Plate 89. Q Area personnel passes. Board at Fairfield Air Force Station, Travis Air Force Base. July-December 1959. Courtesy of the Air Force Historical Research Agency.

the civilian sector, the Federal Aviation Agency (FAA) had developed policy to limit runways to 10,500 feet, in an attempt to force aircraft manufacturers to focus on equipment design issues rather than working with the assumption that runways could be lengthened indefinitely.[163]

Q Areas

In order to carry out its primary Cold War mission to maintain the capability of launching a sustained attack in a nuclear environment, SAC needed a stockpile of protected special weapons, with storage and assembly sites. SAC had 20 such facilities internationally by the close of the 1950s. The Armed Forces Special Weapons Project (AFSWP) oversaw these sites, commonly known as Q Areas, at their outset in 1946-1951. The civilian AFSWP, historically followed by the Defense Atomic Support Agency (DASA) and today the Defense Nuclear Agency (DNA), maintained the reins for selected Air Force, Army, and Navy nuclear facilities during the first years of the Cold War, paralleling jurisdiction of the 1946 Atomic Energy Commission (AEC). The assembly, test, and storage sites came to be known as Q Areas due to the AEC security clearance restrictions. The Q clearance mandated a full Federal Bureau of Investigation check for all personnel—AEC, AFSWP, or contractor—with access to restricted data or excluded areas (Plate 89). Q Areas were geographically dispersed, always associated with an abutting military reservation, and focused upon stockpiling atomic, then thermonuclear, bomb components. Stockpiled special weapons of the 1950s required the storage and testing of detonators (pits); the assembly and disassembly of training bombs for SAC (not live weapons); training alerts inclusive of convoying a training weapon to a SAC bomber on the flightline; laboratory capabilities; a command post; ready crew quarters; radioactive dump sites; and, ancillary units such as power and fire stations. Q Areas were guarded sites, distinct from their surroundings. The U.S. military housed a sizeable stationing of military men immediate to each Q Area, with these individuals too segregated from the larger adjacent

installation. Two types of Q Areas existed historically: operational storage sites and main stockpiles. Although both types were mirror images of one another in their infrastructural components, the operational storage sites were alert facilities assigned the task of achieving a maximum war effort in a number of hours.[164]

The Sandia Corporation of Albuquerque, New Mexico, completely controlled initial management of the Q Areas. Its predecessor, the Z Division of Sandia Laboratory—named for Jerrold R. Zacharias, a physicist who had been brought to the project from the Massachusetts Institute of Technology's Radiation Laboratory by J. Robert Oppenheimer in mid-1945—was organized as numbered groups, such as Z-7 (assembly) and Z-9 (stockpiling).[165] The Z Division next became known as Sandia Base, assuming responsibility for the engineering details, production sites, and military-assisted assembly, testing, and maintenance of ready-state atomic weapons in 1947. Sandia evolved from work at Los Alamos during World War II into a separate installation, near Kirtland Air Force Base in Albuquerque. Stockpiling of the atomic bomb began slowly, with only 13 in the entire arsenal in 1947; 56 in 1948; 298 in mid-1950. The leap came during the Korean war, between 1950 and the close of 1952, when stockpiles reached a total of 832 bombs. In 1955, the United States sustained an inventory of 2,280 nuclear (atomic and thermonuclear) bombs. The first four sites were of the main stockpile type, and were built before 1950. All sites were alpha-coded, with a break in the alpha sequencing for overseas locations.[166]

