= George Kistiakowsky =

George Bogdanovich Kistiakowsky (November 18 , 1900 ? December 7 , 1982) (Ukrainian : ??????? ?????????? ????????????? , Russian : ??????? ?????????? ????????????) was a Ukrainian @-@ American physical chemistry professor at Harvard who participated in the Manhattan Project and later served as President Dwight D. Eisenhower 's Science Advisor .

Born in Kiev in the old Russian Empire , Kistiakowsky fled his homeland during the Russian Civil War . He made his way to Germany , where he earned his PhD in physical chemistry under the supervision of Max Bodenstein at the University of Berlin . He emigrated to the United States in 1926 , where he joined the faculty of Harvard University in 1930 , and became a citizen in 1933 .

During World War II , Kistiakowsky was the head of the National Defense Research Committee (NDRC) section responsible for the development of explosives , and the technical director of the Explosives Research Laboratory (ERL) , where he oversaw the development of new explosives , including RDX and HMX . He was involved in research into the hydrodynamic theory of explosions , and the development of shaped charges . In October 1943 , he was brought into the Manhattan Project as a consultant . He was soon placed in charge of X Division , which was responsible for the development of the explosive lenses necessary for an implosion @-@ type nuclear weapon . In July 1945 , he watched as the first one was detonated in the Trinity test . A few weeks later another Fat Man implosion @-@ type weapon was dropped on Nagasaki .

From 1962 to 1965 , Kistiakowsky chaired the National Academy of Sciences 's Committee on Science , Engineering , and Public Policy (COSEPUP) , and was its vice president from 1965 to 1973 . He severed his connections with the government in protest against the war in Vietnam , and became active in an antiwar organization , the Council for a Livable World , becoming its chairman in 1977 .

= = Early life = =

George Bogdanovich Kistiakowsky was born in Kiev , in the Kiev Governorate of the Russian Empire (now part of Ukraine) , on November 18 , 1900 . George 's grandfather Oleksandr Fedorovych Kistiakovsky was a professor of law and an attorney of the Russian Empire who specialized in criminal law . His father Bogdan Kistiakovsky was Professor of Legal Philosophy at the University of Kiev , and was elected a member of the National Academy of Sciences of Ukraine in 1919 . Kistiakowsky 's mother was Maria Berendshtam , and he had a brother , Alexander . George 's uncle Ihor Kistiakovsky was the Minister of Internal Affairs of the Ukrainian State .

Kistiakowsky attended private schools in Kiev and Moscow until the Russian Revolution broke out in 1917 . He then joined the anti @-@ Communist White Army . In 1920 he escaped from Russia in a commandeered French ship . After spending time in Turkey and Yugoslavia , he made his way to Germany , where he enrolled at the University of Berlin later that year . In 1925 , he earned his PhD in physical chemistry under the supervision of Max Bodenstein , writing his thesis on the photochemical decomposition of chlorine monoxide and ozone . He then became Bodenstein 's graduate assistant . His first two published papers were elaborations of his thesis , co @-@ written with Bodenstein .

In 1926 , Kistiakowsky traveled to the United States as an International Education Board fellow . Hugh Stott Taylor , another student of Bodenstein , accepted Bodenstein 's assessment of Kistiakowsky , and gave him a place at Princeton University . That year , Kistiakowsky married a Swedish woman , Hildegard Moebius . In 1928 , they had a daughter , Vera , who later became a Professor Emerita of Physics at Massachusetts Institute of Technology . When Kistiakowsky 's two @-@ year fellowship ran out in 1927 , he received a Research Associate and DuPont Fellowship . On October 25 , 1928 , he became an associate professor at Princeton . Taylor and Kistiakowsky published a series of papers together . Encouraged by Taylor , Kistiakowsky also published an American Chemical Society monograph on photochemical processes .

