



# Nuclear Weapons R&D Organizations in Nine Nations

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## Summary

Seven nations—China, France, India, Pakistan, Russia, the United Kingdom, and the United States—possess nuclear weapons. North Korea tested a nuclear explosive device in 2006, and announced that it had conducted a test in 2009 and another in 2013. Israel is widely thought to have nuclear weapons. As an aid to Congress in understanding nuclear weapons, nuclear proliferation, and arms control matters, this report describes which agency is responsible for research and development (R&D) of nuclear weapons (i.e., nuclear explosive devices, as distinct from the bombers and missiles that deliver them) in these nations and whether these agencies are civilian or military. It also traces the history of such agencies in the United States from 1942 to the present. This report will be updated annually, or more often as developments warrant.

In the United States, the Army managed the nuclear weapons program during World War II. Since 1946, weapons R&D has been managed by civilian agencies, at present by the National Nuclear Security Administration (NNSA), a semiautonomous agency in the Department of Energy. Concerns about “the immediate and long-term issues associated with the NNSA,” however, led Congress to establish the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise in the FY2013 National Defense Authorization Act, P.L. 112-239.

China’s nuclear weapons R&D is apparently under the direction of the military, collectively called the People’s Liberation Army.

France’s nuclear weapons R&D is supervised by the Ministry of Defense, which delegates the direction of these programs to the French Atomic and Alternative Energy Commission (CEA). However, as with NNSA in the United States, CEA is not a part of the Ministry of Defense. CEA also conducts nuclear programs in science and industry under the supervision of other ministries.

India’s nuclear weapons R&D appears to be controlled by the Department of Atomic Energy, which is under the direct control of the Prime Minister.

Israel’s nuclear program is under civilian control, but since Israel neither confirms nor denies that it possesses nuclear weapons, it classifies information on such weapons, including organizations responsible for R&D. The Israel Atomic Energy Commission reportedly has overall responsibility for Israel’s nuclear weapons program, and the Director General of that commission reports directly to the Prime Minister.

North Korea’s Ministry of Atomic Energy Industry is in charge of the day-to-day operation of the nuclear weapons program. Under it are nuclear-related organizations. Policy is decided by leader Kim Jong-un and other Communist Party and military leaders who advise him.

Pakistan’s National Command Authority (NCA) supervises the functions and administration of all of Pakistan’s organizations involved in nuclear weapons R&D and employment, as well as the military services that operate the strategic forces. The Prime Minister is the chair of the NCA, and membership includes senior civilian and military leaders.

Russia’s State Atomic Energy Corporation (Rosatom) is responsible for nuclear weapons R&D and production. It is a civilian agency, though it has many links to the military.

In the United Kingdom, a private company, AWE Management Limited, manages and operates the Atomic Weapons Establishment (AWE), a government-owned, contractor-operated entity. The Ministry of Defence (MoD), which is headed by a civilian, controls the operations, policy, and

direction of AWE and can veto actions of the company. The MoD provides most of the funding for AWE.

This update revises the section on Israel. The balance of the report is updated to February 2013.

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## Overview

Since 1945, seven nations—China, France, India, Pakistan, Russia, the United Kingdom, and the United States—have developed and currently deploy nuclear weapons. North Korea tested a low-yield nuclear explosive device in October 2006, announced that it had conducted a second nuclear test in May 2009, and announced a third test on February 12, 2013.<sup>1</sup> Israel is generally thought to possess nuclear weapons, although it maintains a policy of ambiguity on this matter. This report describes the organizations controlling research and development (R&D) on nuclear weapons (i.e., nuclear explosive devices, as distinct from the bombers and missiles that carry them) in these nations, and presents a brief history of the organizations controlling nuclear weapons R&D in the United States. It discusses whether these organizations are civilian or military, though in many nations the lines between civilian and military are blurred. This information may be of use to Members of Congress and their staff interested in nuclear weapons, nuclear proliferation, and arms control matters.

## United States

The U.S. program for research, development, and production of nuclear weapons began during World War II. It was initially under the control of the Office of Scientific Research and Development, a civilian agency within the Executive Office of the President. In 1942, control shifted to the Army, in substantial part because the Army had the capability to manage projects to design and build the massive plants to produce uranium and plutonium for atomic bombs.<sup>2</sup> In 1945 and 1946, debate raged in Congress, the White House, the War Department, and among scientists and the public about whether to place atomic energy under civilian or military control.<sup>3</sup> Congress resolved the issue in favor of civilian control of atomic energy in the Atomic Energy Act of 1946 (P.L. 79-585).<sup>4</sup> That act created the Atomic Energy Commission (AEC) to develop nuclear weapons and, more generally, to foster and control research into atomic energy. The AEC was an independent organization, separate from the War Department and, later, from the Department of Defense (DOD). Ever since, nuclear weapons R&D has been conducted by the AEC and its successor organizations, all of which have been under civilian control and separate from DOD.<sup>5</sup>

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<sup>1</sup> Since no radioactive materials (particles or gases) were reported to have been detected from the 2009 explosion, it is not certain that that event was in fact a nuclear test. See CRS Report R41160, *North Korea's 2009 Nuclear Test: Containment, Monitoring, Implications*, by Jonathan Medalia. While no radioactive materials had been reported to have been detected from the third test within a few days of the event, the Office of the Director of National Intelligence issued the following statement: "The U.S. Intelligence Community assesses that North Korea probably conducted an underground nuclear explosion in the vicinity of P'unggye on February 12, 2013." "Statement by the Office of the Director of National Intelligence on North Korea's Declared Nuclear Test on February 12, 2013," February 12, 2013.

