about 41.8 million pages at a cost of about 40 cents per page.[77] It is not known whether this latter review was a line-by-line classification review.

In 1988-1989, Oak Ridge Gaseous Diffusion Plant personnel provided a classification review of 342 gaseous-diffusion-technology documents. Those documents occupied about 24 linear inches of shelf space and totaled about 4800 pages (assuming "used" paper occupies about 2400 pages/foot; "new" paper occupies about 3000 pages/foot). The average time to review a document was 17 minutes, at an average rate of about 50 pages per hour. The paperwork to notify the ORGDP's Records Center that documents had been declassified or downgraded required about 9 minutes per document. Additional paperwork was required of the Records Center to complete their records and notify other holders of the documents of the classification changes.

Line-by-line classification reviews are considerably more costly than "high-volume" or "bulk" declassification reviews. In 1992, the National Archives estimated that high-volume or bulk declassification reviews cost about seven cents per page.[78] In 1994, President Clinton's EO 12937 directed the declassification of certain records at the National Archives, of which 40 million pages were declassified (high-volume review) at an average cost of a fraction of a cent per page.[79]

Classification also has substantial indirect costs, which usually include such items as:

- costs of preparing documents or fabricating hardware on "secure" equipment and in secure areas;
- costs of classified procurements;
- costs of inefficient communication between project personnel (such as requirements for use of secure telephones and holding discussions and conferences only in secure areas);
- the time that employees are required to spend in classification education and training; and
- costs of having to do the same research or development twice because the results from a classified program are not available to others and the work must be repeated.

Like the direct costs of classification, those indirect costs have not been well quantified. It has been estimated that up to half the total cost of a classified development project can be attributed to the information-security costs.[80] ISOO is continuing to improve its methods for obtaining estimates of classification and declassification costs.

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