In 1930 , Kistiakowsky joined the faculty of Harvard University , an affiliation that continued throughout his career . At Harvard , his research interests were in thermodynamics , spectroscopy ,

and chemical kinetics . He became increasingly involved in consulting for the government and industry . He became an associate professor again , this time at Harvard in 1933 . That year he also became an American citizen . In 1938 , he became the Abbott and James Lawrence Professor of Chemistry .

= = World War II = =

= = = National Defense Research Committee = = =

Foreseeing an expanded role for science in World War II , which the United States had not yet joined , President Franklin D. Roosevelt created the National Defense Research Committee (NDRC) on June 27 , 1940 , with Vannevar Bush as its chairman . James B. Conant , the President of Harvard , was appointed head of Division B , which was responsible for bombs , fuels , gases and chemicals . He appointed Kistiakowsky to head its Section A @-@ 1 , which was concerned with explosives . In June 1941 , the NDRC was absorbed into the Office of Scientific Research and Development (OSRD) . Bush became Chairman of the OSRD , Conant succeeded him as Chairman of the NDRC , and Kistiakowsky became head of Section B. In a reorganization in December 1942 , Division B was broken up , and he became head of Division 8 , which was responsible for explosives and propellants , remaining in this position until February 1944 .

Kistiakowsky was unhappy with the state of American knowledge of explosives and propellants . Conant established the Explosives Research Laboratory (ERL) near the laboratories of the Bureau of Mines in Bruceton , Pennsylvania in October 1940 , and Kistiakowsky initially supervised its activities , making occasional visits ; but Conant did not formally appoint him as its Technical Director until the spring of 1941 . Although initially hampered by a shortage of facilities , the ERL grew from five staff in 1941 to a wartime peak of 162 full @-@ time laboratory staff in 1945 . An important field of research was RDX . This powerful explosive had been developed by the British before the war . The challenge was to develop an industrial process that could produce it on a large scale . RDX was also mixed with TNT to produce Composition B , which was widely used in various munitions , and torpex , which was used in torpedoes and depth charges . Pilot plants were in operation by May 1942 , and large @-@ scale production followed in 1943 .

In response to a special request for an explosive that could be smuggled through Japanese checkpoints by Chinese guerrillas , Kistakowsky mixed HMX , a non @-@ toxic explosive produced as a by @-@ product of the RDX process , with flour to create " Aunt Jemima " , after a brand of pancake flour . This was an edible explosive , which could pass for regular flour , and even be used in cooking .

In addition to research into synthetic explosives like RDX and HMX , the ERL investigated the properties of detonations and shock waves . This was initiated as a pure research project , without obvious or immediate applications . Kistiakowsky visited England in 1941 and again in 1942 , where he met with British experts , including William Penney and Geoffrey Taylor . When Kistiakowsky and Edgar Bright Wilson , Jr . , surveyed the existing state of knowledge , they found several areas that warranted further investigation . Kistiakowsky began to look into the Chapman ? Jouguet model , which describes the way the shock wave created by a detonation propagates .

At this time , the efficacy of the Chapman ? Jouguet model was still in doubt , and it was the subject of studies by John von Neumann at the Princeton Institute for Advanced Study . Kistiakowsky realized that the deviations from hydrodynamic theory were the result of the speed of the chemical reactions themselves . To control the reaction , calculations down to the microsecond level were needed . Section 8 was drawn into the investigation of shaped charges , whose mechanism was explained by Taylor and James Tuck in 1943 .

= = = Manhattan Project = = =

At the Manhattan Project 's Los Alamos Laboratory , research into implosion had been proceeding

under Seth Neddermeyer , but his division had worked with cylinders and small charges , and had only produced objects that looked like rocks . Their research was accorded a low priority , owing to expectations that a gun @-@ type nuclear weapon design would work for both uranium @-@ 235 and plutonium , and implosion technology would not be required .

