SECTION 5
THE HAZARDS OF TRIDENT

5.1 SAFETY: CONSIDERATIONS AND CONSEQUENCES

Nuclear weapons are, at their best, dangerous to have around. At their worst they are a near occasion of widespread death and illness. During the design of many nuclear weapons and delivery systems the decision-makers chose performance over safety. Trident missiles, and Trident bombs, are among those cavalier choices. The three-member House Armed Services Committee Panel on Nuclear Weapons Safety, more commonly known as the Drell Panel, pointed out many problems which are discussed below. But the panel warned: The majority of the weapons in the current stockpile will have to be modified to meet [the specified and demanding safety criteria], unless they are retired. *Moreover, for some weapons we still lack necessary data to perform credible safety analyses.* (emphasis added) [Drell Report, p. 31]

A. THE WARHEAD PRIMARY: HANDLE CAREFULLY AND KEEP COOL

It should not have surprised us, then, when the Departments of Energy and Defense (DOE and DOD) in 1990 revealed safety flaws in the Trident-2 warhead, known by the DOE designation W-88. These problems are in the so-called primary -- the fission trigger which provides the temperature and pressure to set off the thermonuclear fusion reaction of a hydrogen bomb. This primary fission A-bomb is first set off by conventional explosives arranged in a hollow, spherical shell around the plutonium core, or "pit." The conventional explosives implode to squeeze and heat the "pit" to a critical mass, thus causing an instantaneous nuclear fission reaction.

The three-member House Armed Services Committee Panel on Nuclear Weapons Safety, more commonly known as the Drell Panel, announced in late 1990 that new computer models show "that unintended nuclear detonations present a greater risk than previously estimated (and believed) for some of the warheads in the stockpile." [Drell Report, p. 25]

1. One Point Safety.

The conventional explosive arrangement in the warhead primary is such that detonation at any one point would certainly burst the warhead case and scatter radioactive material, but it would not result in a nuclear explosion (yield). Thus, a sharp blow at any one point will not cause a nuclear yield. To obtain a yield, the detonation of the conventional explosive would have to be simultaneously at multiple points. One point safety (OPS) is required in all US nuclear warheads, and all are said to have that feature.

With the development of three-dimensional computer modeling of nuclear explosions, however, Dr. Sidney Drell says, "we were wrong in the assumptions about the

location of the most sensitive point in the weapon at which a one-point detonation of the high explosive could initiate a nuclear yield. We also know very little about the risk of multi-point insults -- i.e. incidence of fragments nearly simultaneously -- causing a nuclear detonation." [Drell 1992 Testimony, p. 2]

2. Insensitive High Explosives.

Trident is not the first to have primary problems -- the original conventional-explosive triggers in Poseidon warheads were so touchy that a jolt of the missile could set them off. This *new* Trident problem is similar, and also concerns the chemical explosive trigger which Energy Secretary James D. Watkins, a retired admiral and former Pentagon Chief of Naval Operations, says he would never have chosen. If heated by a fire it would at best detonate and scatter radioactive material, or at worst result in a nuclear explosion. When airplanes crashed with or released the old nuclear bombs -- as they did in Spain, Greenland and North Carolina -- the bombs broke open and spread radioactivity, but there was no nuclear explosion. We have been lucky so far. But when a nuclear bomb is held in shape by a rugged reentry vehicle shell, and that bomb is heated to high temperature, it is more likely to trigger a nuclear blast.

Those warheads which present this newly emphasized danger are the ones using HMX-based explosive which is more sensitive to heat and impact. The insensitive high explosive (IHE) which is more resistant to temperature and shock is known as TATB. Although IHE was introduced into the stockpile in 1979, as of early 1992 less than 35 percent of the warheads had it, and neither Trident warhead falls in that category. After the September 1991 and January 1992 initiatives are implemented, the percentage with IHE will rise to about 65.

The reason IHE was not used in Trident warheads is because IHE has only about two-thirds the explosive power as the same weight of HMX-based explosive. Had IHE been used in the W-88 bomb, for instance, the bomb would have had less yield. It is interesting to note that the W-87 bomb for MX is the same as Trident's W-88, except that the W-87 has a yield of 330 kilotons instead of 475. Air Force officials once said that MX's yield could be increased if necessary. The W-87 has IHE and the W-88 does not. The conclusion is easy to draw.

The Mark-5/W-88 warhead is now only planned for use on four US submarines. It has been announced that the remainder will carry Mark-4/W-76 warheads. The Mark-4/W-76 warheads in Trident-1 missiles, and for use on Trident-2, are just as hazardous. They have highly-detonatable rocket fuel in all three stages and the warheads do not use IHE. This hazard was highlighted by Dr. Ray Kidder of Lawrence Livermore National Laboratory (LLNL): "These safety concerns apply equally to both the W-88/D-5 missiles currently being deployed and the far larger number of W-76/C-4 missiles already deployed, a point largely overlooked by the Drell Panel." [Kidder-1991/1, p. 5] Kidder goes on to explain that replacement of the W-76 warheads with warheads using IHE would probably require a new warhead to be designed and tested. In that light, production of the W-88 warhead was cancelled largely because manufacturing facilities at Rocky Flats was closed, rather than for safety concerns.

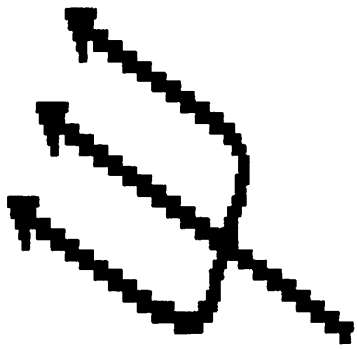
3. Fire Resistant Pits.

Another breach of safety brought to public attention by the Drell panel is that the W-76 and W-88 bombs do not have fire-resistant pits (FRPs). In early 1992, only ten percent of the US stockpile had FRPs. That will only grow to 20 percent upon implementation of the September 1991 and January 1992 initiatives.

FRPs are plutonium "pits" protected and contained by a ductile metal shell that can withstand a temperature of 1000^{0}C. (1832^{0}F.) and the corrosive action of molten plutonium for several hours. That is the heat expected from burning aircraft fuel. The plutonium may melt but it would be contained. Rocket fuel would be a much higher temperature. FRPs would not protect against detonation of the conventional explosive so they would only be useful in conjunction with IHE. Also, FRPs would not be able to withstand the much higher temperatures of burning rocket fuel (about 2000^{0}C) so they are more applicable to bombs and cruise missiles than missiles propelled by rockets.

4. Enhanced Nuclear Detonation Safety.

As IHE protects against physical hazards, enhanced nuclear detonation safety (ENDS) devices protect against electrical and electro-magnetic phenomenon. ENDS were developed in 1972 and first introduced into the US stockpile in 1977, beginning with the B-61-5 bomb. In some reports ENDS is referred to as enhanced electrical isolation (EEI). As of the beginning of 1990, ENDS had been installed on only 52 percent of the US nuclear bombs. After implementing the September 1991 and January 1992 initiatives, and after the planned retirement of other nuclear warheads, the US stockpile by the end of the century should be 100-percent ENDS equipped. Trident's Mark-5/W-88 warhead does have such a device, and so does the Mark-4/W-76. However, some weapons in the US stockpile are not so equipped so ENDS will be mentioned here.



For the chemical explosive shell to compress the nuclear pit to a supercritical state, the chemical explosive must detonate at many points simultaneously, in order to apply pressure evenly all the way around. If this does not happen, a nuclear explosion (yield) will not take place. ENDS is designed to prevent simultaneous activation of all the detonation points by stray radio or radar waves.

ENDS physically isolates and shields the warhead electrical arming device from undesired outside sources of energy or abnormal environments. Electrical entry into this isolation area is by what is described as one weak link and two strong links. They are all in series so that all must be closed in order to arm the bomb. The strong links are both closed by electrical signals initiated by different phenomena. One is closed by a coded electric signal from the operator, and the other by some normal flight environment, such as when a prescribed deceleration force is sensed during reentry.

The weak link is always closed but will fail (open) like a circuit breaker in an ab-

normal environment, such as fire, shock, or crushing. The firing signal must go through all three. If either of the two strong ones are not closed, or if the weak one has failed, the conventional explosive is not supposed to detonate.

ENDS will not necessarily prevent the chemical explosive from detonating, or the spread of highly-radioactive material resulting from such a detonation. But the probability of such a detonation occurring, we are assured, is one in a million.

B. WARHEADS ON THE MISSILE: LOADED TO KILL, MAIM AND POLLUTE

The danger from not having IHE and fire-resistant pits is further amplified by two aspects in the design of Trident missiles, themselves. First is the rocket motor design. Trident-1 uses a rocket fuel which is so touchy the Air Force would not use it in MX, except for the smaller third stage motor which ignites way out in space. Trident-2 uses this more volatile propellant to increase its range a mere 100-150 nautical miles.

The other aspect is the manner in which the warheads are clustered around the third-stage motor. During the 1972 EXPO task force to configure an extended-range Poseidon missile -- now known as Trident-1 -- a third-stage motor was added. Warheads under the Poseidon nose fairing were arranged ten in an outer circle and four in the center, on the deck of the PBCS. To find space for this new third-stage motor, the center reentry vehicles were removed. A third stage motor was then installed protruding up through the deck on which the warheads are mounted -- right in the middle of the circle of bombs. This arrangement then carried over into Trident-2.