<sup>2</sup> Richard Hewlett and Oscar Anderson, Jr., *The New World, 1939/1946, Volume I: A History of the United States Atomic Energy Commission* (University Park, PA, The Pennsylvania State University Press, 1962), pp. 71-83. Building and operating these plants consumed the vast bulk of funds for the Manhattan Project; *ibid.*, p. 723.

<sup>3</sup> *Ibid.*, pp. 7, 408-411.

<sup>4</sup> "Atomic Energy Act of 1946 (Public Law 585, 79<sup>th</sup> Congress), Excerpted from 'Legislative History of the Atomic Energy Act of 1946 (Public Law 585, 79<sup>th</sup> Congress),' " Compiled by James D. Nuse, AEC Headquarters Library, Volume 1, Principal Documents, U.S. Atomic Energy Commission, Washington, 1965, <http://www.osti.gov/atomicenergyact.pdf>.

<sup>5</sup> For a detailed timeline of the history of DOE and its predecessor agencies, see "Energy Timeline" at the DOE website (continued...)

The Atomic Energy Act of 1954 (P.L. 83-703), as amended, replaces the Atomic Energy Act of 1946.<sup>6</sup> The Nuclear Regulatory Commission states that the 1954 act “is the fundamental U.S. law on both the civilian and the military uses of nuclear materials.”<sup>7</sup>

The Energy Research Reorganization Act of 1974 (P.L. 93-438) abolished the AEC. It established the Nuclear Regulatory Commission, which regulated civilian uses of nuclear energy; the Energy Research and Development Administration (ERDA), which was in charge of nuclear weapons, among other things; and the Energy Resources Council. In 1977, the Department of Energy Organization Act (P.L. 95-91) abolished ERDA and the Federal Energy Administration and established the Department of Energy (DOE).

In 1999, Title XXXII of P.L. 106-65, National Defense Authorization Act for FY2000, established the National Nuclear Security Administration (NNSA) as a semiautonomous agency within DOE. Regarding the semiautonomous status, that act, as amended, stated:

SEC. 3220. STATUS OF ADMINISTRATION AND CONTRACTOR PERSONNEL WITHIN DEPARTMENT OF ENERGY.

(a) Status of Administration Personnel.—Each officer or employee of the Administration, in carrying out any function of the Administration—

(1) shall be responsible to and subject to the authority, direction, and control of—

(A) the Secretary acting through the Administrator and consistent with section 202(c)(3) of the Department of Energy Organization Act;

(B) the Administrator; or

(C) the Administrator’s designee within the Administration; and

(2) shall not be responsible to, or subject to the authority, direction, or control of, any other officer, employee, or agent of the Department of Energy.

Section 3203 states that the Secretary of Energy “shall be responsible for establishing policy” for NNSA, while Section 3251 requires that NNSA’s budget shall be treated separately in the DOE budget.

NNSA’s Office of Defense Programs is responsible for such nuclear weapons work as R&D, production, transportation between DOE sites and between DOE and DOD sites, maintenance of weapons (except for minor maintenance at DOD sites), and dismantlement. NNSA’s other primary program areas are Defense Nuclear Nonproliferation (DNN) and Naval Reactors. DNN’s Office of Fissile Materials Disposition is responsible for the disposition of surplus plutonium and highly enriched uranium. The Nuclear Weapons Council coordinates NNSA and DOD work on nuclear weapons. The council was established pursuant to P.L. 99-661, FY1987 National Defense

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at <http://www.energy.gov/about/timeline.htm>.

<sup>6</sup> The Act, as amended, is available at 42 USC 2011 et seq., [http://www.law.cornell.edu/uscode/html/uscode42/usc\\_sec\\_42\\_00002011--000-.html](http://www.law.cornell.edu/uscode/html/uscode42/usc_sec_42_00002011--000-.html).

<sup>7</sup> U.S. Nuclear Regulatory Commission, “Our Governing Legislation,” <http://www.nrc.gov/about-nrc/governing-laws.html#aea-1954>.

Authorization Act, Section 3137.<sup>8</sup> As per 10 U.S.C. 179, the members of the council are the Under Secretary of Defense for Acquisition, Technology, and Logistics, the Vice Chairman of the Joint Chiefs of Staff, the Under Secretary for Nuclear Security of the Department of Energy (who is also the Administrator of NNSA), the Under Secretary of Defense for Policy, and the Commander of the United States Strategic Command.

