SAND86–2955 • Nuclear Weapon Data • Sigma 2
RS3151/87/004
Specified External Distribution Only
Printed February 1987

Distribution
Category C–72

A Review of the US Nuclear Weapon Safety Program – 1945 to 1986 (U)

R. N. Brodie
Sandia National Laboratories
Albuquerque, NM 87185

CRITICAL NUCLEAR WEAPON DESIGN INFORMATION
DOD DIRECTIVE 5210.2 APPLIES.

This definition was expanded in the nuclear weapon reporting system to include:

> Accidental or unauthorized launching, firing, or use, by US forces or supported allied forces, of a nuclear-capable weapon system which could create the risk of an outbreak of war.
>
> Nuclear detonation.
>
> Nonnuclear detonation or burning of a nuclear weapon or radioactive weapon component, including a fully assembled nuclear weapon, an unassembled nuclear weapon, or a radioactive nuclear weapon component.
>
> Radioactive contamination.
>
> Seizure, theft or loss of a nuclear weapon or radioactive nuclear weapon component, including jettisoning.
>
> Public hazard, actual or implied.

Through May 1986, the US has had 32 such accidents, all now acknowledged to the public. Thirty-one of these accidents occurred either in 1968 or before.

The first official nuclear accident involved a Mk 4 weapon assembly (with a dummy capsule) which was jettisoned in Puget Sound from a B-36 bomber experiencing an in-flight emergency. None of the 32 accidents produced any measurable nuclear yield and only 5 resulted in radioactive contamination beyond the immediate accident site.

Because the definition of what would constitute a nuclear weapon accident was formulated at a time when any part of a nuclear weapon was highly classified and literally regarded with awe, events where no fissile material was present (or where only fissile material capsules were involved) were included. If we exclude accidents involving weapon components only and non-sealed pit weapons (unless the capsule was inserted in the pit or stored within the IFI) then the US would have counted only 19 nuclear weapon accidents.

Since accidents usually occur during human operation of equipment, most of the accidents have taken place during ground- and airborne-alert operations. Of the 32 accidents, 29 have been with weapons which were in Air Force custody. This does not imply a cavalier attitude on the part of the Air Force, but rather that the preponderance of alert-ready weapons have been associated with Air Force systems. In fact, because of the number of accidents handled by the Air Force, their reporting chain for safety matters is exemplary in that it is within the Inspector General's office and the Inspector General (a Lieutenant General) has direct access to the Air Force Chief of Staff, independent of the major operating commands.

Considerable insight may be gained by a review of a few of the more troubling accidents without attempting to detail each individual one.

Bunker Hill AFB, 1964—A B-58 bomber on active alert with two B43 bombs externally carried under each wing and a B53 bomb in the centerline pod skidded on ice while taxiing onto the runway for a simulated takeoff during an exercise. The aircraft left the runway, collapsing the landing gear, and began to burn. Two of the B43s were crushed by the aircraft wing box while being subjected to a fuel fire at the same time that the lower halves of the bombs were immersed in melted-snow water. Aircraft power was available and potentially present at any external connector. The HE of these two B43s, although directly exposed to the fire, did not detonate even though the weapon's electrical system was badly charred. The other two B43s and the B53 were shielded from direct effects of the fire and were relatively undamaged. The aircraft was a total loss.

Goldsboro, NC, 1961—A B-52 flying alert with two B39 bombs experienced a ruptured wing-fuel-tank and broke up over Goldsboro, NC. Before the accident, the manual arming pin in each of the bombs was in place. Although the pins required a horizontal movement for extraction, they were both on a lanyard to allow the crew to pull them from the cockpit. During the breakup, the aircraft experienced structural distortion and torsion in the weapons bay area sufficient to pull the pin from one of the bombs, thus arming the Bisch generator. The Bisch generator then provided internal power to the bomb when the pullout cable was extracted by the bomb falling from the weapons bay. The operation of the baroswitch

arming system, parachute deployment, timer operation, low and high voltage thermal batteries activation, and delivery of the fire signal at impact by the crush switch all followed as a natural consequence of the bomb falling free with an armed Bisch generator. The nonoperation of the cockpit-controlled ready-safe switch prevented nuclear detonation of this bomb. The other bomb, which free-fell, experienced HE detonation upon impact. One of the secondary subassemblies was not recovered.

Ellsworth AFB, 1964—A maintenance team was dispatched to check the security system at a remote Minuteman launch site. The procedure involved pulling a fuse to reset the system after each check. The team found that they had failed to bring a fuse-puller with them, and since it was a considerable distance back to the base, they elected to use a screwdriver to remove the fuse. While they were attempting to remove the fuse after two successful tests, there was a violent explosion. The Mk 11 RV containing a W56 warhead fell approximately 75 feet to the floor of the silo. The RV sustained significant damage, but the warhead high explosive did not detonate and no nuclear yield or radiation contamination resulted.

(b)(3)

Summary—1945 to 1968

Until the mid-1950s, there really were no unresolved nuclear safety issues. Nuclear safety was achieved in a visible and almost absolute manner by ensuring that the fissile material was kept physically separate from the HE and that gun type devices remained unassembled.

The decision to go to an all sealed-pit stockpile and alert deployments was made for the overriding reasons mentioned earlier, but the full impact on nuclear safety was not duly considered or immediately recognized. The late 1950s and early 1960s saw considerable remedial activity in trying to address adequately nuclear detonation safety for sealed-pit weapons and their widespread alert deployments.

(b)(3)

It was also in this period that the need for a nuclear weapon system safety process was realized and slowly formulated. While continued weapon system incidents and accidents indicated some problem areas of concern concerted hardware reviews uncovered others.
radars and communications transmitters were i

(b)(3)

Beginning in 1961, essentially all of the stockpile was retrofitted to include environmental sensing devices as a measure to prevent intentional or accidental detonation of a warhead in other than the intended-use mode.

After this rather frantic period, the mid-1960s were rather static with respect to nuclear safety. This was due in part to the relative inactivity in new weapon development work during that time and a perception that the existing safety features and review process were sufficient.

1968 may be viewed as the beginning of a transition between what might be called "old" safety and "new," or "enhanced" nuclear safety. We will see that some of the features which were incorporated as safety measures and which were based on then current design practices would not have provided the level of protection in certain accident environments for which they were given credit.