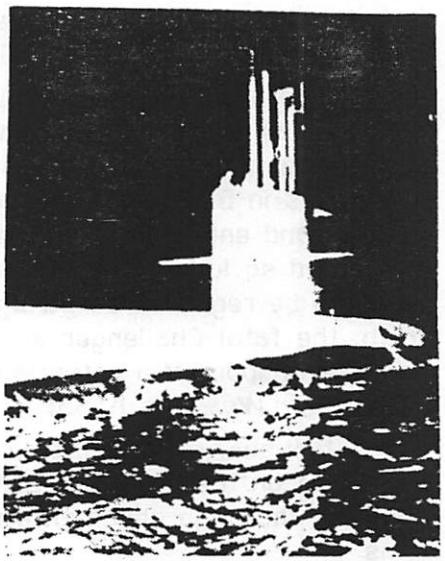
So now the responsible officials are belatedly worried that placing such touchy propellant in the middle of the warheads raises the ante for an accidental nuclear blast. Since the Drell Committee released its report, Trident missiles can no longer be handled with their warheads installed. The warheads are mated to the missile after the missile is installed in the submarine. Both the British and US Navies claim this was their procedure anyway.

According to the Bush-Yeltsin Agreement, only half the previously-planned number of Trident warheads will be deployed by 2003. One way of accomplishing that is to only load four on each missile, instead of eight. If that were the means chosen for reduction, Dr. Ray Kidder suggests using the space left to add blast deflectors and shielding that would protect the four remaining warheads from possible explosion of the third-stage motor. [See Kidder-1992, p. 13] If that were done, no missile could carry more than four warheads. And since Britain plans to lease missiles from a common pool, the British missiles would also be limited to four warheads each. A bad aspect of this idea is that the planned compliment of missiles will still be required and production could not be stopped.

C. THE SAFETY OF BRITAIN'S TRIDENT.

In response to public and parliamentary concern over how the Drell findings relate to the British Trident, the Secretary of State for Defence in mid-1991 commissioned MOD's Chief Scientific Adviser, Professor E.R. Oxburgh, to head up a Safety Review Group to "review, in the light of any relevant aspects of the report of the Drell Panel ... the

safety of the present and prospective UK nuclear armory." [HC-337 of Session 1991-92, p. xv] The Safety Review Group's 12 February 1992 report (not published in sanitized version until the following July) pointed out that procedures for ensuring the safety of British nuclear weapons are many and complex, and that there is no single coordinating body. Although present arrangements are good for individual systems, "they are less good for viewing the safety of the *system as a whole*." (emphasis in original) [*The Safety of UK Nuclear Weapons*, p. 1]



The Safety Review Group pointed out that "in the case of Trident, the *whole system* comprises warhead, missile, submarine reactor, torpedoes, shore facilities, etc.," and added that an overview of the whole system is difficult but essential." [*The Safety of UK Nuclear Weapons*, p. 1] The Group then offered twenty detailed recommendations to provide that proper overview. [*The Safety of UK Nuclear Weapons*, pp. 4-6]

Britain's 100-kiloton warhead for Trident has been shown in previous chapters to be the equivalent of the US W-76. The MOD's Safety Review Group reported that AWE personnel are reviewing the nuclear safety of their warhead's design with new computational methods. The Group points out that substituting computer studies of this kind for actual nuclear testing has only become feasible in recent years. But US government experts don't seem so confident that such studies are yet reliable. They say computer-assisted modeling *if perfected* could *eventually* accomplish the same goal as actually nuclear test explosions in verifying safety improvements. (emphasis added) [*The Sun*, 6 August 1992, pp. A1 & A4]

In addition, the Safety Review Group points out that the accuracy of such computer modeling can only be verified when another team of experts arrives at the same results independently, and by comparing these results with data from low-yield underground tests. In the first place, there is no second group of experts in Britain to independently verify the computer-assisted results. Regarding comparison with actual nuclear tests, US Assistant Secretary of Energy Richard Claytor said at least 25 test explosions would be needed to verify the effectiveness of proposed new safety enhancements to five US weapons systems, including the W-76 warhead. [*The Sun*, 6 August 1992, p. A4] Under the September 1992 US law, no more than 15 nuclear tests are possible between the end of the 9-month moratorium and the complete ban in 1996. It is unlikely that past tests would be transferable to new safety features.

Another recommendation of the Drell Panel was to *not* attach warheads before transporting the missile to and installing it in the submarine. Rather, the missile should first be installed into the submarine and then proceed with attaching the warheads. The Safety Review Group acknowledged that attaching warheads after missiles are in the submarine is to be British policy, but expressed concerns that when whole-system considerations are taken into account, "we feel that one practice may not be significantly pre-

ferable to the other." [*The Safety of UK Nuclear Weapons*, p. 29]

Still another point of concern is in regard to the missiles, themselves, which are to be leased from the US. The Safety Review Group said: "The US have now accepted the Trident [missile] for service use but, particularly because some elements of the UK system are different, the UK authorities do not take the view that [the missiles] can therefore be assumed to be safe for UK use.... the UK must also assess safety thoroughly where there are differences from the US practices, e.g. different cranes, different jetties, different hulls, differently trained civilian and military personnel, etc." [*The Safety of UK Nuclear Weapons*, pp. 29 & 30]

The Safety Review Group's conclusion stands as a stark signal of danger -- "We conclude as we began by emphasizing that there is inevitably some degree of hazard associated with nuclear weapons." The Group's report ended with a warning that past successes in British nuclear weapons programs may be the nation's worst enemy: "The physics and engineering programmes remain enormously challenging, but they have been conducted so long without major untoward incident, that there is a danger that they may come to be regarded as straightforward and routine. Nothing could be further from the truth: the fatal Challenger accident in the US space programme is a chilling reminder of what can happen if a potentially dangerous technology is taken for granted. [*The Safety of UK Nuclear Weapons*, p. 35]

British-American Security Information Council (see Appendix-A) will soon release its report on the safety of Britain's nuclear stockpile, probably in late 1992. It is a concise and thorough documentation of Britain's nuclear weapons safety and potential problems.

The report on the safety of British nuclear weapons can hardly be classed as "generally a reassuring statement," as the Ministry of Defence described it to Parliament. [HC-337 of Session 1991-92, pp. xv-xvi] Rather, it seems to reveal a plethora of deficiencies in understanding and meeting the hazards of British nuclear weapons. A long and detailed list of recommendations was forthcoming. Techniques for determining safety were questioned and in some cases, at least by implication, decried. In many cases more detailed studies and better understanding were advised in order to perform realistic safety evaluations. Yes, the Ministry of Defence has gone through the motions of performing a safety investigation. But passing that investigation off as "generally a reassuring statement" is gross deception.

D. COMMAND AND CONTROL: LOOSE FINGERS ON THE BUTTON

Another worrisome matter for both the US and Britain is that so much destructive power is put under the control of so few men on a Trident submarine. In a 1984 letter, the late Congressman Ted Weiss said the Navy's Congressional Liaison Office admitted that a conspiracy of only four men on a Trident submarine could fire the missiles. A Trident submarine skipper with the cooperation of three other officers -- presumably the executive officer, the weapons officer, and the communications officer -- could unleash the destructive power of as much as 6,500 Hiroshimas. They would also have a selection of target sets stored in the submarines computer, which could be fed into the missiles

before launch. That is scary. Given 70 days of confined environment in an atmosphere of paranoia and secrecy, it is not hard to construct scenarios where reality can be distorted.

The Drell Panel expressed satisfaction with the technical measures and serious consideration regarding control of the use of US Air Force nuclear weapons. But it points out that "the Navy's fleet ballistic missile system differs in that, whereas launch authority comes from outside the submarine, there is no requirement for external information to be provided in order physically to enable a launch. It is also important to evaluate the suitability of continuing this procedure in the future." [Drell Report, p. 34]

In response to the report's criticism, the US Navy "reluctantly agreed" to install electronic devices in Trident submarines that can only be unlocked by shore-based authorities. [*The Day*, 4 January 1995, p. A1] How much safer this will be than previous methods is not known. But it will undoubtedly serve a public-relations purpose.

Command and control of missiles on a British submarine must be similar, and hardly any more stringent. The danger is certainly no less.

E. A CRITICALITY PROBLEM

By Katherine Jane Harine, PhD, a nuclear weapons consultant who warned of this Trident-2 missile safety hazard while working for Lockheed.

The W-88 warhead, due to its high yield, has a criticality problem that was not known to the Drell panel, although it was listed as an "exception" in the final weapon development report by the designing laboratory, the Los Alamos National Laboratory. Subcriticality cannot be assured if water penetrates the warhead. There is a sufficient quantity of enriched uranium in a small volume so that when water floods the internal U^{235}-rich components, moderating the neutrons, a critical geometry is established. The result is a boiling water reactor.

A boiling water reactor is one whose criticality depends on the presence of water. As the power level of the reactor increases and the heat turns the water into steam, fewer water molecules are present in the reactor; hence, the moderation decreases and the nuclear reactions are fewer. Then, as the power level decreases, the reactor cools causing the water to condense. Thus more water molecules return to the reactor and the nuclear reactions increase again. The result is a reactor which is self-limiting. It will not explode. It will continue working.

In the case of the W-88 an explosion would be small and the reaction would cease. By continuing, the W-88's nuclear reactions will produce radiation and radioactive debris, fission fragments. The radiation will only have a local effect. However, the radioactive fission fragments will disperse throughout the environment emitting radiation wherever they go. These radioactive products are deadly when ingested or inhaled by animals or humans.

The [Mark-5] reentry body and the [W-88] warhead inside it have seals to prevent the ingress of water at moderate pressures. Initially it might appear that only the loss of a submarine in the deep waters of the ocean would produce pressures high enough to

rupture the seals. However, several other scenarios of accidents which could result in the breach of the seals exist. One would start with the weakening of the seals due to heat from a fire. Another would begin with damage to the seals from a shock wave or projectiles from an explosion or dropping accident. If one of these scenarios preceded the falling of the reentry body into a shallow depth, water infusion could easily occur. The nuclear reactions would begin and continue until enough of the enriched uranium was expended so that the mass is no longer critical. Although the direct radiation from the warhead would be dangerous to animals or humans nearby, the real danger is from the fission products that would escape and propagate throughout the environment.

