

Human Reliability and Safety in the Handling of Nuclear Weapons

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The problem of accidental or inadvertent nuclear war has been couched largely in terms of superpower confrontations during a crisis. Whether the focus is on the major powers, or on developing nations with ballistic missiles and probable nuclear weapons capability, stability in those who handle weapons and effective safeguards on use are essential preventive measures.

The United States and the USSR have been careful to guard against unauthorized launch. All nuclear nations have been concerned with retaining ultimate control of nuclear weapons in civilian hands; with monitoring the reliability and stability of the forces that handle the weapons; and with preventing weapons from coming into the possession of outsiders.

In 1986, an analysis of the sources of human instability in those who handle nuclear weapons concluded that thousands of unstable individuals were involved in "minding our missiles."¹ The present paper serves as an update on the problem and links it to potential areas of increasing risk as the world changes.

A YEAR IN THE LIFE OF BANGOR

The Bangor Submarine Base in the state of Washington employs approximately 5,000 servicemen. Of these, 1,024 are certified under the Nuclear Weapons Personnel Reliability Program (PRP). They are responsible for the handling of 1,700 nuclear weapons, 1,500 of which are on board Trident submarines.² Other weapons are kept at Bangor's Strategic Weapons Facility, the sole west coast site for assembling and loading Trident missiles for the Pacific fleet.³

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January 1989

At 9:30 pm on 14 January 1989, Lance Corporal Patrick Dale Jelly, an 18-year-old Marine, shot himself in the head with his M-16 rifle while stationed in a guard tower at the Bangor Strategic Weapons Facility.⁴ Jelly was PRP-certified and held a clearance which allowed him knowledge of "asset location."⁵

His behavior had been unusual for several weeks.⁶ He had talked about killing himself, punctured his arms with a needle and thread, and claimed to be the reincarnation of a soldier killed in Vietnam.⁷ If this had been reported before his suicide, it would have led to his decertification from the PRP.

July 1989

On 1 July, 34-year-old Tommy Harold Metcalf, a fire-control technician on the submarine *Alaska*, murdered an elderly couple by suffocation in their home after responding to an advertisement they had placed. Like all fire-control technicians, he was PRP-certified and was one of the crew members responsible for carrying out orders to fire the Trident's 24 nuclear missiles.⁸

Such personnel are classified by the navy as "critical," meaning that together with others they can cause the launch or use of a nuclear weapon. They also control or may use sealed authenticators, missile computer tapes, or other sensitive aspects of release procedures. A review of Metcalf's records by the navy was said to have found no problems with the screening process.⁹

August 1989

Commander William Pawlyk was arrested in early August after stabbing a man and a woman to death. Pawlyk had served for five years aboard the nuclear submarine *James K. Polk*, and had commanded Submarine Group 9 at Bangor. At the time of the murders, he was head of a reserve unit in Portland, Oregon.¹⁰

January 1990

On 15 January, Shyam David Drizpaul, a 23-year-old fire-control technician on the submarine *Michigan*, shot and killed one crew member in his living-quarters lounge, and then another one in bed.

The bodies of the victims were discovered when they and Drizpaul failed to

report for duty later that morning. Meanwhile, Drizpaul had attempted to buy another 9-millimeter pistol at a pawn shop. He grabbed the gun from the clerk, shot her to death, and critically wounded her brother. He then fled, checked into a motel near Vancouver, and killed himself with the same pistol.¹¹

Aftermath

All of these episodes were associated with a single ballistic-missile submarine base. Similar breakdowns in behavior have occurred at other weapon facilities.¹² In this case, the events were sufficiently publicized to provoke concern in Washington State about the navy's missile handlers. All had been PRP certified. Recent reviews had disclosed no problems, behavior or attitudes that might have caused revocation of their PRP status.¹³