At present, NNSA's nuclear weapons activities are conducted at eight sites: Los Alamos National Laboratory (NM), Lawrence Livermore National Laboratory (CA), and Sandia National Laboratories (NM and CA), all of which conduct weapons R&D; Pantex Plant (TX), Kansas City Plant (MO), and Y-12 National Security Complex (TN), all of which are involved in the production, maintenance, and dismantlement of nuclear weapons; the Savannah River Site (SC), which processes tritium, a key ingredient of nuclear weapons; and the Nevada National Security Site (NV, formerly Nevada Test Site). While the last U.S. nuclear test was conducted in September 1992, the Nevada National Security Site conducts weapons-related experiments not involving nuclear explosions and remains available to conduct nuclear tests if needed. A DOE website contains summary and detailed DOE budget requests for FY2002-FY2013.<sup>9</sup>

In the FY2013 budget cycle, both Armed Services Committees expressed concerns about NNSA, questioning its relationship with DOE and raising the prospect that it should have more, if not total, autonomy from DOE. The FY2013 National Defense Authorization Act, P.L. 112-239, Section 3166, established the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise, with an interim report due by July 2013 and a final report due by February 2014. According to Section 3166, the panel was to "examine options and make recommendations for revising the governance structure, mission, and management of the nuclear security enterprise." While the legislation addressed the "nuclear security enterprise," the conference report made clear that the panel was "to address the immediate and long-term issues associated with the NNSA."<sup>10</sup> (Written by Jonathan Medalia, Specialist in Nuclear Weapons Policy.)

## China

The research, development, and production of nuclear weapons in the People's Republic of China (PRC) appear to be under the control of the military, which is collectively called the People's Liberation Army (PLA). The PLA's Second Artillery (missile force) deploys nuclear-armed and conventionally armed missiles for strategic deterrence and manages the storage and security of nuclear weapons. The nuclear weapons work is conducted by the China Academy of Engineering Physics (CAEP), which refers to a large organization that encompasses at least 17 major research institutes located near the cities of Mianyang (Sichuan province),<sup>11</sup> Shanghai, Beijing, and Chengdu. Founded in 1958, the CAEP has used names of entities that include the Ninth Academy, High Power Laser Laboratory, and Institute of Applied Physics and Computational Mathematics

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<sup>8</sup> See 10 USC 179, at [http://www.law.cornell.edu/uscode/html/uscode10/uscode10 USC\\_sec\\_10\\_00000179—000-.html](http://www.law.cornell.edu/uscode/html/uscode10/uscode10 USC_sec_10_00000179—000-.html).

<sup>9</sup> U.S. Department of Energy. Office of the Chief Financial Officer, *Office of the Chief Financial Officer Products and Services*, <http://www.cfo.doe.gov/crorg/products.cfm>, and select "Budget Justifications & Supporting Docs" from the drop-down menu.

<sup>10</sup> U.S. Congress, Joint Committee of Conference, *National Defense Authorization Act for Fiscal Year 2013*, conference report to accompany H.R. 4310, 112<sup>th</sup> Cong., 2<sup>nd</sup> sess., December 18, 2012, H.Rept. 112-705 (Washington: GPO, 2012), p. 995.

<sup>11</sup> CAEP was especially concerned about the impact of a major earthquake that shook Sichuan in May 2008.

(IAPCM). CAEP seems to report to the Science and Technology Commission of the PLA's General Armaments Department (GAD). The PLA, through the GAD, also controls the nuclear weapon testing base at Lop Nur in the northwestern Xinjiang region. The PRC's last announced nuclear weapons test took place in July 1996.

At the same time, the PRC has a policy of military-civilian integration in national defense, including work at military and civilian institutes and universities. Under the Central Military Commission (CMC) and the State Council, the Central Special Commission is believed to be responsible for top-level coordination of strategic weapons programs. Other PRC organizations reportedly involved with nuclear warheads reportedly include the following: Northwest Institute of Nuclear Technology, Fudan University, Shanghai Institute of Nuclear Research, China Institute of Atomic Energy, China Institute of Radiation Protection, China Aerospace Science and Technology Corporation (CASC), China Academy of Sciences (CAS), and China Academy of Engineering (CAE). The China National Nuclear Corporation (CNNC) is a defense industrial state-owned conglomerate that works with nuclear fuel, nuclear power plants, enrichment, and other related nuclear activities. In 2008, CNNC was re-organized as one of 10 defense industrial conglomerates under the Ministry of Industry and Information Technology (MIIT).

The PRC is believed to possess a nuclear force that totals approximately 240 nuclear warheads, according to some experts. They also say that satellite images and other data suggest that China's nuclear production facilities are not producing more plutonium and do not have enough fissile material for thousands of warheads. Still, uncertainty remains about China's nuclear weapons. The PLA's Second Artillery reportedly uses an extensive network of underground tunnels, totaling over 3,100 miles, to hide and move strategic missiles, as the Secretary of Defense reported to Congress in 2011. In 2011, Professor Phillip Karber of Georgetown University focused on the tunnels and argued in a study that China's nuclear weapons could total as many as 3,000. A retired general who commanded Russia's strategic forces, Viktor Yesin, argued that China has 1,600-1,800 nuclear warheads. However, in August 2012, the Commander of the U.S. Strategic Command (STRATCOM), Air Force General Robert Kehler, said that he disagreed with arguments that China has hundreds or thousands more nuclear weapons than the size estimated by intelligence assessments. (Written by Shirley Kan, Specialist in Asian Security Affairs.)<sup>12</sup>