Iodine 131, cesium 137, and strontium 90 are typical radioactive products that will enter the body and then radiate as they decay. Iodine is absorbed by the thyroid gland, cesium is similar chemically to sodium and potassium, and strontium is similar chemically to calcium. As might be expected, strontium 90 shows up in milk and then bones after it is released throughout the environment. The fact that these radioactive isotopes enter tissues so easily and then radiate inside the tissue makes their effects so hideous.

The design criteria that forced the warhead to have this critical geometry are the range and yield that have been stipulated. If a shorter range of a lower yield were allowed, a warhead could be designed without this criticality problem. Of course, the high yield and long range are needed to attack hard targets -- i.e. super hard missile silos. Since these silos contain the SS-18 missiles, which would be the first missiles launched [if Russian struck first] due to their high number of multiple reentry vehicles, the Trident-2 with the W-88 would [by targeting these silos] be a first strike weapon. If the former Soviet Union had launched first, these silos would be empty.

There are only 400 of the W-88 warheads instead of a planned 4,000 or so because the Rocky Flats facility, which manufactured the W-88 pits, was closed down due to safety and security problems. The 400 W-88s are still a significant number, however. The 400 could be loaded on two Trident-2 submarines or spread out over all the Trident-2 submarines, which are based in the Atlantic Ocean. Since the United States does *not* need a first-strike capability, it would seem prudent to replace the 400 W-88 high yield warheads with lower yield W-76 warheads which do not have the criticality problem.

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5.2 TRANSPORTATION: UNSEEN DANGER LURKS

Trains and trucks (lorries) criss-cross our nation daily with cargos ranging from small missile motors through monstrous strategic rockets and space launch boosters, to the actual nuclear warheads. Yet the public is never warned. A nationwide network called The Agape Community has been tracing these rail shipments and organizing track-side vigils along their routes to alert endangered people. Another organization called Nukewatch monitors the roads for nuclear tractors and trailers in both the US and Britain. Citizens are dumfounded to discover the cavalier practices used to ship extremely dangerous materials.

If a main highway or railroad track passes through your community, there is high likelihood that this dangerous cargo also goes by. We have been lucky that previous accidents were not worse, but it is only a matter of time until we reach what statisticians call "Probability One," the moment when our chances run out and something really serious occurs. Will it take such a catastrophe before the peoples' right to know abates this hazard?

A. THE NUCLEAR TRAIN

Prior to 1972, US nuclear weapons were transported by commercial carriers under armed escort by the Atomic Energy Commission (AEC), predecessor to the Department of Energy (DOE). The AEC also shipped nuclear weapons by aircraft until 1976, until it became unlawful to ship plutonium by air. Since those dates nuclear weapons have been shipped in DOE-owned other means. The DOE does not use ships.

The DOE is only responsible for nuclear weapons shipments from the point of assembly (Pantex, Texas) to a Department of Defense (DOD) destination. After that the shipping responsibility lies with the DOD.

The nuclear train and its commercial predecessors ran unnoticed from the early 1960s until Jim Douglass discovered its purpose on 8 December 1982. The train as originally noticed was composed of 25 low-height, heavily-armored cars (known as safe-secure railroad cars) which were painted pure white to reflect heat. At each end of the string of safe-secure cars was a security car with a high turret from which a guard could look over the top of the train. Additional security vehicles traveled the road alongside the train.

Discovering the movement of this nuclear train prompted formation of a network of track vigilers all along the route. A lookout at Pantex, the train's origin, would alert the network when the train embarked, either for Sub Base Bangor on the west coast or Charleston, South Carolina to the east.

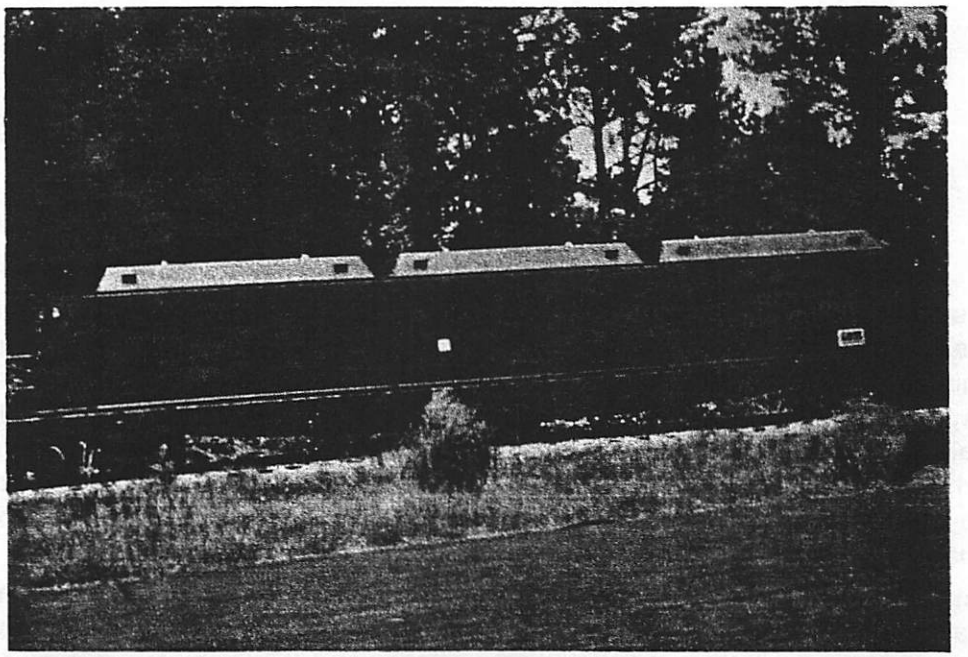


FIGURE 5.2-1
SAFE-SECURE RAILROAD CAR -- TSSX-567
Photo taken at Kings Bay on 17 May 1988
White superstructure added to accomodate Mark-5/W-88 warhead.

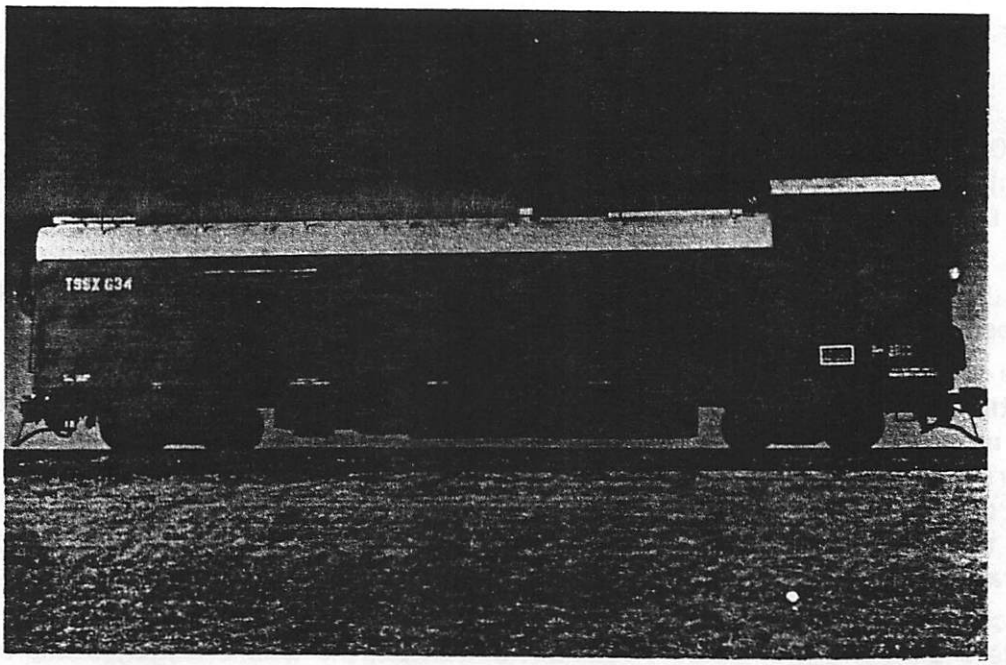


FIGURE 5.2-2
SAFE-SECURE GUARD CAR -- TSSX-G34
Photo courtesy of Agape Community.

Sometimes the train would take alternate routes in an attempt to evade the people waiting along the tracks to express concern about this load of destruction passing through their communities. But the white train stood out like a sore thumb and aerial patrols -- usually media helicopters -- could pick it up quickly. This led to repainting the train -- each car a different color. Later some of the bomb-carrying cars had an additional superstructure added to accommodate the larger Trident-2 warheads.

Nuclear train cars are designated TSSX -- TSS meaning Transportation Safeguards [at DOE] Sandia, and the X meaning the cars are not owned by the railroad, or that they are under long-term lease from the railroad. The bomb-carrying cars range from TSSX 519 to 570. The turret or guard cars are designated TSSX G32 through G35.

The Department of Energy threatened to make it a crime to publish information about movements of the nuclear train. Violations would be punishable by a $100,000 fine or 20 years in prison. Nevertheless, the Agape Community grew, and continued to vigil along the tracks as the train passed.

The nuclear train disappeared in 1986, except for a trial run of a car converted to carry Trident-2 warheads in 1988. (See Figure 5.2-1) So much attention being drawn to nuclear warhead movement must have embarrassed the US government, so shipments by train were discontinued. It is presumed that warheads are now being transported by other means. DOE transportation by air is currently only of weapons equipped with IHE. The Pentagon, with a need to ship overseas as well as in the US, has restrictions that are not so rigid. The Drell Panel recommended: "In the interest of safety against plutonium dispersal there should be a consistent policy governing the very large number of weapons movements whose numbers have typically, in recent years, added up to more than 1,000 vehicle trips and one-million miles per year." [Drell Report, p. 30]

In early February 1992, Assistant Defense Secretary Stephen J. Hadley suggested to the Senate Armed Services Committee that the nuclear train be loaned to Russia to haul its warheads in from the field for deactivation. On February 17th Russia accepted the offer of using the 25 special boxcars along with 250 special warhead containers and smaller containers for components -- even bullet-proof blankets with which to cover the warheads. However, the nuclear train still sits at Pantex, Texas and could be used again. As for now, nuclear warheads continue to be hauled by truck [see below]. Observers at Pantex are seeing a lot of nuclear truck activity movi ng in and out of the plant.