The Bangor base commander, Rear Admiral Raymond G. Jones, ordered a review of the PRP procedures and management. Washington congressman Norman Dicks called for a review of the navy's PRP, saying "Dramatic improvements [in the monitoring system] are necessary."¹⁴ A week later, chief of naval operations Admiral Carlisle A.H. Trost told a House subcommittee that he had ordered a complete review of the Naval PRP because of the incidents. Subsequent investigation by the navy revealed that Drizpaul had been known to drink excessively, to carry an unregistered hand gun, and to have claimed to have been a trained assassin. But this information was never conveyed to his superiors—a "significant lapse in security," according to the chief of the US Pacific Command, Admiral Charles R. Larson.¹⁵

The experience at Bangor is a striking illustration of the difficulty of assuring stability in nuclear weapons personnel even when well developed systems of screening are employed.

PSYCHIATRIC PROBLEMS

Psychiatric disorders are an important and difficult problem in the military.¹⁶ A longitudinal study of 11,000 naval enlistees found that approximately 1 in 12 (8.7 percent of the total) was discharged during his first enlistment because of psychiatric illness.¹⁷ From 1980 through 1989 95,000 individuals in the army had psychiatric disorders. Over 6,000 were schizophrenic, while an additional 7,000 had other psychotic disorders (table 1).¹⁸ In the US Navy during the

same period, there were 129,000 personnel with psychiatric problems.¹⁹

The risk of mental illness is especially acute in nuclear-armed submarines, in which crews remain for months at a time.²⁰ In one study, 3.8 percent of nuclear submarine crew members required psychiatric consultation. Eight percent of those referred were psychotic.²¹

The available data suggest that, if anything, there has been an increased incidence of psychiatric disorders during the past five years.²²

DRUG AND ALCOHOL USE IN THE US MILITARY

Drug use was not considered an important problem for nuclear weapons personnel until 1970.²³ A 1980 survey revealed that 27 percent of the respondents had used drugs within the last 30 days.²⁴ The 18–25 year old age group were most heavily involved.

A study in 1985 indicated a striking drop in the use of drugs, from the previously reported 27 percent to about 14 percent (table 2).²⁵ Furthermore, while early surveys showed comparable prevalence in the civilian and the military populations, current data indicate lower rates of use in the armed forces.²⁶

Table 1: Distribution of psychiatric diagnoses in the US Army 1980–1989^a

<i>Diagnosis</i>	<i>Total</i>
Alcoholic psychoses	1,033
Alcohol dependence	23,635
Drug psychoses	428
Drug dependence	1,602
Drug abuse	14,329
Schizophrenia	6,324
Other psychotic states	6,370
Neurotic disorders	4,919
Personality disorders	8,484
Mental disorders following organic brain damage	1,186
Other diagnoses	26,860
<i>Total</i>	<i>96,134</i>

a. Department of the Army 1985, 1990.

In the most recent study, nine percent of US military personnel reported using drugs in the last 12 months.²⁷ The most commonly used drug continues to be marijuana, followed by cocaine. The change in the military use of drugs is almost certainly attributable to the widespread use of urinalysis and to a strict "zero tolerance" policy instituted by the military in 1981.²⁸

The visible effects of drug use have also declined sharply (figure 1), with far fewer negative experiences in the military than in the civilian population (table 3).²⁹ In 1988, 1.8 percent of personnel reported "serious consequences" and 2.1 percent reported productivity loss during the last 12 months. For the three lowest pay grades (E1-E3) these figures are higher: 5 percent each.³⁰ Negative experiences from drug use included fighting, trouble on the job, unsafe driving, health problems, and trouble with the police.³¹

In contrast to the decrease in drug use, alcohol continues to be a major problem among military personnel.³² Military programs to reduce alcohol con-

Table 2: Percentage of the population aged 18-25 that used drugs in the past 30 days (1985)

	<i>Civilian</i>	<i>Military</i>
Marijuana	26.2	10.6
Cocaine	9.3	4.5
Psychotherapeutic	8.3	4.9
Any drug	29.0	13.7

Source: Bray et al., 1986, National Institute on Drug Abuse, 1988.