Sites A, B, C, and D included Mansano Base adjacent to Kirtland Air Force Base and Sandia Base itself; Clarksville Base, adjacent to Campbell Air Force Base and Fort Campbell (Tennessee and Kentucky); Medina Base, adjacent to Kelly and Lackland Air Force Bases (Texas); and Killeen Base, adjacent to Gray Air Force Base and Fort Hood (Texas). Site B achieved completion first in 1948, with Sites A and C operational in 1949. Sandia Base initiated construction of the operational storage sites, the physically smaller alert facilities of key strategic importance, in 1950. The first five of these installations were set up by Sandia immediately neighboring selected SAC bases. These Q Areas were Caribou Air Force Station (AFS) [Site E] at Loring Air Force Base (Maine); Rushmore Air Force Station [Site F] at Ellsworth Air Force Base (South Dakota); Deep Creek Air Force Station [Site G] at Fairchild Air Force Base (Washington); Fairfield Air Force Station [Site H] at Travis Air Force Base (California) (Plate 90); and, Stonybrook Air Force Station [Site I] at Westover Air Force Base (Massachusetts). Two additional main stockpile sites were in construction during the early 1950s, inclusive of Bossier Base, adjacent to Barksdale Air Force Base (Louisiana).[167] Sandia transferred operation of the five alert sites bordering the SAC bases to Air Materiel Command after a shakedown period during which Sandia personnel worked at the sites with the Air Force and AEC. Air Materiel Command designated the sites depots, with associated Air Force personnel referenced as Aviation Depot Groups, and subsequently, Aviation Depot Squadrons. Ordered as they had been built, chronologically, the five squadrons were the 3080th through the 3084th, and reported to the 3079th Aviation Depot Wing at Air Materiel Command headquarters at Wright-Patterson Air Force Base in Dayton, Ohio. The 3079th maintained a liaison office at Kirtland Air Force Base near Sandia. Total U.S. continental Q Area sites, inclusive of main stockpile installations and operational storage (alert) sites, was 13. In 1962 the Air Force achieved full control of the Q Areas neighboring its installations through SAC.

The AFSWP did not confine Q Areas to the United States. By August 1950, seven operational storage sites were under contract on foreign soil. Of these, the key group clustered in French Morocco and Spain, with those in Morocco—at Nouasseur, Sidi Slimane, and Ben Guerir—in planning out of SAC headquarters at Offutt in January 1951 and under construction in May. (See Plate 26.) Master plans for Air Force installations of late 1957 indicate that additional Q Areas were located at Goose Bay Air Base in Canada; Anderson Air Force Base in Guam; and, Moron and Torrejon Air Bases in Spain. (See Plate 65.) French Morocco siting developed out of Allied presence there at the close of World War II. Nousasseur, Sidi Slimane, and Ben Guerir were critically important for SAC during its first reflex exercises with B-36 and B-47 bombers, and KC-97 tankers. Noussasser hosted the B-36; Side Slimane and Ben Guerir, the B-47 and KC-97, with asphalted-concrete runways of 12,000, 11,000, and 14,000 feet, respectively. During the early and middle 1950s, the air bases supported the command's emergency