B. MISSILE-MOTOR BOXCARS

When a special freight train destined for Sub-Base Bangor derailed near Puget Sound in April 1986, Navy officials promptly disclaimed the presence of explosive material. Documents later obtained through the Freedom Of Information Act revealed that over 50 tons of Class-A explosives in the form of Trident-1 (C-4) rocket motors were on board. Class-A tops the danger list.

Conditions became acute in Alabama in November 1988 when an afternoon freight train enroute to Cape Canaveral edged east from Birmingham. It derailed a mile outside of Talladega at about 4:00 PM. Steel box car number DODX 29504 left the tracks with a pair of Trident-2 (D-5) missile motors inside. Flashing warning lights and a placard reading "EXPLOSIVES A" prompted sheriff deputies to immediately evacuate people living within a

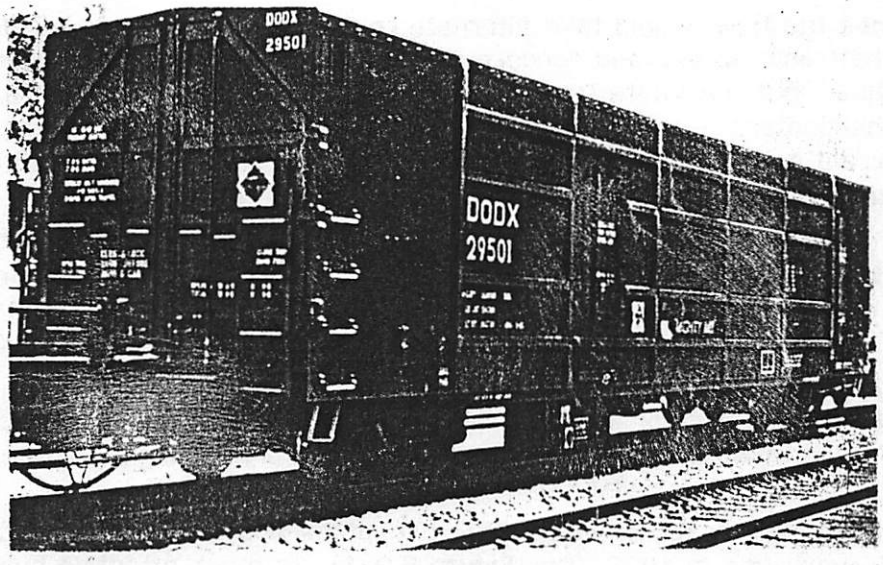


FIGURE 5.2-3
MISSILE-MOTOR BOXCAR -- DODX-29501
Photo Courtesy of Agape Community

mile radius.

These close encounters with disaster epitomize the danger that rides the rails of America. Luckily, no one was hurt in either incident. But had a fire started this story could have had a different ending. Had it caught fire in a city, the outcome would have been catastrophic.

The Department of Defense owns nine specially designed and constructed boxcars designated DODX 29500 through 29508. DOD, of course meaning that the cars belong to the Department of Defense, and the X signifies they are not owned by the railroad. These boxcars have an environmental control system (air conditioning) which maintain the temperature between -20^{0}F and 120^{0}F. If the environmental control system should fail and the weather outside is not in that range, the cars cannot maintain the desired temperature for twelve hours. A warning light on an upper corner goes on if such a failure occurs.

For that reason, when the train's route will encounter an outside temperature more extreme than the desired shipping range, security escort personnel go along in case the environmental control system fails. To accommodate these people, the DOD has exclusively leased four comfortably-equipped cabooses which are also designated DODX.

Trident-2 motors contain almost 56 tons of extremely high explosive propellant. It is general practice for over 50 tons of rocket propellant to be shipped in one boxcar. Two such box cars have been observed adjacent to each other in one train -- it is possible there could be more. The propellant composition is secret but it is a real bomb which can be ignited by fire or a sharp blow. The resulting explosion is so powerful that Trident-2 test launches at Cape Canaveral took place according to stringent weather criteria because under certain atmospheric conditions a motor explosion would damage the nearby

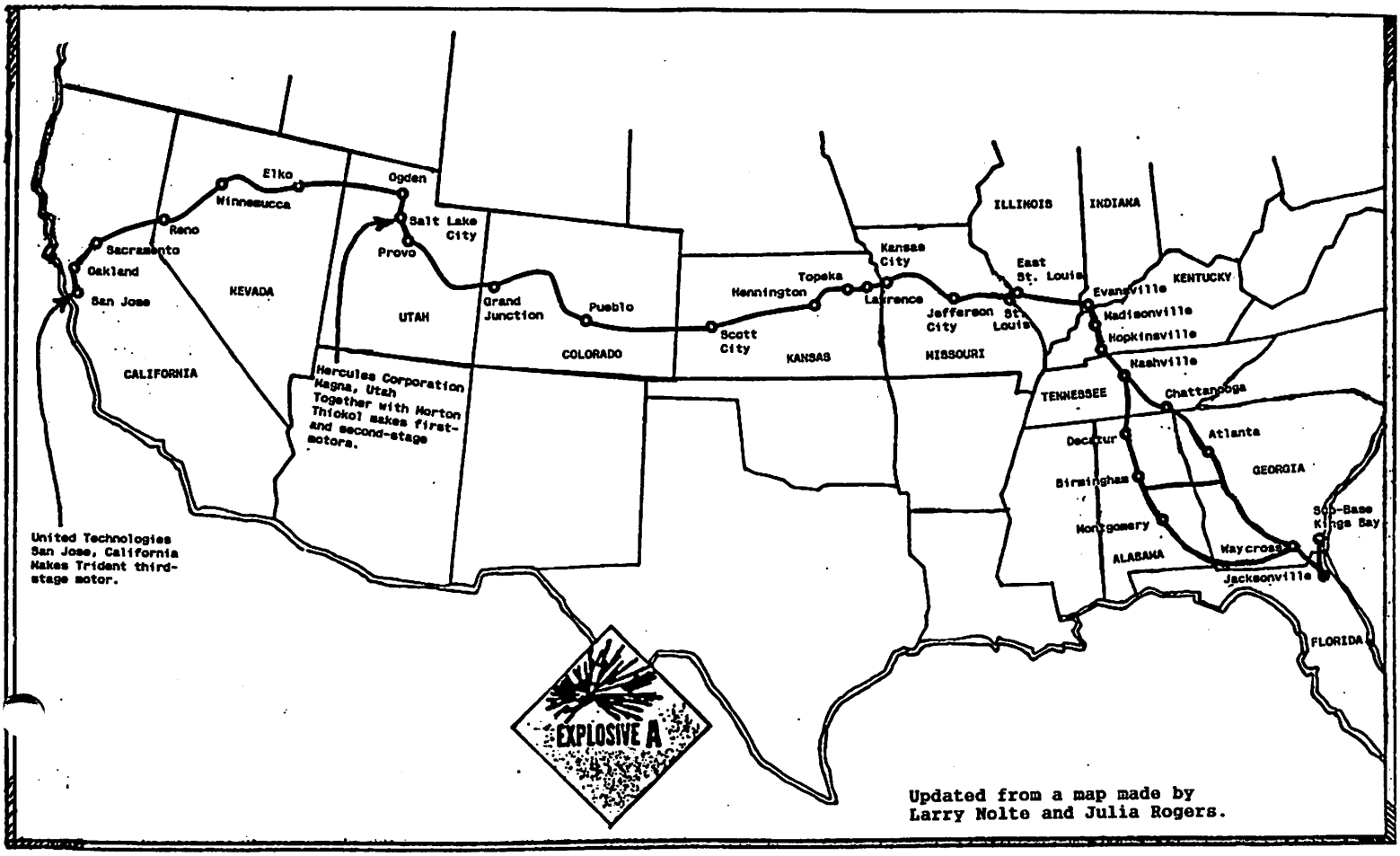


FIGURE 5.2-4
RAILROAD MAP OF MISSILE MOTOR SHIPMENTS

town.

The Navy requires wide buffer areas around all locations where Trident motors are handled and assembled. Personnel are also kept to a minimum. But no such safety considerations exists along railroad tracks and roads during transit because, according to the Navy, commercial carriers are subject only to Department of Transportation regulations. There are, however, special instructions warning that if a fire reaches the cargo compartment everyone, fire fighters and the public alike, must withdraw to at least one mile from the scene. Under such lax transportation procedures, these multi-ton bombs pass through our communities unannounced. Even the Alabama sheriffs didn't know what was in that fractious boxcar in November 1988.

Glen Milner of Seattle (see Appendix E) has for years studied government bills of lading obtained through the Freedom Of Information Act. From this data he has determined that during the first half of 1992 some 300 tons of propellant were transported by rail

that during the first half of 1992 some 300 tons of propellant were transported by rail each month. The propellant in all three stages of Trident-2 motors is the so-called class 1.1 propellant which can detonate (as opposed to burn fiercely) from a sharp blow or fire. It is so dangerous that the Air Force will only allow it in the third stage of the silo-based MX missile.