In September 1943 , the Los Alamos Laboratory 's director , Robert Oppenheimer , arranged for von Neumann to visit Los Alamos and investigate implosion with a fresh set of eyes . After reviewing Neddermeyer 's studies , and discussing the matter with Edward Teller , von Neumann suggested the use of high explosive in shaped charges to implode a sphere , which he showed could not only result in a faster assembly of fissile material than was possible with the gun method , but which could greatly reduce the amount of material required . The prospect of more efficient nuclear weapons impressed Oppenheimer , Teller and Hans Bethe , but they decided that an expert on explosives was required . Kistiakowsky 's name was immediately suggested , and he was brought into the project as a consultant in October 1943 .

Kistiakowsky was initially reluctant to come , " partly because " , he later explained , " I didn 't think the bomb would be ready in time and I was interested in helping to win the war " . At Los Alamos , he began reorganizing the implosion effort . He introduced techniques such as photography and X @-@ Rays to study the behavior of shaped charges . The former had been extensively employed by the ERL , while the latter had been described in papers by Tuck , who also suggested using three @-@ dimensional explosive lenses . As with other aspects of the Manhattan Project , research into explosive lenses followed multiple lines of inquiry simultaneously because , as Kistiakowsky noted , it was " impossible to predict which of these basic techniques will be the more successful . "

Kistiakowsky brought with him to Los Alamos a detailed knowledge of all the studies into shaped charges , of explosives like Composition B , and of the procedures used at the ERL in 1942 and 1943 . Increasingly , the ERL itself would be drawn into the implosion effort ; its deputy director Duncan MacDougall also took charge of the Manhattan Project 's Project Q. Kistiakowsky replaced Neddermeyer as head of E (for explosives) Division in February 1944 .

The implosion program acquired a new urgency after Emilio Segrè 's group at Los Alamos verified that plutonium produced in the nuclear reactors contained plutonium @-@ 240 , which made it unsuitable for use in a gun @-@ type weapon . A series of crisis meetings in July 1944 concluded that the only prospect for a working plutonium weapon was implosion . In August , Oppenheimer reorganized the entire laboratory to concentrate on it . A new explosives group , X Division , was created under Kistiakowsky to develop the lenses .

Under Kistiakowsky 's leadership , X @-@ Division designed the complex explosive lenses needed to compress the fissile plutonium pit . These employed two explosives with significantly different velocities of detonation in order to produce the required wave form . Kistiakowsky chose Baratol for the slow explosive . After experimenting with various fast explosives , X @-@ Division settled on Composition B. Work on molding the explosives into the right shape continued into 1945 . The lenses needed to be flawless , and techniques for casting Composition B and Baratol had to be developed . The ERL managed to accomplish this by devising a procedure for preparing Baratol in a form that was easy to cast . In March 1945 , Kistiakowsky became part of the Cowpuncher Committee , so @-@ called because it rode herd on the implosion effort . On July 16 , 1945 , Kistiakowsky watched as the first device was detonated in the Trinity test . A few weeks later a Fat Man implosion @-@ type nuclear weapon was dropped on Nagasaki .

Along with his work on implosion , Kistiakowsky contributed to skiing in Los Alamos by using rings of explosives to fell trees for a ski slope ? leading to the establishment of Sawyer 's Hill Ski Tow Association . He divorced Hildegard in 1942 and married Irma E. Shuler in 1945 . They were divorced in 1962 , and he married Elaine Mahoney .

= = White House service = =

In 1957 , during the Eisenhower Administration , Kistiakowsky was appointed to the President 's Science Advisory Committee , and succeeded James R. Killian as chairman in 1959 . He directed the Office of Science and Technology Policy from 1959 to 1961 , when he was succeeded by

Jerome B. Wiesner .

In 1958 , Kistiakowsky suggested to President Eisenhower that inspection of foreign military facilities was not sufficient to control their nuclear weapons . He cited the difficulty in monitoring missile submarines , and proposed that the arms control strategy focus on disarmament rather than inspections . In January 1960 , as part of arms control planning and negotiation , he suggested the " threshold concept " . Under this proposal , all nuclear tests above the level of seismic detection technology would be forbidden . After such an agreement , the US and USSR would work jointly to improve detection technology , revising the permissible test yield downward as techniques improved . This example of the " national means of technical verification " , a euphemism for sensitive intelligence collection used in arms control , would provide safeguards , without raising the on @-@ site inspection requirement to a level unacceptable to the Soviets . The US introduced the threshold concept to the Soviets at the Geneva arms control conference in January 1960 and the Soviets , in March , responded favorably , suggesting a threshold of a given seismic magnitude . Talks broke down as a result of the U @-@ 2 Crisis of 1960 in May .