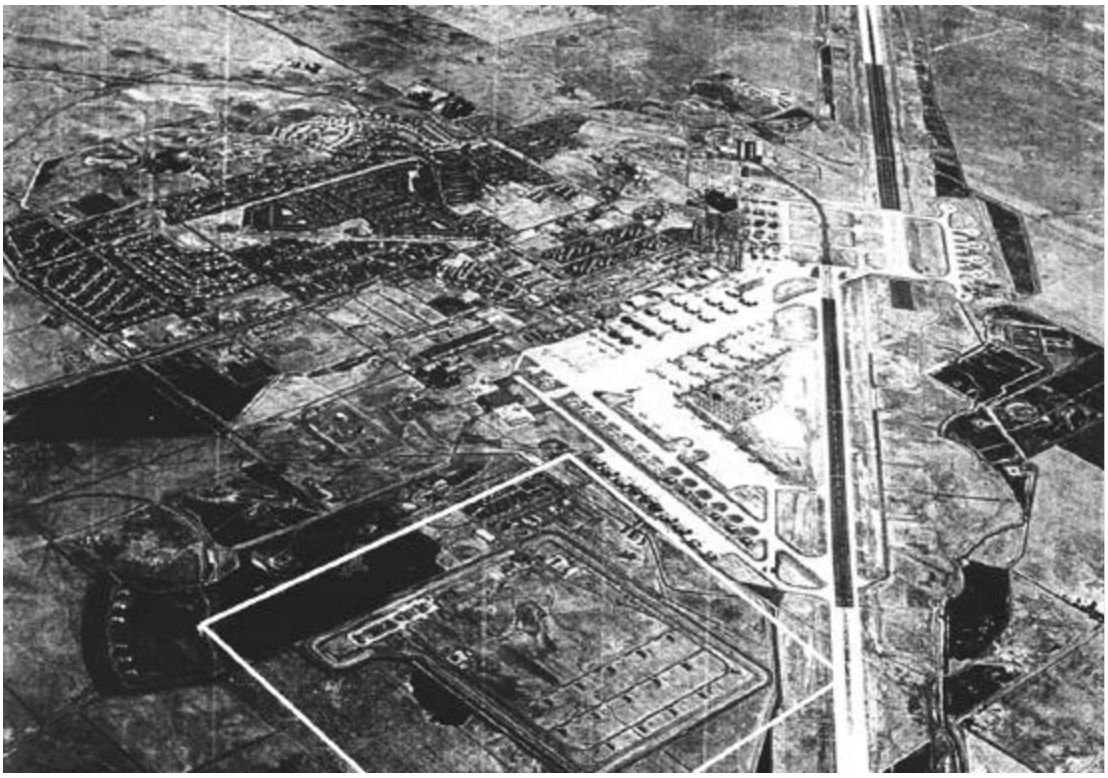

Plate 90. Aerial view of the Q Area at Fairfield Air Force Station, Travis Air Force Base. View of 1962 or 1963. Courtesy of Geo-Marine, Inc.

war plan as staging areas for bombers pointed at the Soviet Union.[168] (See Map 1.) However, with the destabilization of French government in Morocco, and Moroccan independence in 1956, the government of Mohammed V wanted the U.S. Air Force to pull out of the SAC bases in Morocco, insisting on such action after American intervention in Lebanon in 1958. The United States agreed to leave as of December 1959, and was fully out of Morocco in 1963. SAC felt the Moroccan bases were much less critical with the long range of the B-52, and with the completion of the Spanish bases in 1959. After the coup by Muammar Qadhafi in 1969 in Libya, that leader evicted SAC from Wheeler Air Base as well. Libya's SAC base was renamed Uqba bin Nafi Airfield, and went into Soviet use, an irony of the Cold War.[169]

Q Areas typically included about 40 to 50 buildings, inclusive of an igloo nuclear weapons storage area comprising a large percentage of the grouping and distinctly sited within the larger segregated environment. Circumscribed by high, chain-link fences topped with strands of barbed wire, as well as by patrol and maintenance roads, the compounds evolved in three stages. In the initial phase, Q Areas focused on a minimal administrative group of buildings at the main entrance gate, with an underground command post; a weapons spares area with emergency power plant and buried radioactive dump sites; a semihardened, multi-part assembly plant interconnected by an underground vestibule (two plants, I and II—also referenced as A and B—at storage sites augmented for the thermonuclear [TN] weapon); an isolated, detonators (also known as pits or initiators) storage building, the A structure; a checkout building for the stored bomb components, the C structure; and, the igloo storage area. Sandia built alert crew quarters immediate to the assembly plant at the operational storage sites. During 1954-1957, Q Areas augmented their administrative components, focused on greater hardening of the command and control buildings, and the articulation of their multiple communications links; and adding a special weapons crew building, replacing the alert quarters at the assembly plant. Key additions were the nuclear booster storage buildings, the A-2s, substantially bermed or completely underground; and, the S structure, a separate "surveillance" building used to conduct another level of quality assurance activities for weapon

disassembly and maintenance. In 1959-1960, Q Areas expanded their assembly plants to accommodate new nuclear weapons technologies, also adding laboratory facilities for heavy metals studies at some locations.

Key buildings within the Q Area were the A and A-2 structures; the C structure; the assembly plants I and II (A and B); the command and control building; and the S structure.[170]

A Structures

The A and A-2 structures both stored nuclear weapons components, also known as "bird cages." The A structure housed atomic bomb detonator pits, while the A-2 structure housed booster capsules for the thermonuclear, or hydrogen, bomb (Plates 91-95). The A-2 structure did not become part of the Q Area until the shift toward the TN bomb in 1954. Generally, both structures are referenced as "A" structures. The roles of the A and A-2 structures were parallel. Both were considered hardened structures, with that of the A-2 additionally shielded by bermed earth or built completely below ground. Identical in design, the A and A-2 structures were built of reinforced concrete, with 10-foot thick walls. For the windowless, aboveground A structure, measuring 41.5 feet by 53 feet (21.5 feet by 33 feet, interior, of nine-foot height), a second story actually provided more protection through its 17 feet of solid reinforced concrete. For the A-2 structure, the storage space for the capsules is entirely bermed or below ground, with a false single story aboveground (again, actually solid reinforced concrete) in the cases where berming was selected. The interior space is divided into four, single-entry rooms with a narrow bisecting corridor between pairs. Each room contained four, six-cubicle; and two, three-cubicle; structural steel Holt racks welded to special weapons storage standards. One A structure stored 120 detonators, 30 per room. Both the A and bermed A-2 structures furthermore gave the appearance of office buildings, when viewed from any distance, through the addition of bands of paired false fenestration and a projecting entrance offset. The bermed A-2 structure was less convincing in this regard from a near perspective, due to the mounded earth and the resultant tunnel-like extension of the offset on one facade. Of curious note, the Q Area A structure is closely related in its generic appearance to the building housing the first command headquarters for SAC at Offutt Air Force Base. That structure, designed in 1941 by architect Albert Kahn for the Martin Bomber Plant adjacent, contained Curtis LeMay's office from 1948 into 1957. When viewed from the side, the first SAC headquarters also offered a simple rectangular box shape, with banded fenestration and a corner entrance offset. LeMay's early headquarters was known as the A Building—a continuance from its designation during the Martin bomber days[171] (Plates 96-97).