It is this potential for disaster rumbling through Alabama, coupled with the near miss in 1988, which prompted the Birmingham City Council to pass a resolution opposing any further rocket motor shipments through their city. The resolution reads as follows:

WHEREAS Trident-2 (D-5) missile propellants are shipped by rail twice a week through the City of Birmingham; and

WHEREAS these heavily encased "CLASS A" explosives require an isolation area of one mile in all directions (should they catch fire) and thus endanger residents of Birmingham and its neighboring municipalities; and

WHEREAS the $2 billion spent on each Trident submarine siphons needed funds from the same neighborhoods endangered by these Trident shipments; and

WHEREAS our nation stands in a critical need of a conversion from wasteful, life-threatening weapons systems to a transforming response to the needs of our cities;

THEREFORE BE IT RESOLVED that the City council of Birmingham

1. Opposes all further Trident shipments through Birmingham;

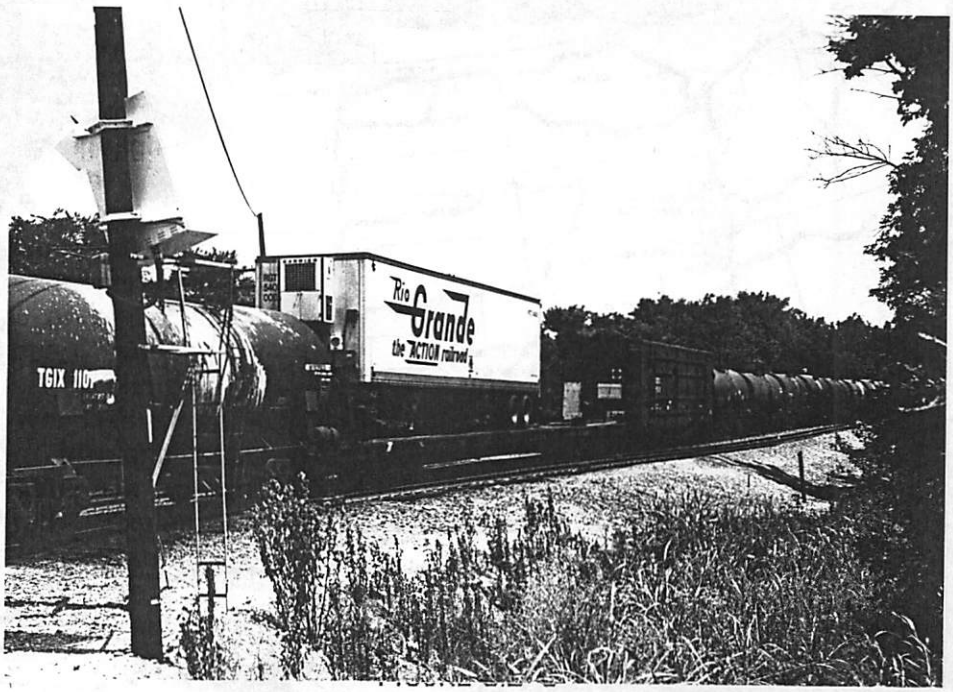
2. Requests that the President and Congress end all Trident funding and redirect the money thus saved to the needs of our neighborhoods: schools, health care, housing, job training, rehabilitation programs, and day care;

3. Supports Mayor Richard Arrington, Jr. in placing a similar resolution before the Black Mayors' Conference in Kansas City, Missouri opposing Trident shipments passing through and endangering any of the cities there represented and seeking the conversion of all Trident funding to human resources for our cities.

Trident-2's third-stage motors are made at the United Technologies' Chemical Systems Division plant near San Jose, California. The completed motors are trucked from San Jose to Oakland in a special RGTZ trailer which is painted white and marked "Rio Grande The Action Railroad." Each trailer can hold four

FIGURE 5.2-5
RGTZ TRAILER WITH TRI-STATE TRACTOR
Photo courtesy of Agape Community

third-stage motors and has an air-conditioning system in front. Two warning lights are on the right-upper-front corner -- one to warn if the temperature is out of the desired range, and the other to indicate a power loss. A yellow diamond sign denotes a cargo rated "Explosives A" Tri-State tractors have been used to pull the RGTZ trailers, but it appears that Diablo Transportation may be doing the trucking between San Jose and Oakland.



RGTZ TRAILER ON A FLAT CAR
Photo by Ann Sorenson, Evansville, Indiana, 1991

At the Oakland freight yard the trailer is loaded onto a flat car for shipment to Sub-Base Kings Bay in Georgia. Sometimes this flat car may end up in the same train with DODX boxcars.

C. ARMORED NUCLEAR TRUCKS

Every day a fleet of unmarked, armored, and heavily armed articulated trucks (tractor and trailer) owned by the Department of Energy travel the nation's highways. They log over 3.5 million miles per year and are accompanied by one or more escort vehicles. Nukewatch USA has mapped the routes travelled by these trucks. It has also advertised the truck's appearance and characteristics, as well as that of escort vehicles. Periodic "Truck Watches," sponsored by Nukewatch, keeps this information current.

On 18 July 1991, Metanoia Community observed for the first time a convoy of three 18-wheeler trucks escorted by five security vehicles enter Sub Base Kings Bay in Georgia. It is presumed they were carrying thirty-six Mark-5/W-88 warheads.

The DOE tractors which transport nuclear warheads and components are made by Marmon Motor Company of Dallas, Texas, but have no special markings and carry no warning signs of explosive or radioactive cargo. The heavily-armed personnel wear no distinctive uniforms or badges. The trucks do bear government license plates beginning with "E", and usually have stripes painted on the cab. There is a horizontal radio antenna

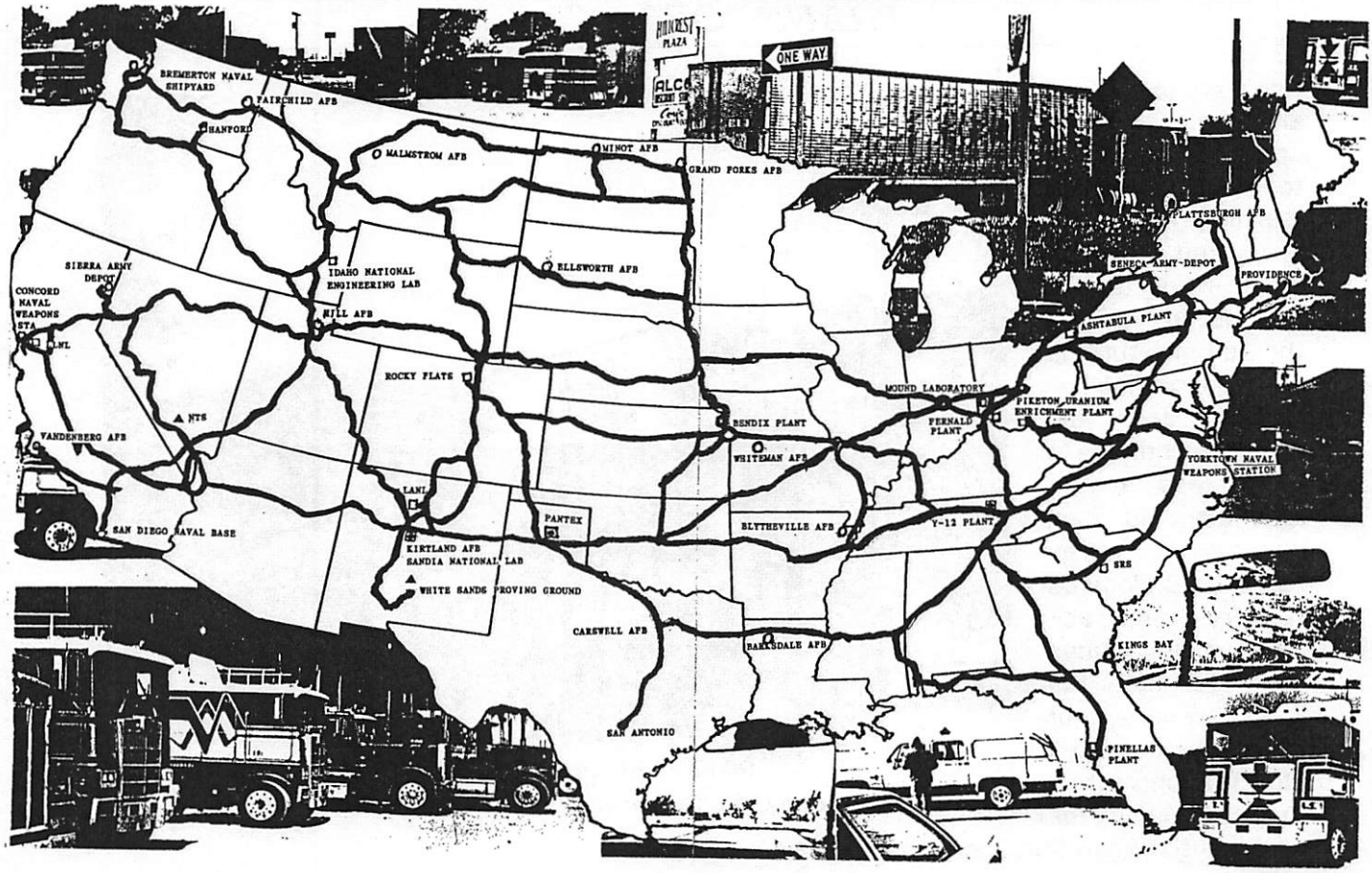


FIGURE 5.2-7
MAP OF NUCLEAR TRUCK ROUTES
Courtesy of Nukewatch USA

across the top of the cab. Newer tractors are long-snouted rather than cab-over-engine design.

The "safe-secure trailers" have unpainted steel sides. The letters "AM" are painted on the right front. A metal box protrudes below the trailer floor. Diagonal black and white stripes on the rear go about a third the way up the back of the trailer, which contains intricate alarms and security devices to prevent unauthorized entry.

Two or more courier vehicles escort the trucks. They are also plain and are usually Chevrolet Suburbans. A radio antenna is on the left rear of the vehicle and a white box is at the base of the antenna. Both truck and courier personnel are heavily armed and have shoot-to-kill authorization.

Nukewatch-USA has not tracked nuclear bomb trucks since 1992 because they lack funds and volunteers. Peace Camp at Pantex, Texas reports there is a lot of activity hauling H-bombs and materials in and out of the Pantex plant. Anyone wishing to become involved with tracking nuclear bombs and warning local people and authorities should contact Nukewatch-USA, P.O. Box 2658, Madison, Wisconsin 63701-2658; Phone 608-256-4145.