Table 3: Percentage of negative experiences after drug use in the past 12 months, aged 18-25 (1985)

<i>Civilian</i>	<i>Military</i>
30.9	5.6

Source: Bray et al., 1986, National Institute on Drug Abuse, 1988.

sumption—education, enforcement of rules against drunk driving, and regulation of the price and availability of alcohol on bases—appear to have had an effect.³³ Between 1980 and 1988, the average alcohol intake among military personnel declined by about 35 percent.³⁴ Nevertheless, alcohol dependence has remained relatively constant.³⁵ Furthermore, military personnel are more likely to drink and drink heavily than their civilian counterparts; in 1985 the military showed almost double the prevalence of heavy drinkers (defined as those who consume five or more drinks at a time at least once a week).³⁶

About 10 percent of military personnel report drinking *during* or *immediately before* work hours.³⁷ In 1988, 22.1 percent of military personnel reported lost productivity in the last 12 months as a result of alcohol use. Six percent reported alcohol dependence and nine percent reported other “serious consequences.”³⁸

Thus, while drug abuse remains an important problem in the military, its prevalence has gone down considerably. Alcohol use, however, is an intractable

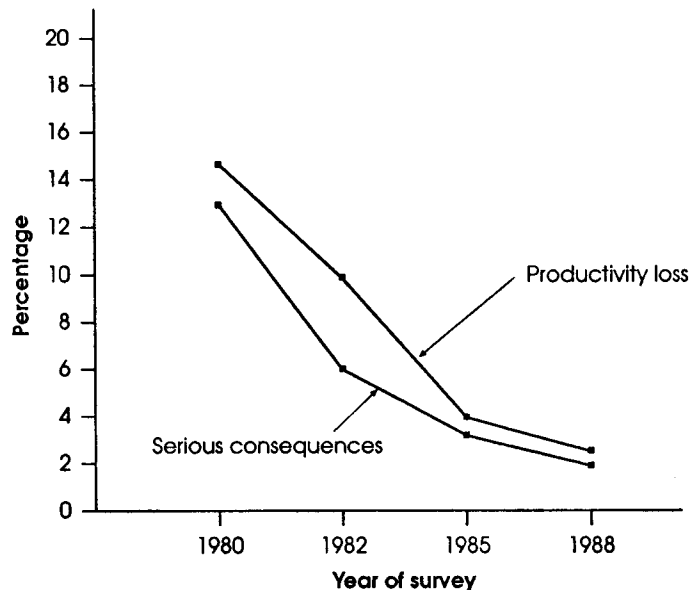


Figure 1: Negative effects of drug use: total DoD, 1980–1988. In 1980, 13–15 percent of all military personnel reported negative effects of drug use. By 1988, this figure had declined to less than 4 percent. Source: Bray et al.³³

problem; it seems unlikely to yield to the kinds of measures employed to diminish drug use in the military.

THE PERSONNEL RELIABILITY PROGRAM (PRP)

Inevitably, then, some individuals assigned to nuclear weapon duties are unstable. The PRP is supposed to weed them out during the screening process, or decertify and reassign them if the problem is detected later. The initial screening procedure includes a background investigation, security clearance, medical evaluation, review of the candidate's personnel files, and a personal interview advising the individual as to the nature of the PRP.