Plate 91. Black & Veatch. A Structure in the Q Area at Barksdale Air Force Base. View of 1995. Courtesy of Mariah Associates, Inc.

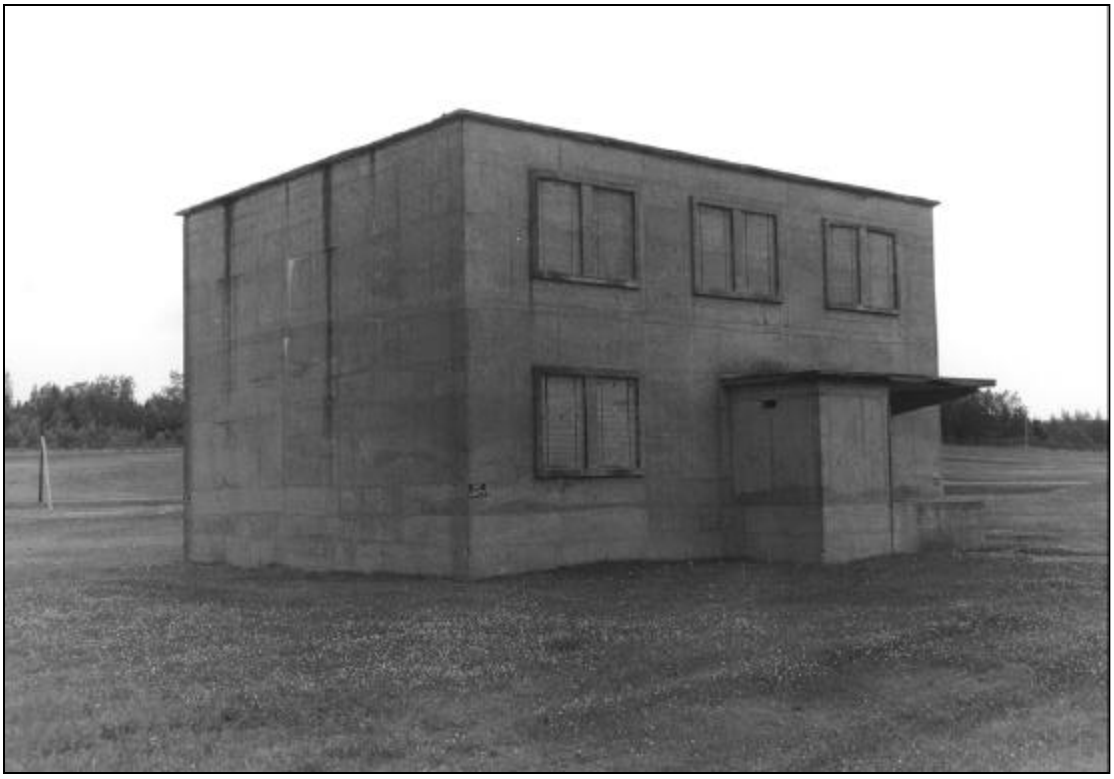

Plate 92. Black & Veatch. A Structure in the Q Area at the former Loring Air Force Base. View of 1995. Courtesy of Mariah Associates, Inc.