At the same time as the early nuclear arms control work , the Chairman of the Joint Chiefs of Staff , General Nathan F. Twining , sent a memorandum , in August 1959 , to the Secretary of Defense , Neil McElroy , which suggested that the Strategic Air Command (SAC) formally be assigned responsibility to prepare the national nuclear target list , and a single plan for nuclear operations . Up to that point , the Army , Navy , and Air Force had done their own target planning . This had led to the same objectives being targeted multiple times by the different services . The separate service plans were not mutually supporting as in , for example , the Navy destroying an air defense facility on the route of an Air Force bomber going to a deeper target . While Twining had sent the memo to McElroy , the members of the Joint Chiefs of Staff disagreed on the policy during early 1960 . Thomas Gates , who succeeded McElroy , asked President Dwight D. Eisenhower to decide the policy .

Eisenhower said he would not " leave his successor with the monstrosity " of the uncoordinated and un @-@ integrated forces that then existed . In early November 1960 , he sent Kistiakowsky to SAC Headquarters in Omaha to evaluate its war plans . Initially , Kistiakowsky was not given access , and Eisenhower sent him back , with a much stronger set of orders for SAC officers to cooperate . Kistiaknowsky 's report , presented on November 29 , described uncoordinated plans with huge numbers of targets , many of which would be attacked by multiple forces , resulting in overkill . Eisenhower was shocked by the plans , and focused not just on the creation of the Single Integrated Operational Plan (SIOP) , but on the entire process of picking targets , generating requirements , and planning for nuclear war operations .

= = Later life = =

Between his work for the Manhattan Project and his White House service , and again after he left the White House , Kistiakowsky was a professor of physical chemistry at Harvard . When asked to teach a freshmen class in 1957 , he turned to Hubert Alyea , whose lecture style had impressed him . Alyea sent him some 700 4 @-@ by @-@ 6 @-@ inch (10 @.@ 2 by 15 @.@ 2 cm) index cards containing details of lecture demonstrations . Aside from the cards , Kistiakowsky never prepared the demonstrations . He later recalled :

I didn 't think that was giving mother Nature a sporting chance . I would come into the lecture hall , glance at the chemicals and pile of cards and announce to the students " let 's see what Alyea has for us today " . I never used a text book , only your cards . I would glance at the instructions and carry out the experiment . If it worked we would bless you and pass on to the next demonstration . If it didn 't work we would curse you , and spend the rest of the lecture trying to make it work .

He retired from Harvard as professor emeritus in 1972 .

From 1962 to 1965 , Kistiakowsky chaired the National Academy of Science 's Committee on Science , Engineering , and Public Policy (COSEPUP) , and was its vice president from 1965 to 1973 . He received several awards over the years , including the Department of the Air Force Decoration for Exceptional Civilian Service in 1957 . He was awarded the Medal for Merit by

President Truman , the Medal of Freedom by President Eisenhower in 1961 , and the National Medal of Science by President Lyndon Johnson in 1967 . He was also a recipient of the Priestley Medal from the American Chemical Society in 1972 and the Franklin Medal from Harvard .

In later years , Kistiakowsky was active in an antiwar organization , the Council for a Livable World . He severed his connections with the government in protest against the US involvement in the Vietnam War . In 1977 , he assumed the chairmanship of the Council , campaigning against nuclear proliferation . He died of cancer in Cambridge , Massachusetts , on December 17 , 1982 . His body was cremated , and his ashes scattered near his summer home on Cape Cod , Massachusetts . His papers are in the Harvard University archives .