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<sup>12</sup> This section on the PRC is based on numerous unclassified consultations and citations that include John Wilson Lewis and Xue Litai, *China Builds the Bomb* (Stanford University Press, 1988); Department of Commerce, "Entity List," published since 1997; Thomas Reed, "The Chinese Nuclear Tests, 1964-1996," *Physics Today*, September 2008; Tai Ming Cheung, *Fortifying China* (Cornell University Press, 2009); Thomas Reed and Danny Stillman, "The Nuclear Express," *Wall Street Journal*, January 16, 2009; information published by the State-owned Assets Supervision and Administration Commission (SASAC), CAEP, CNNC, MIIT, and PRC and Hong Kong media; Mark Stokes, "China's Nuclear Warhead Storage and Handling System," Project 2049 Institute, March 12, 2010; Hans Kristensen and Robert Norris, "Chinese Nuclear Forces, 2011" *Bulletin of the Atomic Scientists*, November/December 2011; Gregory Kulacki, "China's Nuclear Arsenal: Status and Evolution," Union of Concerned Scientists, May 2011; Secretary of Defense, "Military and Security Developments Involving the People's Republic of China," August 2011; William Wan, "Georgetown Students Shed Light on China's Tunnel System for Nuclear Weapons," *Washington Post*, November 30, 2011; Hans Kristensen, "No, China Does not Have 3,000 Nuclear Weapons," Federation of American Scientists (FAS), December 3, 2011; Jeffrey Lewis, "Collected Thoughts on Phil Karber," Arms Control Wonk, December 7, 2011; Hans Kristensen, "STRATCOM Commander Rejects High Estimates for Chinese Nuclear Arsenal," Federation of American Scientists, August 22, 2012; Bill Gertz, "Number the Nukes," *Free Beacon*, December 14, 2012; and Tai Ming Cheung (editor), "Chinese Defense Economy Takes Off," University of California Institute on Global Conflict and Cooperation, 2013.



## France

France's nuclear weapons R&D is supervised by the French Ministry of Defense, which delegates the direction of these programs to the French Atomic and Alternative Energy Commission (*Commissariat à l'énergie atomique et aux énergies alternatives*, or CEA).<sup>13</sup> CEA was established in 1945 and is a public entity. It "is active in four main areas: low-carbon energies; defense and security; information technologies; and health technologies."<sup>14</sup>

According to the Embassy of France, CEA's general programs are determined by a committee, *Comité à l'Énergie Atomique*, which is chaired by the French Prime Minister. The CEA Chairman serves as "a sort of Chief Executive Director" of the organization. He or she is appointed by the government, chairs the CEA Board, and is a permanent member of the aforementioned *Comité*. A High Commissioner, also appointed by the government, is tasked with advising the CEA Chairman on scientific and technical issues. The High Commissioner chairs the CEA Scientific Committee and is usually a member of the *Comité*.

CEA activities in the military field are carried out in the CEA's *Direction des Applications Militaires* (DAM). DAM's activities are supervised by the Ministry of Defense, but program management is in large part delegated to CEA. A commission, the *Comité Mixte Armées-CEA*, oversees program execution, particularly the financial aspects. As is the case for other CEA directorates, DAM is not a part of the Ministry of Defense or any other government ministry.

CEA receives its funding from several government ministries and directorates: the Ministry of Ecology and Sustainable Development; the General Directorate for Energy and Climate; the Ministry for Higher Education and Research; and the Ministry of Defense. Funding decisions are based on a common CEA strategy, but each ministry submits to parliament a separate budget proposal for programs in its area. (Written by Paul Belkin, Analyst in European Affairs.)

## India

The organizations concerned with research and development for India's nuclear weapons all appear to be controlled by the Department of Atomic Energy (DAE), which was set up in 1954 under the direct charge of the Prime Minister.<sup>15</sup> The department continues to function under the direct control of the Prime Minister and includes facilities widely believed by experts to be part of (or potentially part of) India's nuclear weapons program, including nuclear reactors, reprocessing facilities, and enrichment facilities. All of these facilities appear to be under the control of the Bhabha Atomic Research Centre and the Indira Gandhi Centre for Atomic Research, both of which are part of the DAE.<sup>16</sup> (Written by Paul Kerr, Analyst in Nonproliferation.)

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<sup>13</sup> Unless otherwise noted, information in this section was provided by the Embassy of France, Washington, DC.

<sup>14</sup> Commissariat à l'énergie atomique, "Facts and Figures," [http://www.cea.fr/english\\_portal/cea/identity](http://www.cea.fr/english_portal/cea/identity). For an organization chart, see [http://www.cea.fr/english\\_portal/cea/identity/organization\\_chart](http://www.cea.fr/english_portal/cea/identity/organization_chart).

<sup>15</sup> Statement from the Atomic Energy Commission. Available at <http://www.aec.gov.in/>. See also Government of India, Department of Atomic Energy, *Constitution of the Atomic Energy Commission*, Resolution No. 13/7/58-Adm. of March 1, 1958, with several amendments (most recently February 18, 2010), <http://www.dae.nic.in/sites/default/files/resolution.pdf>.

<sup>16</sup> For more information, see <http://www.barc.gov.in/>.