NUKEWATCH PHOTO by Camy Condon

Rear view of safe secure trailer: Diagonal black and white "pin stripes" go about one-third the way up the back of the trailer.

NUKEWATCH photo by Nat Batchelder

Courier car: One or more of these escort each convoy, traveling sometimes close by and sometimes at a distance. Usually Chevrolet suburbans or similar. They are fitted with a radio antenna at left rear of vehicle; white box near the base of the antenna.

FIGURE 5.2-8

DOE TRUCKS AND ESCORT VEHICLES

Department of Energy "safe secure trailers" have no identifying markings and no warning signs of the nuclear and explosive cargo. The convoy crews are heavily armed but wear no uniforms or insignia. Features typical of these trucks are (a)unmarked and unpainted steel trailer sides, (b) horizontal radio antenna on top of cab, (c) perhaps the "Marmon" manufacturing emblem on front and sides of cab, (d) most trucks painted with stripes as shown, (e) US government license plates starting with the letter "E", (f) the letters "AM" on right front of trailer, and (g) metal box protruding below trailer floor. Cab-over-engine tractor at upper right has been in service since the 1970s. The long-snouted tractor at bottom right --also made by Marmon Motor Company of Dallas, Texas -- has been in use since the late 1980s. Tractor photos obtained from the DOE through a Freedom-of-Information request by Glen Milner of Seattle, Washington.

D. NUCLEAR WARHEAD CONVOYS ON BRITISH ROADS

By Nigel Chamberlain (Nukewatch-UK)

Most nuclear warheads are transported in Britain by road although the Ministry of Defence has investigated the possibility of a return to sea transportation. Trident warheads are moved from AWE Burghfield near Reading in the south of England to RNAD Coulport on the Clyde near Glasgow in Scotland. The warheads are stored in underground bunkers until required for the operational patrols of *Vanguard, Victorious, Vigilant* and *Vengeance* from their Faslane submarine base.

Chevaline warheads from the decomissioned Polaris submarines are returned by road to AWE Burghfield from RNAD Coulport for dismantling. Britain's other nuclear bombs, the WE-177, are being removed from Royal Navy surface ships and Royal Air Force Tornado bombers. It is believed that the fissile material from these warheads is refurbished for Trident warheads.

Unmarked warhead convoys frequently use the very busy British roads and drive past, or through, major conabations (Oxford, London, Peterborough, Leeds, Newcastle, Carlisle, Edinburgh, Glasgow) without informing the Local Authorities. Nukewatch-UK is a network of local activists which monitors the movements of these convoys and campaigns against secrecy and for public safety.

FIGURE 5.2-9
FODEN TRACTOR WITH TRUCK CARGO HEAVY DUTY MARK-II NUCLEAR WARHEAD CARRIER
Photo courtesy of Nukewatch-UK and CND

The aging Mammoth Major carriers were replaced by "Truck Cargo Heavy Duty Mark-II" carriers in 1992, which are manufactured by Brown and Root Vickers. The carriers are built over three axles and are articulated. They are dark green and covered with a green tarpaulin. The tractor units are made by Foden and have a distinctive vertical exhaust pipe and an air conditioning system on the cab with a spiked cooling unit on the driver's side. There are military number plates on the front of the tractor unit and on the back of the carrier. Apart from two "long vehicle" signs, there are no other warning signs on the carriers.

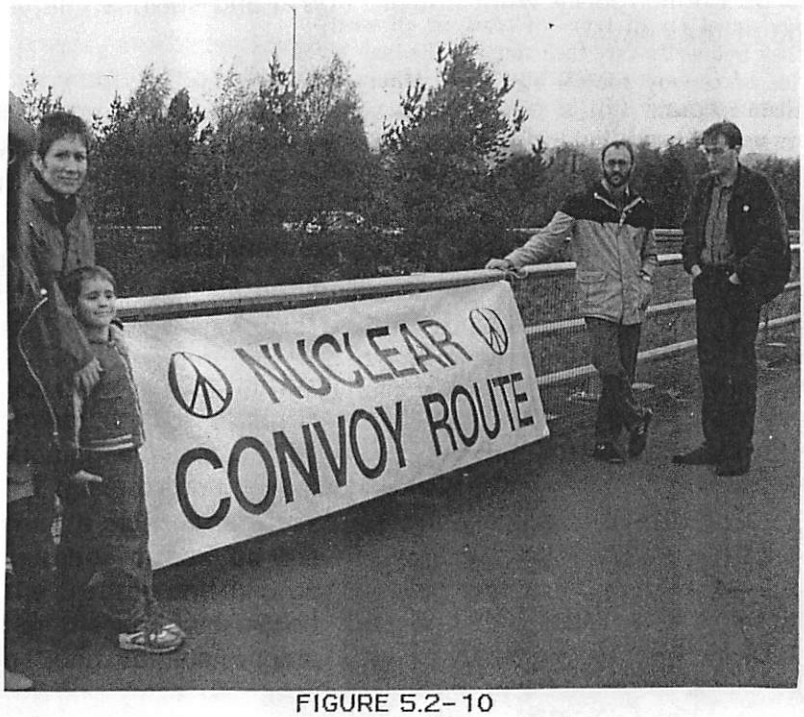


FIGURE 5.2-10
CHRIS AND NIGEL CHAMBERLAIN WITH ONE OF THEIR SONS MARKING A NUCLEAR CONVOY ROUTE
Photo courtesy of Nukewatch-UK and CND

As many as five warhead carriers are escorted in convoy by three RAF and MOD motorcycle outriders, two light green transits with officers and technicians, four or five grey transit vehicles with armed Royal Marines, a spare tractor unit for breakdowns, a fire engine, a tow truck, and a convoy support vehicle which carries radiation detection and decontamination equipment and is fitted with sophisticated communications.

There have been a disturbingly large number of "incidents" involving nuclear warhead convoys through the 1980s and 1990s, ranging from frequent breakdowns, occasional accidents, and one civilian fatality. Most serious of these were the overturning of one carrier on icy roads in Wiltshire on 10 January 1987, a crash which killed a motorists in Somerset on 17 September 1988, and a crash in Northumberland on 11 August 1993 when

FIGURE 5.2-11
RAF TRANSIT VAN
Photo courtesy of Faslane Peace Camp

a large civilian lorry went out of control and seriously injured an RAF motorcyclist at the head of the convoy.

On 1 December 1991, the very busy M25 motorway around London was closed for several hours while a warhead was removed from one vehicle by crane and transferred to another carrier. Typically, the military attempt to deal with these potentially hazardous "incidents" with their own resources and keep local authority emergency services in the dark.

Nukewatchers inform the local authorities of the movements of nuclear warhead convoys and work closely with journalists to inform an unassuming public. We lobby local and national politicians and prepare briefings for interested organisations and political parties. Some Nukewatchers are also involved with direct action against the convoys which impedes their progress, draws attention to the secrecy which surrounds them, and builds opposition to the development of the nuclear state.

* * * * *

FIGURE 5.2-12
OTHER BRITISH CONVOY VEHICLES
Left to right above: Support Vehicle, Fire Engine. Left to right below: Tow Truck, RAF Police Motorcycle, Unidentified Convoy Vehicle. Photos courtesy of Faslane Peace Camp.

Nukewatch Regional Contacts:

Scotland

Jane Tallents 0436-79194
Scottish CND 041-423 1222
Faslane Peace Camp 0436-820901

England (North)

Jimmy Barnes 091-272 2046
John Brierley 0274-730795
Nigel Chamberlain 0768-898641

England (South)

Di MacDonald 0703-554434
Evelyn Parker 0635-253231
Jean Kaye 0865-771046

England (East)

Peter Lanyon 0394-386273
Barbara Sunderland 0462-814186

Send details of convoy movements to Andy Pritchard, West Midlands CND, 54 Allison Street, Birmingham B5 5TH, telephone 021-643 4617.

FIGURE 5.2-13

BRITISH ROADS THE CONVOYS TRAVEL

The convoys travel all types of roads in all weather conditions. They frequently vary their routes. This map shows the main roads but many other roads throughout Britain are used.

Courtesy of Nukewatch-UK and CND

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5.3 ENVIRONMENTAL DESTRUCTION: A MILITARY LEGACY

An inevitable legacy of military installations is toxic waste strewn in their wake. Trident bases and related installations are no exception. The following examples speak for themselves.

A. US DEPARTMENT OF DEFENSE BASES AND CONTRACTORS

As military bases are being closed in the wake of the Cold War, the hazardous residue left behind has come to public attention. Virtually every base scheduled for closure has a hazardous waste problem, and we can be certain that those which remain in use are no less contaminated. To cover the entire spectrum of military nuclear waste would be a huge task. This section will only touch briefly on facilities associated in some way with Trident. For those who wish to delve into the matter further, the bibliography should be of some help. Further information in this area will be appreciated.

1. Sub-Base Bangor.

Sub-Base Bangor has 21 sites which made the federal Superfund list of America's worst hazardous waste sites. One 12-acre site is expected to cost $3-million and take ten years to clean up. It had been used to detonate old explosives which leave cancer-causing residues. These residues seep into the soil and eventually get into the water table which is only 60 feet below the surface. The plan is to pump ground water to the surface and zap it with ultra violet rays and oxygen to neutralize the residue. The soil will also be washed and the pollutants removed will be zapped in the same way. This operation is scheduled to start in April 1993 or thereafter.

Another site is at the south end of the base where toxic fumes from a buried drum of waste paint stripper was *unexpectedly* found in December 1991. Then containers of diesel fuel and tar were found. Ground-penetrating radar will be used to search for more waste.