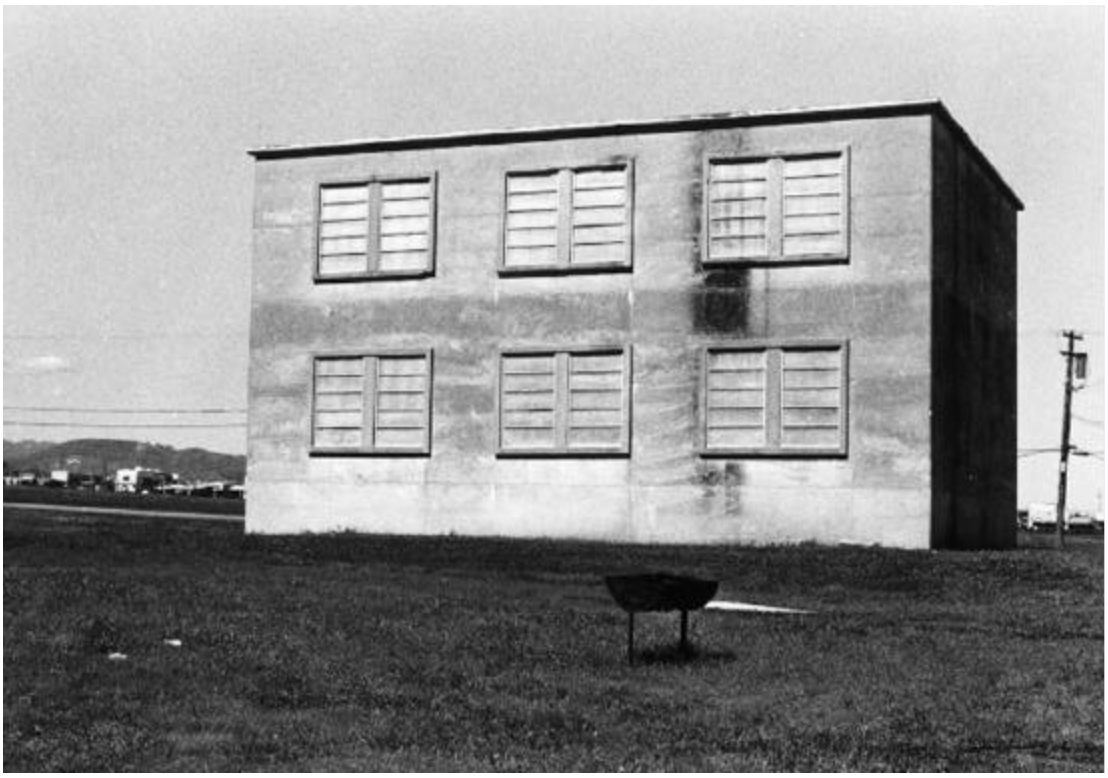

Plate 93. Black & Veatch. A Structure in the Q Area at Travis Air Force Base. View of 1995. Courtesy of Geo-Marine, Inc.

Plate 94. Black & Veatch. A-1 Structure in the Q Area at the former Loring Air Force Base. Entrance view, 1995. Courtesy of Mariah Associates, Inc.

Plate 95. Black & Veatch. A-1 Structure in the Q Area at the former Loring Air Force Base. Rear corner view, 1995. Courtesy of Mariah Associates, Inc.

Plate 96. Albert Kahn. A Building of the Martin Bomber Plant (1941). SAC Command Headquarters, 1948-1957. View of July 1999. Photograph, K.J. Weitze.

Plate 97. Oblique view of the A Building (first SAC Command Headquarters). View of July 1999. Photograph, K.J. Weitze.

C Structure

Q Area personnel used the architecturally undistinguished C structure to maintain the pits and capsules stored in the A and A-2 structures. The early atomic bomb required polonium/beryllium detonator pits (or initiators) to generate the neutrons of the explosive sequence. Polonium-210 has a half-life of about 138 days, a fact that mandated the replacement of the pits periodically. In order to access the pits, personnel opened threaded couplings machined from fissile uranium—a process that produced radioactive waste items buried within the Q Area. With the phasing out of the atomic bomb, and the phasing in of the TN weapon, a sealed neutron initiator replaced the polonium/beryllium pit. These second generation capsules, brought into the inventory as of late 1954, still required periodic disassembly to verify the integrity of the fissile materials. As of 1962, capsules were completely phased out and AEC maintenance activities with nuclear materials ceased in the C structure.