## Israel

Israel follows a policy of strategic ambiguity or “nuclear opacity” regarding its nuclear weapons status, neither confirming nor denying the existence of a nuclear weapons program.<sup>17</sup> Its officials simply state that Israel would not be the first to introduce nuclear weapons into the region, without explaining what that means. Israel has followed this policy for more than four decades in the apparent hopes of deterring adversaries without triggering widespread regional proliferation. Therefore, the Office of the Military Censor<sup>18</sup> disallows any reporting on the country’s nuclear infrastructure, facilities, and organizations that implies the existence of a nuclear weapons program. Nonetheless, there have been many international reports alleging and concerning Israel’s nuclear weapons program.<sup>19</sup> Indeed, as far back as 1974, a U.S. Special National Intelligence Estimate stated, “We believe that Israel already has produced and stockpiled a small number of fission weapons.”<sup>20</sup>

Israel’s nuclear program is under civilian control. In 1952, the Israel Atomic Energy Commission (IAEC) was created to advise the government on nuclear policy and on nuclear research and development priorities, as well as to implement policies and conduct research. Between 1957 and 1966, during the development of the nuclear site near Dimona in the Negev, Shimon Peres, then director general of the defense ministry (and now Israel’s president), diminished the IAEC’s role by giving authority over the nuclear project to two new organizations within the defense ministry that reported directly to him.<sup>21</sup>

A restructured IAEC resurfaced in 1966, shortly after Peres’s departure from the defense ministry. At that point, the IAEC reportedly assumed overall responsibility for Israel’s nuclear weapons program.<sup>22</sup> The director general of the IAEC officially reports directly to the prime minister, who is the ex-officio chairman of the organization. Like the Mossad (Institute for Intelligence and Special Operations)—another secretive Israeli organization under the prime minister’s

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<sup>17</sup> The traditional consensus among media and analysts’ reports is that Israel possesses an arsenal of 80 to 200 nuclear weapons. See, e.g., Timothy McDonnell, “Nuclear pursuits: Non-P-5 nuclear-armed states, 2013,” *Bulletin of the Atomic Scientists*, vol. 69(1), 2013.

<sup>18</sup> The office is run by a one-star general officer under the authority of the defense ministry.

<sup>19</sup> The most notable revelations may have been those of Mordechai Vanunu, a former technician at Israel’s nuclear reactor complex, who provided data on and photographs of the nuclear reactor center at Dimona to the *Sunday Times* (London) in 1986. Vanunu reported that Israel had been building nuclear weapons for 20 years and possessed a stockpile of between 100 and 200 warheads. In 1988, Israel convicted Vanunu of espionage and treason for selling secrets to the *Times*, but did not admit that his disclosures were truthful. Several books rely on Vanunu’s information, including Frank Barnaby, *The Invisible Bomb: The Nuclear Arms Race in the Middle East*, London: I.B. Tauris & Co., Ltd., 1989; and Seymour Hersh, *Samson Option*, New York: Vintage Books, 1993. Other sources include Avner Cohen, *Israel and the Bomb*, New York: Columbia University Press, 1998, p. 1, and “Completing the Deterrence Triangle,” Carnegie Endowment for International Peace, Non-Proliferation Project, vol. 3, no. 18, June 29, 2000.

<sup>20</sup> U.S. Director of Central Intelligence, *Special National Intelligence Estimate: Prospects for Further Proliferation of Nuclear Weapons*, SNIE 4-1-74, 1974, p. 20.

<sup>21</sup> One organization was the Center for Nuclear Research Center in the Negev (or KAMAG, its Hebrew acronym), and the other was the Armament Development Authority (or RAFAEL, its Hebrew acronym). RAFAEL became responsible for research and development work on weaponization. Avner Cohen, “Israel,” in Hans Born, et al., *Governing the Bomb: Civilian Control and Democratic Accountability of Nuclear Weapons*, Oxford: Oxford University Press, 2010, pp. 152-170. RAFAEL has since established itself as the premier domestic weapons designer, developer, and supplier for the Israeli military.

<sup>22</sup> Federation of American Scientists, <http://www.fas.org/nuke/guide/israel/agency/iaec.htm>.

responsibility—the IAEC and its activities are not codified in Israeli law.<sup>23</sup> In 2007, the IAEC established a website that includes some basic unclassified information on Israel’s nuclear program, without referring to any military aspects of the program.<sup>24</sup> Such aspects remain classified. In August 2007, then Prime Minister Ehud Olmert named Dr. Shaul Horev (alternate transliteration: Chorev), formerly deputy chief of the Israeli navy and then head of a secret “special means” division within the defense ministry, to be the IAEC director general. According to a 2010 book by a U.S.-based Israeli academic specializing in Israel’s nuclear history, the defense ministry reportedly plays a substantial but publicly undisclosed role in steering the program, largely due to its control over “key aspects of the IAEC’s operations, such as budget and security.”<sup>25</sup> The 2010 book characterizes the IAEC as, in some respects, Israel’s most secretive security organization.<sup>26</sup>