2. United Technologies Corporation.

United Technologies Corporation (UTC) in Santa Clara County, California, operates a plant to manufacture, test, and dispose of solid rocket motors. Known as the "invisible empire," this plant nestles out of public view in the Las Animas hills southeast of San Jose, and upstream from Anderson Reservoir, one of the primary water supplies for the Santa Clara Valley. It is here that the third-stage motors for Trident-2 missiles are being manufactured, as were the third-stage motors for Trident-1. The UTC Conversion

Project contends that UTC pollutes the air over high-density areas, contaminates the valley's water supply, and trucks extremely hazardous explosives through highly populated communities without prior notification to safety officials. [UTC Fact Sheet]

In addition, UTC plans to build a road through a serpentine grassland plant community which includes rare and endangered plants and animals, including the Bay Checkerspot Butterfly, the Metcalf Canyon Jewel, the Santa Clara Dudlyea, and the Fragrant Fritallaria. The road cannot be started until an Environmental Impact Statement (EIS) is completed. UTC has now halted work on the EIS, presumably waiting for the Endangered Species Act to be weakened by the White House. Bay Area Mountain Watch has helped in outreach regarding endangered species.

The Youth Science Institute reported to the Morgan Hill City Council that there are an unusual number of deformed animals around the UTC facility. (Rocket testing and burning scrap fuel produces toxic byproducts, including dioxin.) [UTC Fact Sheet]

In its 28 August 1991 letter to the Santa Clara County Planning Commission, the UTC Conversion Project charged that UTC had over the past twenty years erected 82 buildings for rocket motor and propellant manufacture in violation of a county regulation that an architectural site review be conducted for manufacturing buildings. Without the public hearing required under the county regulation, UTC's use permit is valid only for research and development. Section 5 of UTC's use permit requires adequate transportation routes for hazardous materials. Loaded rocket motors have been tracked through populated areas of San Jose. Transportation hazards were discussed in a previous chapter.

On 3 February 1992 the US Environmental Protection Agency levied an eight-point hazardous-waste-violation complaint against UTC and assessed a $588,000 penalty. Three days later, on 6 February 1992, the Santa Clara County Planning Commission voted to hold a hearing on whether to revoke UTC's use permit.

The UTC Conversion Project contends that (1) UTC uses six pits to burn rocket fuel which releases tons of toxic material annually into the atmosphere, and (2) toxic chemicals are leaking from the burn pits into near underground water supplies and are less than half a mile from Anderson Reservoir. The Bay Area Air Quality Management District has ordered UTC to cease open burning by 1 January 1995. The Santa Clara Valley Water District, working with the Regional Water Quality Control Board has been working with UTC to contain the underground seepage from the burn pits. Had it not been for citizen action, these practices would have gone unnoticed.

The County Planning Commission hearing was held on 7 May 1992. They voted 4:3 to hold off on a judgment until they heard from other government agencies such as the Environmental Protection Agency. The UTC Conversion Project plans to take the issue up directly with the County Board of Supervisors. At the time of this writing the outcome has not been decided. John Beall of the UTC Conversion Project believes that, in addition to a fine, UTC will be forced to spend a given amount of money to remove toxic rocket fuel residue from huge amounts of stored solvents that were used in conjunction with the

burn pit, so those solvents can be recycled.

B. US DEPARTMENT OF ENERGY SITES

On 16 December 1991 US Energy Secretary James Watkins announced that nuclear arms production sites will be cut from 15 to 5 by 1996 -- four production plants in the south and mid-west, and the Nevada Test Site. That means an enterprise which once manufactured up to 6,000 nuclear warheads annually will be chiefly responsible for maintenance of the ones now deployed and cleaning up the pollution it produced. The total employment would remain at about 57,000 workers but their effort will be changed. The ratio used to be that for every two people working on weapons production, one would be working on environmental cleanup. That ratio will now shift toward environmental clean up. Because of that some DOE facilities are claiming they perform more civilian work than military whereas they are really just mopping up their own mess.

1. Y-12 Nuclear Weapons Components Plant.

On 17 May 1963, under state and public pressure, the DOE admitted it had lost some 2.4 million pounds of mercury from the Y-12 plant. During its ten years of lithium separation (1953-1963) large amounts of mercury were required for the process. Between 220,000-470,000 pounds went into East Fork Poplar Creek. Contaminated soil from this creek was used to construct Oak Ridge city civic center and two junior high schools -- one of which was found to contain up to 300 times the normal level.

The Y-12 plant in Tennessee spreads over 811 acres with an additional 4,800 acres fenced off as a security buffer zone. Employment in 1989 was 6,500. Today it is the source for finely-machined H-bomb parts made from depleted uranium (U_{238} after all the weapons-grade U_{235} has been removed by isotope separation), lithium, beryllium, carbon foam, and other materials. A legacy of past and present activity rests in the Bear Creek Valley Waste Disposal Site west of Y-12, and is a known source of water and soil contamination. Nitrate is the main contaminate but carcinogenic polychlorinated biphenyl (PCBs), toxic chemicals, heavy metals, and radioactive substances have also been identified. This disposal site is made up of three areas: the S-3 Ponds, the Oil Landfarm Site, and The Burial grounds.

a. The S-3 Ponds.

Four unlined seepage pits were used to dispose of over 2.7 million gallons of liquid waste between 1951 and 1984. This waste included concentrated acids, caustic solutions, and by-products from uranium recovery. What wasn't evaporated or absorbed by the soil leached directly into ground water, bear Creek, and East Fork Poplar Creek.

b. The Oil Landfarm Site.

More than a million gallons of liquid oily wastes were plowed into thirteen acres between 1973-1982. These included PCBs, beryllium compounds, depleted uranium, and tetrachlorethane.

Another area was contaminated with acids, coolants, oils, metals, and debris between 1943-1970. In addition, 100,000 tons of undocumented waste was burned or buried between 1943-1968. And between 1975-1981 a 3.5-acre hazardous chemical area received solid, liquid and gaseous materials which were intentionally leaked into the soil or evaporated.

c. The Burial Grounds.

This site is divided into four sections designated "A," "B," "C," and "D." Eighteen-acre Burial Ground "A" began in 1955 to receive construction debris and secret contaminated scrap metal in unlined trenches. Over 4.8 million gallons of radioactive mop waters were dumped down standpipes into the ground. PCB-contaminated oils, coolants, and solids were also dumped, as were solvents and radioactive asbestos waste. Burial Ground "A" was covered with a waterproof cap in 1989.

Into 7.3-acre Burial Ground "C" was dumped beryllium, thorium, and uranium-contaminated materials between 1962 -1984. Closure procedures started in 1991.

Burial Grounds "B" and "D" received depleted uranium metals and oxides during the 1960s. Burial Ground "B" was closed in 1982. Burial ground "D" remains in use, especially for radioactive uranium byproducts in unlined trenches and pits.

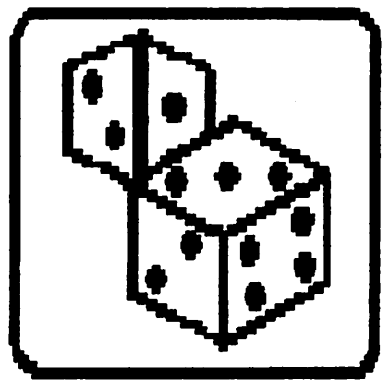
2. Rocky Flats Nuclear Weapons Complex.

Rocky Flats in Golden, Colorado is one of four plutonium processing sites run by the DOE. The other three are the Savannah River Site in South Carolina, the Hanford Site in Washington, and Las Alamos National Laboratory (LANL) in New Mexico. All are now shut down for plutonium processing except LANL. The DOE no longer produces plutonium for use in nuclear weapons -- it now recycles plutonium from retired nuclear weapons and reclaims plutonium that remains as scrap or residue from recycling and former processing.

Rocky Flats was closed down in November 1989 for environmental, safety and health (ES&H) issues. It is not expected to reopen as a plutonium processing plant. In February 1992 the Secretary of Energy announced that Rocky Flats will undergo a transition from weapons components production to site cleanup.

As of 7 May 1992 there were 2,805 ES&H issues identified at Rocky Flats. Three buildings (371, 559 & 707) will be put back into operation to accomplish the clean up. These buildings account for 666 of the ES&H issues. After they are cleaned up and opened, work will continue to

decontaminate and decommission the remaining buildings and grounds.



An internal DOE memo labeled "Ticking Time Bombs" disclosed that substantial amounts of plutonium were stored at Rocky Flats in unstable conditions or in potentially unsafe containers as recently as 24 September 1992 -- almost three years after the plant was closed. But the memo's author and other DOE scientists on September 25th placated adverse publicity by saying the situation presents "no immediate hazard" and that "higher-priority items are being addressed at this time." [*SJMN*, 8 October 1992, p. 6C] This raises the question of how bad Rocky Flats really is if there are more serious conditions than unsafe plutonium storage.

3. Savannah River Site.

The Savannah River Site (SRS) in Aiken, South Carolina is one of the two US facilities for producing plutonium and tritium for hydrogen bombs. It has three of the nation's four weapons-producing reactors (K, L and P). The fourth reactor -- the N-reactor -- is at Hanford in Washington. All three of the SRS reactors were shut down in 1988 because of safety considerations.

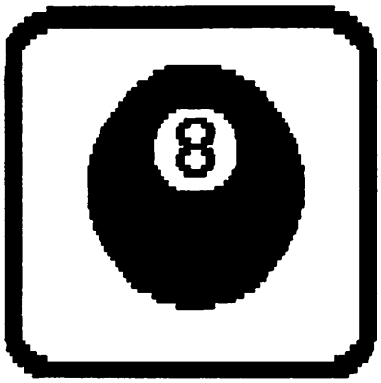
Plutonium production has now been cancelled by the DOE because enough can be recycled or reclaimed to meet military quotas. Tritium is another matter because its half-life is about 12.5 years or -- it decays at the rate of 5.5 percent per year. So the K-reactor started up again in June 1992 for a three-month trial period before reaching its goal of 50 percent power. The L-reactor is kept on standby with a one-year lead time for startup. Plans are to mothball the P-reactor. The joint DOD/DOE announcement that the reactor project had been scrapped was with reference to a new reactor, not the aging K-reactor.