Plants I and II (A and B)

Plant I (A) served as a maintenance and assembly building for the non-nuclear components of the atomic bomb. Plant II (B) had the same function for the first generation TN weapon of 1955-1957, and was built at selected Q Areas after 1954 (Plates 98-99). The plants were always multi-unit reinforced concrete facilities, earthen embanked, and tunnel interconnected. Concrete arch construction varied in thickness from two feet at the base to 12 inches through the spring, with a crown of 1.5 feet thickness. Plant I was a six-bay structure; Plant II a two-bay structure. Activities in the plants consisted of weapons sub-assemblies during maintenance; inspection and testing of non-nuclear mechanical and electrical systems; and maintenance of TN booster cylinders. For the latter activity in Plant II, a special room vented tritium gas through a vacuum intake device through the top of the building.

Plate 98. Black & Veatch. Plant I (A) in the Q Area at Ellsworth Air Force Base. View of 1995. Courtesy of Mariah Associates, Inc.

Plate 99. Black & Veatch. Plant II (B) in the Q Area at Ellsworth Air Force Base. View of 1995. Courtesy of Mariah Associates, Inc.

Plate 100. Black & Veatch. Command/Control Bldg. Q Area, Caribou AFS, former Loring Air Force Base. View of 1957. Courtesy, Air Force Historical Research Agency.

Command and Control Building

Q Areas added a command and control building in about 1955-1956, coincident with augmentation for the special weapons facilities generally, and with the addition of TN bomb capacity at some locations. The building featured a below ground command post with heightened communications in place, with a single aboveground story. Bands of windows accented the upper story on all of its facades, while the flat roof cantilevered out from the structure (Plate 100).

S Structure

The S structure was a large additional maintenance building constructed after 1954 to augment quality control by separating routine maintenance and assembly functions performed in Plants I and II from other distinct quality assurance activities. Also known as a surveillance structure, the S structure contained electrical and mechanical bays, a calibration room, and a photographic laboratory. Sandia staffed the Quality Assurance and Inspection Agency responsible for work in the S structure.

A single engineering firm, Black & Veatch of Kansas City, designed the primary structures of all Q Areas.[172] The firm began its specialized work for the U.S. government with these facilities, dating to 1946, when the company "accomplished all the architect-engineer services in connection with original planning for Los Alamos."[173] Partners Ernest Bateman Black and Nathan Thomas Veatch, Jr., had founded the firm in 1915, first undertaking city water, sewage disposal, and power systems across Kansas. During World War I, Black & Veatch was among the firms selected to provide the engineering design for U.S. military camps. Beginning in the late 1920s, the firm also involved itself in major highway projects in Jackson County. During that period, Thomas Veatch became close friends with then county judge Harry S. Truman. Black & Veatch maintained its connections to Truman while he served as Senator in Washington, D.C., and later during his Presidency. It was during the Truman term in office, 1948 to 1952, that the firm established itself as the leader in design of special weapons storage facilities—both for SAC and ADC. Design Group 115, of Black & Veatch, handled the Q Areas project, with engineer Harry Callahan involved from the beginning. The firm's Design Group 470 initiated work at the Army Ordnance Plant, Burlington, Iowa, at this same time, to convert the facility to a nuclear components plant. Black & Veatch would go on to design missile checkout and assembly structures and heightened military security systems. Today, Black & Veatch continues as a leader in the design and engineering of advanced technology facilities; hardened structures; and security design. Their expertise extends to radioactive and electromagnetic environments, clean rooms, weapons research facilities, laboratories, nuclear-chemical waste treatment, blast resistant design, blast containment design, and storage magazines.[174]

The Air Force Directorate of Installations (later, the Directorate of Civil Engineering) made explicit references to the development of design and engineering standards for the SAC specialized weapons depots between 1952 and 1956. The project ranked among the top construction concerns—given on a short list that focused on air defense infrastructure, not SAC. The list included the ADC fighter-interceptor alert facilities, the ADC first generation command and control centers, and the ADC early warning radar web.[175] Nonetheless, discussion for the Q Areas was lengthy, noting that SAC proposed Aviation Depot Squadrons at home and overseas. Funding for fiscal year 1953 was roughly five million dollars for three planned Q Areas, with three other special weapons depots actively in the design and construction process. The Directorate anticipated that four of the first Q Areas would be fully completed by the close of 1953. This year was a highpoint for the SAC specialized weapon storage program, and was the period during which Black & Veatch prepared the definitive drawings and facilities criteria that "would identify to the major commands, the construction requirements to support the Air Force Atomic Energy program throughout the world. … These definitive drawings and other pertinent information will be incorporated into a brochure for distribution to major commands."[176] In mid-1954, the Directorate referenced planned construction for a Q Area at one of the Spanish bases, which would complement the three already in place in French Morocco.[177] From this point forward the Q Area program was

approaching buildout, and SAC sought approval for its specialized weapons storage as "standard." The upcoming shift marked the transition from engineering and construction, to full scale special weapons receipt and day-to-day operations at the storage sites.