The IAEC directs research at the Center for Nuclear Research at Nahal Sorek (alternative transliteration: Soreq), approximately 10 miles south of Tel Aviv, and at the larger Center for Nuclear Research in the Negev south of Dimona. The Sorek center has a small civilian research reactor under International Atomic Energy Agency (IAEA) safeguards. According to some reports, Sorek also conducts nuclear weapons research and design activities.<sup>27</sup> Dimona is the site of a reactor and fissile material processing plant that is off-limits to international inspectors, and reportedly both highly enriched uranium (HEU) and plutonium are produced there.<sup>28</sup>

In March 2012, Israeli officials announced plans to phase out the civilian reactor at Sorek by 2018, largely because the reactor’s stock of HEU fuel—provided by the United States in 1960—is running out and the reactor is aging. Nuclear Suppliers Group guidelines prohibit suppliers from exporting additional reactor fuel to Israel because the country is not a signatory to the Nuclear Non-Proliferation Treaty (NPT). Israel will reportedly replace the reactor with a particle accelerator that will fulfill many of the same research and medical functions.<sup>29</sup> (Written by Jim Zanotti, Specialist in Middle Eastern Affairs.)

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<sup>23</sup> Avner Cohen, “Nuclear Legislation for Israel,” *Strategic Assessment*, vol. 12, no. 1, June 2009, pp. 7-18.

<sup>24</sup> Website accessible at <http://iaec.gov.il/english/About%20Us/Pages/default.aspx>.

<sup>25</sup> Avner Cohen, *The Worst-Kept Secret: Israel’s Bargain with the Bomb*, New York: Columbia University Press, 2010, p. 174. This book asserts that the diffusion of formal and practical authorities for the program and its military elements among the prime minister, defense ministry, the cabinet (which includes the prime minister and defense minister), Israel’s military chiefs, and the IAEC has fostered ambiguity and potential confusion regarding current and future decisionmaking, amplified by Israel’s policy of nuclear opacity. The book refers to various documents whose exact contents are unknown, but which reportedly have been drafted and updated at different times in apparent attempts to define aspects of command and control. Ibid., pp. 93-98, 177, 185-186. Moshe Ya’alon, a former Israeli military chief of staff, became defense minister in March 2013.

<sup>26</sup> According to the book, all the reports of Israel’s State Comptroller on the IAEC are strictly classified. There is very limited and strictly classified parliamentary oversight over the IAEC’s activities from one or two small subcommittees of the Knesset’s Foreign Affairs and Defense Committee. Cohen, *The Worst-Kept Secret: Israel’s Bargain with the Bomb*, op. cit., pp. 194-202.

<sup>27</sup> Mark Fitzpatrick, “Nuclear capabilities in the Middle East,” EU Non-Proliferation Consortium, July 6-7, 2011, citing H. Hough, “Israel’s Nuclear Infrastructure,” *Jane’s Intelligence Review*, November 1994.

<sup>28</sup> Nuclear Threat Initiative, “Israel Nuclear Facilities.”

<sup>29</sup> The source for the information in this paragraph is Dan Williams, “Israel to phase out civilian atomic reactor by 2018,” *Reuters*, March 20, 2012.

## North Korea<sup>30</sup>

Policy-making toward North Korea's nuclear program has been vested in the National Defense Council since 1991. North Korean leader Kim Jong-un heads this body. The other members represent the North Korean Workers (Communist) Party and the North Korean military. Kim Jong-un was appointed "Supreme Commander" of the Korean People's Army after his father (Kim Jong-il)'s death in December 2011. Kim Jong-un has had the supreme decision-making authority on nuclear policy, as did his father and grandfather before him.

At the top of the operational organization is North Korea's Ministry of Atomic Energy Industry, a full-fledged cabinet ministry. Under this ministry, there are a number of nuclear-related organizations and research centers. There are two committees: an Isotope Application Committee and a Nuclear Energy Committee. The ministry also directs a nuclear research center at Yongbyon, the site of North Korea's known plutonium facilities. There also is a nuclear energy institute in Pyongyang, the capital.

The Yongbyon nuclear research center consists of 10 branches: (1) Uranium Resources Development Institute; (2) Nuclear Physics Institute; (3) Radiochemical Laboratory (plutonium reprocessing); (4) Nuclear Material Institute; (5) Nuclear Energy Research Institute; (6) Isotope Utilization Institute; (7) Neutron Physics Institute; (8) Reactor Design Institute; (9) Nuclear Electromagnetics Institute; and (10) Radiation Protection Institute.

Under this organizational framework, the South Korean government estimates that there are about 20 nuclear facilities. The main ones at Yongbyon are a 5-megawatt nuclear reactor, a plutonium reprocessing plant, a newly built gas centrifuge uranium enrichment plant, and initial construction on a 100 megawatt-thermal (approximately 25-30 megawatt electric) light-water reactor.<sup>31</sup> There also are at least five uranium mining and milling facilities. It also is believed that North Korea has facilities for storing its stockpile of plutonium, which it has produced at Yongbyon, and for storing a few nuclear weapons that it may have produced. U.S. officials have also stated that they believe North Korea operates clandestine uranium enrichment facilities as well.<sup>32</sup> The South Korean government estimates that there are about 3,000 people working throughout North Korea's nuclear facilities.<sup>33</sup> (Written by Mary Beth Nikitin, Specialist in Nonproliferation.)