A review by the Defense Nuclear Facilities Safety Board could hamper the continued operation of the K-reactor. SRS officials can't show that the plant meets standards to insure that no radiation is released into the air. The Board's report said that lack of documentation before 1989 casts doubts on the reliability of parts and equipment in the tritium-producing facility.

4. The Hanford Site.

Hanford is the other former nuclear-weapons-producing site and the home of the N-Reactor. It is the most contaminated of all DOE facilities. The place is a mess with radioactive contamination leaking into the Columbia River and elsewhere. There are problems with inadequate storage of hazardous and radioactive materials. Worker health and safety procedures have serious flaws and many injuries go unreported. A citizens group called COHO (West 2122 Dean, Spokane, WA 99201; 509/325-3475) has been monitoring the plant activities and informing the public.

Hanford is also the graveyard for submarine nuclear reactor compartments. Through June of 1991 the US Navy had commissioned 165 nuclear-powered submarines. Now the Navy has embarked on a program to inactivate about 100 of those submarines and dispose of about 85 of them by the year 2000, at an estimated cost of $2.7 billion. [See GAO/NSIAD-92-134] There are six nuclear-capable shipyards in the US but, because of its proximity to Hanford, only Puget Sound Naval Shipyard removes reactor compartments. Any submarine not inactivated at Puget Sound is towed there for reactor compartment removal.



Since 1969 there have been 42 inactivations started, 31 of those since 1986, of which six were started in fiscal year 1991. Reactor compartments have been removed from 20 of those 42. So it is easy to see that a lot more radioactive and bulky waste will be arriving at Hanford during the 1990s. Significant amounts of PCBs have also been found during submarine inactivation. Regulatory agencies are now reviewing a strategy developed by the Navy to *better* meet environmental regulatory requirements for disposal of reactor compartments.

C. BRITAIN'S NUCLEAR LEGACY

By William Peden (CND-Britain)

The British Trident nuclear weapons system relies on a large industrial infrastructure both in the UK and the US in order to survive. This infrastructure has been in place since the conception of Britain's bomb. Many plants no longer produce materials for British nuclear weapons but the legacy from over 50 years of bomb production lingers on.

This infrastructure continually pollutes the environment with large quantities of toxic and radioactive waste. The main site involved in putting together the over 2,000 components that go into a Trident warhead is Atomic Weapons Establishment, Aldermaston.

1. Atomic Weapons Establishment, Aldermaston.

This is where all British nuclear weapons are designed. The site also manufactures the key plutonium and uranium components for nuclear warheads. Due to contractorisation this site will become the only warhead component manufacturing plant in the UK by the end of 1997. Manufacturing facilities at Cardiff and Burghfield are to close, with Burghfield only retaining the role of assembling and disassembling British nuclear weapons.

a. Nuclear Waste. AWE Aldermaston produces large quantities of toxic and radioactive waste. They discharge radioactive material into the atmosphere through 69 chimneys and beryllium out of another nine. Aldermaston produces an average of 551 tons of low and intermediate level nuclear waste each year. They have stored on-site in

an untreated state some 2,382 tons of nuclear waste. It is projected that by the year 2000 this will have increased to almost 104,000 tons and by 2030 this amount will have increased to 130,000 tons. Enough to fill roughly 423,000 London double decker buses.

By the year 2000 AWE will have run out of storage space, much of the waste is already being stored in sub-standard conditions. All AWE plans to do at present is build more warehouses to store the increasing amounts of waste.

Alongside all the operational waste stored on-site, AWE discharges into the nearby River Thames between two and three million gallons of liquid radioactive waste each year. Over the last 30 years they have discharged approximately 160 million gallons of liquid radioactive waste into the river.

They also dispose of low level waste at the national disposal site at Drigg and discharge approximately 266 million gallons of radioactive and toxic waste into the local sewerage system.

Even more worrying is the state of storage for the vast quantities of plutonium in oxide and metal forms stored on-site. All plutonium is stored in safes which are known to be inadequate for the task. The safes are in buildings with no way of stopping any leakage from escaping to the environment. Many workers have been contaminated as a result of poor plutonium storage.

b. Contaminated Site. AWE Aldermaston is heavily contaminated with plutonium and uranium as well as a number of toxic substances such as toloulene. Exact details of internal contamination are unknown as no reports are ever released. However, there is evidence that points to on-site contamination being extensive.

In 1977 a study was done of rabbits who live on-site, their skeletal systems were found to be radioactive. There have also been reports of radioactive waste dumps scattered over the site, left in the open for years unattended.

AWE's own monitoring reports have found elevated levels of radioactivity around the base perimeter thought to result from soil disturbance as a result of heavy construction on-site.

And more recently land adjacent to Aldermaston was extensively contaminated by plutonium as a result of heavy rainfall which resulted in contaminated soil being washed off-site.

c. Aldermaston's Accident Record. A detailed investigation by Greenpeace uncovered a previously unknown list of accidents on-site. These include:

-- 22 fires involving radioactive material in the area where nuclear weapons design and manufacture occurs;

-- 5 serious explosions that caused fatalities and wrecked buildings and equipment;

-- 2 accidents involving lithium;
-- 4 fires involving beryllium;
-- 2 accidents involving tritium;
-- 9 electrical fires in areas that could have resulted in explosions;
-- A serious leak of radioactive waste in the pipeline to the Thames; and
-- A tritium gas leak into the environment.

As a result of the Greenpeace report and extensive public pressure the Health and Safety Executive (HSE) conducted an investigation into health and safety at all Britain's Atomic Weapons Establishments. Their report was highly critical.

HSE found "a number of significant inadequacies in health and safety management arrangements." And that "taken as a whole, standards did not come up to those found elsewhere in high hazard industries, including the nuclear industry." HSE made a total of 65 recommendations on ways to improve health and safety at all Atomic Weapons Establishments. Many of these are being carried out at the moment.

Over the coming years AWE Aldermaston will have to decommission many old buildings and heavily contaminated plant and equipment. This will produce more nuclear waste that has no where to go. This problem will continue as long as Britain continues to produce Trident warheads.

This is just a brief overview of the massive environmental legacy left as a result of Britain's nuclear weapons programme. There are many other sites and many more problems. For more information read *Nuclear Wastelands: A Global Guide To Nuclear Weapons Production And Its Health And Environmental Hazards.*

NUCLEAR SUBMARINE GRAVEYARD

(This section is excerpted from a CND Defence Briefing entitled "Polaris Is Retired, Trident Takes Over. What Is The Cost?", written by William Peden.)

On 13 May [1996] Britain's last Polaris submarine, *HMS Repulse*, joined the ten other nuclear-powered submarines that have been decommissioned in the last few years. *HMS Revenge* was the first to be retired in 1992 followed by *Resolution* in 1994 and *Renown* in 1995. The retirement of the last ageing and decrepit Polaris submarine raises another question -- **What do you do with an old Polaris submarine?**

The Polaris missile rocket motors are fueled by a solid propellant of powdered aluminum bound with ammonium perchlorate. These are taken to Shoeburyness where they are disposed of by setting them on fire using explosive charges. The Navy also has to dispose of PCB based lubricant and heat exchange oils from capacitors and transformers; CFCs within the air conditioning and refrigeration plants; and huge amounts of lead-acid batteries full of heavy metals, among other things.

But in addition to the toxic materials on-board there is the huge radioactive inventory that has to be dealt with. The [submarine propulsion] fuel rods are taken to Sellafield where they sit awaiting an as yet undetermined fate in cooling ponds. Nobody knows how to reprocess submarine spent nuclear fuel. There are about forty fuel cores at Sellafield

waiting to be dealt with, each containing between 200 and 250 kilograms of highly enriched uranium.

There is also toxic and radioactive sludge accumulating at the two refit yards -- Rosyth and Devonport. This waste material not only arises from decommissioning but also from the day-to-day refit operations carried out on nuclear-powered submarines. To clean out the reactor pipes, resin beads are flushed through the reactor. The resultant waste beads are not only radioactive but are also toxic. There is currently no solution as to how to dispose of them because of their heavy toxic content. The beads eventually form a very nasty porridge-like substance. This is stored in Resin Catch Tanks or old nuclear fuel flasks. There are at present over 23 containers full of this stuff at Devonport and 20 at Rosyth. If no solution is found to this problem Devonport management estimates that 180 containers of this waste will have accumulated there by 2010.

The Chevaline nuclear warheads will be returned to the Atomic Weapons Establishment at Burghfield where they will be dismantled and those parts that can be reused or recycled will eventually find their way into Trident warheads.

The biggest question is what to do with the hulk of the submarine, containing around 850 tons of radioactive material in its reactor compartment -- 30 feet in diameter and 24 feet in length. The Royal Navy has decided to store the submarines afloat until 2012, when they hope the deep disposal NIREX facility will be available. At present at Rosyth there are seven submarines:

HMS Dreadnought
HMS Swiftsure
HMS Churchill
HMS Revenge
HMS Resolution
HMS Renown
HMS Repulse

At Devonport there are a further four:

HMS Conqueror
HMS Courageous
HMS Warspite
HMS Valiant

The policy to store afloat will cost an estimated 225 million pounds.

Despite the vast quantities of radioactive and toxic waste produced and left for future generations to dispose of, the MOD has decided to continue deploying nuclear-powered submarines. The Royal Navy has at present 27 nuclear-powered submarines, including the four Trident boats. Eleven of these have already been decommissioned with a further two or three to follow by the turn of the century.

Is it wise to continue building nuclear-powered submarines when you don't know how to get rid of them at the end of their life and you don't know how to get rid of the vast majority of radioactive and toxic waste produced throughout a nuclear submarine's operational lifetime?

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