In late summer of 1954 Air Force headquarters prepared to submit a written plan of the comprehensive SAC special weapons storage facilities—siting and operations—to the Joint Chiefs of Staff, followed by Secretary of Defense and Presidential review. The Air Force then met with Black & Veatch in Kansas City in August. The next month, the Directorate of Construction within the office of the Assistant Chief of Staff, Installations, produced the formal schedule for a second-tier SAC program of special weapons storage design and construction, estimated dates of completion, and beneficial occupancy dates. In October formal guidance was ready for distribution to the appropriate SAC bases. During the remaining months of 1954, the Air Force held meetings with Black & Veatch, amended original guidance, and received Presidential approval.[178] In early 1955, the Armed Services and Appropriations Committees gave this SAC special weapons storage program the necessary clearances, with the Secretary of Defense, the Joint Chiefs of Staff, and the AFSWP staff produced and received memoranda discussing the "responsibilities for the provision of Zone of Interior atomic weapon storage facilities." The AFSWP had the role of approving "site and building plans for each location in the program." Agencies in charge were to approve SAC base locations as accepted for the special storage sites at four per month.[179] As of the close of 1956, 15 of the Q Areas were considered fully complete and approved, with the remaining five Q Areas anticipated to achieve the same status by June 1957.[180]

SAC's planned use of the atomic bomb, and later TN weapon, hinged on its bomber force and their access to the Q Areas. While the Cold War was gearing up during the 1948-1953 years, SAC had B-36s (as of late 1948) and B-47s (as of late 1951) in its inventory. The B-36 could carry the atomic bomb and the very large, first generation TN weapon; the B-47 could not. After the middle 1950s, large yield TN devices compatible with the B-47 were developed. Before 1954, SAC B-36s were required to fly to one of the main storage Q Areas from their home base to receive their bombs, then proceeding on either a hypothetical strike mission or deploying to a forward base—such as those in French Morocco—from which they were posed to launch a strike mission. This first method of coordinating the bombers with the bombs was cumbersome and slow, and meant that SAC could not penetrate the Soviet early warning radar net in a mass strike in under 36 hours. Not until 1954 did several bases with operational special weapons storage sites (alert Q Areas) began receiving atomic bombs. And not until 1956 were atomic bombs in place at all five of the alert Q Areas neighboring Ellsworth, Fairchild, Loring, Travis, and Westover Air Force Bases.[181] It was no coincidence that these five bases also each had large percentages of the total B-36 SAC inventory and the only clusters of the first generation Luria B-36 wing hangar. In select instances, bomber infrastructure supported a specialized mission directly related to an adjacent Q Area, rather than to a wing of B-36s. At Kirtland Air Force Base, neighboring Sandia and the main storage site of Mansano Base, SAC conducted atomic bomb and TN weapon handling courses for crews of the B-36, and subsequently B-47 from 1953 to late 1955.[182] Kirtland supported three double-cantilever hangars—one prototypical medium bomber hangar (and likely the first built in the nation), and two standard medium bomber hangars. By 1957, SAC had the infrastructure, weapons, and organization to "use both atomic and thermonuclear weapons on a mass scale," honed through "major atomic exercises."[183] The SAC mission was a fully integrated one.

Alert Apron Configurations and Crew Quarters

By the early 1950s, SAC was planning for an all-jet, intercontinental bomber, the B-52, and an accompanying all-jet refueling tanker, the KC-135. SAC took delivery of its first B-52 in June 1955. Castle Air Force Base was SAC's first B-52 base, with the installation receiving aircraft in 1956. Loring and Westover also began to receive B-52s before the close of the year. As 1957 opened 88 B-52s were located at SAC bases, while 17 more were in test programs or being modernized at the Wichita Boeing plant. The KC-135 production ran slightly behind that of the B-52, with its initial flight in August