## Pakistan

The National Command Authority (NCA) supervises the functions and administration of all of Pakistan's organizations involved in nuclear weapons research, development, and employment, as

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<sup>30</sup> This section is based largely on *North Korea's Weapons of Mass Destruction: Problems and Prospects*, edited by Kim Kyong-soon, Hollym Publishers, 2004. See also CRS Report RL34256, *North Korea's Nuclear Weapons: Technical Issues*, by Mary Beth Nikitin.

<sup>31</sup> Hecker, "A Return Trip to North Korea's Yongbyon Nuclear Complex," Center for International Security and Cooperation, Stanford University, November 20, 2010. <http://iis-db.stanford.edu/pubs/23035/HeckerYongbyon.pdf>.

<sup>32</sup> Amb. Glyn Davies, "U.S. Statement to the IAEA: DPRK," IAEA Board of Governors Meeting, December 2-3, 2010, <http://vienna.usmission.gov/101202dprk.html>.

<sup>33</sup> "N. Korea Employs 3,000 Workers in 20 Nuclear Facilities," *Asia Pulse*, October 22, 2009.

well as the military services that operate the strategic forces.<sup>34</sup> The Prime Minister is Chairperson of the NCA.<sup>35</sup> Other members of the NCA include senior military and civilian officials.<sup>36</sup> The NCA, as Pakistan's main decision-making body for nuclear weapons issues, is made up of two committees. One, the Development Control Committee (DCC), includes several military officials; its Deputy Chairperson is also the Chair of the Joint Chiefs of Staff. The DCC "exercises technical, financial and administrative control over all strategic organisations, including national laboratories and research and development organisations associated with the development and modernisation of nuclear weapons."<sup>37</sup> The second is the Employment Control Committee. The Strategic Plans Division (SPD) acts as the secretariat for the NCA.<sup>38</sup> The SPD is tasked with the daily management of Pakistan's strategic assets and has oversight over the "Strategic Organizations," which include the Pakistan Atomic Energy Commission and Dr. A.Q. Khan Research Laboratories. The SPD also oversees "the systematic progress of weapon systems."<sup>39</sup> (Written by Paul Kerr, Analyst in Nonproliferation.)

## Russia

The Russian Federation has continued the Soviet pattern of civilian government control of the nuclear infrastructure, including military and civilian programs. The Soviet Union's nuclear weapons program began in the late phases of World War II and developed into 10 closed "nuclear cities." The Soviet nuclear complex was under the Soviet Ministry of Atomic Power and Industry, which in 1992 became the Ministry for Atomic Energy (MinAtom). The Russian Federation inherited the vast majority of the Soviet Union's nuclear assets. After government restructuring in 2004, MinAtom became the Federal Agency for Atomic Energy (FAAE, known as Rosatom). After being appointed head of the agency, former Prime Minister Sergei Kiriyenko led a restructuring of the nuclear complex to facilitate an expansion of nuclear power exports and international collaboration. A 2007 law, the "Tunnel Law," consolidated all civilian nuclear assets under a new joint stock company, Atomenergoprom, under Rosatom. A further restructuring converted Rosatom itself from a federal agency to a government-owned corporation, the Rosatom State Atomic Energy Corporation (which retained nearly all of its functions as a government agency). Kiriyenko, who stayed in his post as head of the organization, is accountable to the

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<sup>34</sup> December 2007 Ordinance To Provide For The Constitution And Establishment Of National Command Authority.

<sup>35</sup> When the NCA was established in 2000, the government's announcement designated the Head of Government, or Prime Minister, as Chairperson. At that time, General Musharraf, as Chief Executive, became Chairperson and stayed in that position after becoming President in 2002. He appointed the Prime Minister as Vice Chairman. However, President Zardari returned the NCA to its original structure when, in a November 2009 re-promulgation of the 2007 NCA Ordinance, he specified that the Prime Minister would be Chairperson, removing himself from that position. This re-promulgation also abolished the position of Vice Chairman.

<sup>36</sup> December 2007 Ordinance.

<sup>37</sup> *Nuclear Black Markets: Pakistan, A.Q. Khan and the Rise of Proliferation Networks*, (London, International Institute of Strategic Studies, 2007), p. 111; Pakistan Announcement of Nuclear-Weapons Command-and-Control Mechanism, *Associated Press of Pakistan*, February 3, 2000. *Nuclear Black Markets*, pp. 110-111, has organization charts of the NCA and SPD.

<sup>38</sup> The SPD is headed by a Director General from the Army.

<sup>39</sup> *Nuclear Black Markets*, p. 111.

Prime Minister of the Russian Federation. Rosatom manages Atomenergoprom and is directly responsible for defense-related nuclear work, nuclear science, the back end of the fuel cycle, and nuclear safety and security matters.

Rosatom's Nuclear Weapons Complex branch is responsible for developing, testing, producing, and dismantling all nuclear weapons.<sup>40</sup> The Nuclear Weapons Complex branch consists of two divisions: the Nuclear Weapons Production Division and the Development and Testing Division. The latter oversees the two major Russian nuclear weapon design research institutes—the All-Russian Scientific Research Institute for Experimental Physics in Sarov (VNIIEF) and the All-Russian Scientific Research Institute for Technical Physics in Snezhinsk (VNIITF), founded in 1946 and 1955, respectively. A number of research centers also participate in nuclear weapons work. Russia also maintains a test site at Novaya Zemlya. The Ministry of Defense oversees the storage and deployment of nuclear weapons.<sup>41</sup> (Written by Mary Beth Nikitin, Specialist in Nonproliferation.)