The reasons for decertification are:

- ◆ alcohol abuse
- ◆ drug abuse
- ◆ negligence or delinquency in performance of duty
- ◆ court martial, serious civil convictions or behavior indicative of contemptuous attitude towards law and authority
- ◆ aberrant behavior: mental, physical or character traits that would lead to unreliable performance
- ◆ poor attitude or lack of motivation.³⁹

The strengths and weaknesses of the Personnel Reliability Program have been analyzed in detail.⁴⁰ In the past five years, a number of changes have been made, among them:

- (i) Closer monitoring. If an individual is transferred to a new PRP position under the oversight of a new certifying official, he must undergo a new interview, similar to the initial one. If medical and personnel records are moved to a new location, they must be re-screened.⁴¹
- (ii) Definition of scope. As in the past, the PRP is applicable to all personnel responsible for operations of nuclear weapons.⁴² It is now described, however, as "a peacetime program...adherence to PRP procedures during war-

time may be impractical...."⁴³ This addition makes clear that in wartime or crisis, nuclear weapons might come under the control of individuals who had never been screened or monitored by the PRP.

(iii) **Disqualification.** It has become easier to disaffiliate personnel for aberrant behavior. The certifying official can now determine whether the behavior requires disqualification, without substantiation by "competent medical authority," as previously required.⁴⁴

(iv) **Exclusion of immigrant aliens.** Controlled and critical positions must now be filled by US citizens or US nationals.⁴⁵

A number of recommendations for improving the PRP⁴⁶ have not yet been implemented. These include:

- ◆ Requiring a physician to examine all candidates, without exception
- ◆ Informing the physician of the nature of the candidate's work
- ◆ Including an interview designed to assess the candidate's emotional stability
- ◆ Utilizing standardized psychological testing
- ◆ More systematic monitoring.

Largely as a result of the Bangor incidents, PRP policies are currently under review at several levels in the US armed forces. Officials from the Department of Defense, the Joint Chiefs of Staff, the National Security Agency and the branches of the military recently met to consider updating and revising procedures.⁴⁷ While improvements are both desirable and feasible, it seems unlikely that these reviews will result in fundamental changes.

During the period from 1975 through 1984, 51,000 personnel—4.5 percent per year on average—were decertified from the PRP.⁴⁸ Analysis of the corresponding data through 1989 demonstrates both a sharp decrease in the number of individuals in the PRP, and a simultaneous drop in the numbers and percentage decertified from the program (figure 2, table 4). The large drop in number of PRP personnel, from 119,625 in 1975 to 66,510 in 1990, is probably attributable to the reduction in number of weapons and the consolidation of