## United Kingdom

The Atomic Weapons Establishment (AWE) is responsible for the design, production, assembly, and maintenance of the UK's nuclear weapons, as well as decommissioning and disassembly.<sup>42</sup> The British government owns all AWE sites and assets, which are based at two facilities in Berkshire: Aldermaston and Burghfield. Government control of AWE is exercised by the civilian-led Ministry of Defence (MoD) and vested in its top official, the Secretary of State for Defence.<sup>43</sup> Since creation of this post in 1964, this official has always been a civilian, a Member of Parliament, and a member of the Prime Minister's cabinet. Within the MoD structure, the Minister for Defence Equipment, Support and Technology, also a civilian and a Member of Parliament, has lead responsibility for government policy regarding AWE.

In 1993, AWE was made a government-owned, contractor-operated entity, and its management was contracted to the private consortium Hunting-BRAE. In 2000, the MoD awarded a new 10-year contract to AWE Management Limited (AWE ML), which was then a partnership of Lockheed Martin, Serco, and British Nuclear Fuels Limited. In 2003, this contract was extended through 2025. With the management contract, AWE ML took over the operating company AWE plc, which handles day-to-day operations and employs the workforce of around 4,500 staff and 2,000 contractors. The MoD retains a “golden share”—a nominal share allowing it to veto corporate action—in AWE plc. In December 2008, Jacobs Engineering Group Inc. acquired

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<sup>40</sup> According to most sources, the Soviet Union conducted the last Soviet or Russian nuclear test in 1990, though some allege that Russia may have conducted low-yield tests since then. Russia ratified the Comprehensive Nuclear-Test-Ban Treaty in 2000.

<sup>41</sup> Unclassified Nuclear Proliferation Assessment Statement Pursuant to Section 123 a. of the Atomic Energy Act of 1954, as Amended, With Respect to the Proposed Agreement Between the Government of the United States of America and the Government of the Russian Federation For Cooperation in the Field of Peaceful Uses of Nuclear Energy, May 1, 2008; “Russia Profile: Nuclear Research Facilities,” Nuclear Threat Initiative, [http://www.nti.org/e\\_research/profiles/Russia/Nuclear/facilities\\_research.html](http://www.nti.org/e_research/profiles/Russia/Nuclear/facilities_research.html); and Rosatom State Corporation website, <http://www.minatom.ru/>.

<sup>42</sup> AWE's mission also covers nuclear threat reduction, including threat assessment, response to defense-related nuclear incidents, and verification (for example, monitoring Comprehensive Test Ban Treaty compliance and conducting research into future multilateral arms control regimes). See AWE website, <http://www.awe.co.uk/>.

<sup>43</sup> See statement by The Parliamentary Under-Secretary of State, Ministry of Defence (Baroness Taylor of Bolton) in *Atomic Weapons Establishment*, Lords Hansard Written Answers, January 26, 2009, Column WA3.

British Nuclear Fuels Limited's share of AWE ML. AWE ML is contractually obligated to consult with the government regarding all such changes in the composition of its ownership.<sup>44</sup>

The great majority of funding for AWE comes from the UK defense budget, primarily under allocations for the Defence Equipment and Support (DE&S) section of the MoD.<sup>45</sup> The Directorate Strategic Weapons of DE&S manages the AWE contract, leading MoD monitoring and liaison with AWE ML to ensure the execution of government decisions regarding Britain's strategic requirements.<sup>46</sup> AWE facilities are subject to the same regime of licensing and safety regulations as civil nuclear plants, and are regularly inspected for compliance by the Office for Nuclear Regulation, a division of the UK Health and Safety Executive.<sup>47</sup>

An agreement signed by the United Kingdom and France in November 2010 commits the two countries to a program of cooperation with regard to nuclear weapons R&D. Under the treaty, the UK and France are expected to jointly develop, operate, and staff a new hydrodynamics research facility at Valduc, France, and a Technology Development Center at AWE Aldermaston.<sup>48</sup> The new joint facilities are expected to be operational starting in 2015. (Written by Derek Mix, Analyst in European Affairs.)

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<sup>44</sup> See Stephen Jones, *Recent developments at the Atomic Weapons Establishment*, House of Commons Library, March 24, 2009, <http://www.parliament.uk/briefing-papers/SN05024>; and AWE website, [http://www.awe.co.uk/aboutus/the\\_company\\_eb1b2.html](http://www.awe.co.uk/aboutus/the_company_eb1b2.html).

<sup>45</sup> A small percentage of AWE's funding is understood to come from other government departments, with this money allocated mainly for its threat reduction mission.

<sup>46</sup> Lords Hansard Written Answers, op. cit.

<sup>47</sup> <http://www.hse.gov.uk/nuclear/regulated-sites.htm>

<sup>48</sup> See Claire Taylor, *Trident after the Strategic Defence and Security Review*, House of Commons Library, June 20, 2011, <http://www.parliament.uk/briefing-papers/SN05757>.