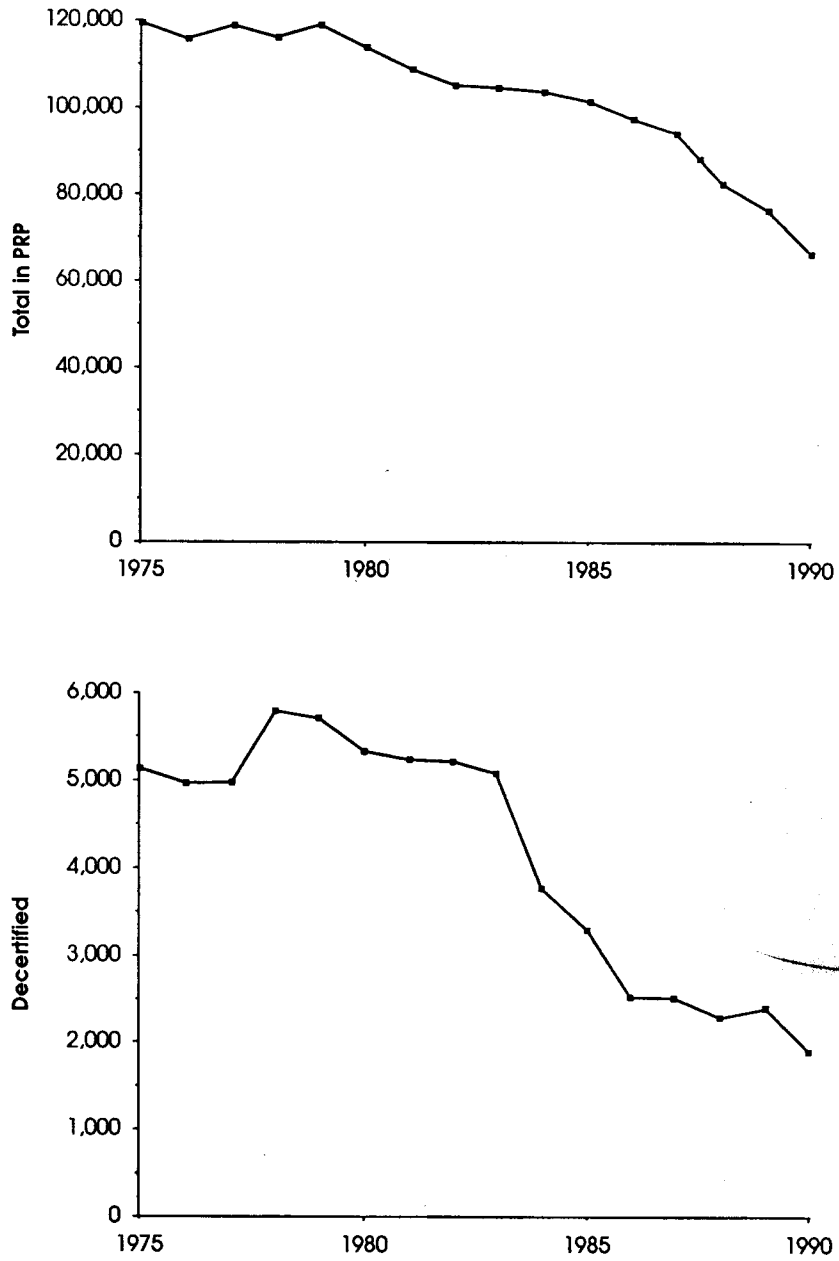


Figure 2: Total in PRP and total decertified

Table 4: PRP totals and decertifications 1975–1990

	<i>Totals</i>	<i>Decertifications</i>	<i>Percent</i>
1975	119,625	5,128	4.3
1976	115,855	4,966	4.3
1977	118,988	4,973	4.2
1978	116,253	5,797	5.0
1979	119,198	5,712	4.8
1980	114,028	5,327	4.7
1981	109,025	5,235	4.8
1982	105,288	5,210	4.9
1983	104,772	5,085	4.9
1984	103,832	3,766	3.6
1985	101,598	3,293	3.2
1986	97,693	2,531	2.6
1987	94,321	2,524	2.7
1988	82,736	2,294	2.8
1989	76,588	2,392	3.1
1990	66,510	1,900	2.9

Source: US Department of Defense, OSD, "Annual Disqualification Report, Nuclear Weapon Personnel Reliability Program," RCS DD-COMP (A) 1403, calendar years ending 31 December 1975; 1976; 1977; DoD, OSD, "Annual Status Report, Nuclear Weapon Personnel Reliability Program," RCS DD-POL (A) 1403, years ending 31 December 1978; 1979; 1980; 1981; 1982; 1983; 1984; 1985; 1986; 1987; 1988; 1989; 1990.

weapon storage sites, and to the increased use of automated security and surveillance systems (reducing the number of security guards needed).⁴⁹

The decertification rate has moved from a level of 4 to 5 percent during the period 1975 to 1983 to a current level of about 3 percent. This decline might be interpreted as a sign that the monitoring and enforcement processes have grown more lax, but there is no evidence to support this. Alternatively, it might suggest that the initial screening has improved. In fact, the most important factor in the decline appears to have been the introduction of drug testing and "zero tolerance" in 1981. Both the number of individuals and the percentage decertified because of alcohol abuse have increased, while the number and percentage related to drug abuse have gone down considerably. Meanwhile, the percentage caused by psychiatric or behavioral problems has increased slightly from about 24 percent in 1975 to 27 percent in 1990 (table 5).⁵⁰

Even though drug abuse in the military has diminished in recent years,

Table 5: PRP decertification numbers and percentages by reason 1975-1990

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Total numbers	5,128	4,966	4,973	5,797	5,712	5,327	5,235	5,210	5,085	3,766	3,293	2,531	2,524	2,294	2,392	1,900
<i>Percentage breakdown</i>																
Alcohol abuse	3	4	5	7	8	11	13	12	12	15	15	16	16	17	15	18
Drug abuse	38	30	27	34	36	32	33	35	40	27	28	22	19	11	15	8
Negligence or delinquency	14	15	17	9	4	4	5	5	4	4	11	7	6	4	5	7
Court martial or civil conviction	7	8	7													
Behavior contemptuous towards the law ^a	14	19	18	13	13	13	11	12	12	15	10	18	19	20	18	18
Physical, mental character trait or aberration	24	25	26	24	22	18	20	17	14	17	17	16	17	21	20	27
Poor attitude ^b	-	-	-	14	17	21	20	19	18	22	19	22	22	27	26	23

a. The categories "court martial or civil conviction" and "behavior contemptuous towards the law" were combined.

b. Category not applied until 1978.

Source: US Department of Defense, OSD, "Annual Disqualification Report, Nuclear Weapon Personnel Reliability Program," RCS DD-COMP (A) 1403, calendar years ending 31 December 1975; 1976; 1977; DoD, OSD, "Annual Status Report, Nuclear Weapon Personnel Reliability Program," RCS DD-POL (A) 1403, years ending 31 December 1978; 1979; 1980; 1981; 1982; 1983; 1984; 1985; 1986; 1987; 1988; 1989; 1990.

over the entire period from 1975–1990, it was the largest single cause of decertification (30 percent) as compared to alcohol dependence (11 percent) (table 6).⁵¹ Most of the personnel investigated under PRP, and hence most disqualified, belonged to the air force. Data on the air force, the navy, and the army reveal trends that are quite similar, except for the lower incidence of drug abuse in the air force.^{52,53,54}

Despite the measurable decrease in disaffiliated personnel during the past six years, the 1990 decertification statistics indicate that there are still on average at least 1,900 unstable individuals in our nuclear weapons forces at any one time. Such personnel must be considered unpredictable in their behavior, especially during periods of heightened tension.

The available information on human reliability screening in other major nuclear powers is fragmentary but suggestive. It is summarized below.

THE SOVIET UNION

Although the Soviet military is obviously concerned about secure management of its nuclear weapons, their practices are difficult to assess.

Table 6: Summary of PRP decertifications 1975–1990

	<i>Total</i>	<i>percent</i>
Alcohol abuse	6,919	11
Drug abuse	19,863	30
Negligence	5,146	8
Court martial	10,660	16
Traits	13,413	20
Attitude	10,132 ^a	15
<i>Total</i>	<i>66,503</i>	

a. Values are for 1978–1989

Source: DoD, OSD, "Annual Status Report, Nuclear Weapon Personnel Reliability Program," RCS DD-POL (A) 1403, years ending 31 December 1975; 1976; 1977; 1978; 1979; 1980; 1981; 1982; 1983; 1984; 1985; 1986; 1987; 1988; 1989; 1990.

The current instability in the Soviet Union has helped push the military into a period of great uncertainty.⁵⁵ Soviet officers and politicians now speak openly about deteriorating discipline among the troops.⁵⁶

Morale is poor, and the endemic problem of alcoholism in the civilian population is also reflected in the armed forces.⁵⁷ The Soviet officer corps and noncommissioned officers may account for more than three-quarters of alcoholics and heavy drinkers in the armed forces.⁵⁸

The anti-alcohol campaign initiated in 1985 has not reduced consumption measurably, but instead has stimulated a black market in alcohol. Soldiers now participate in biannual training sessions on the dangers of alcohol abuse. Personnel with drinking problems are subject to strict observation and treatment, and possible discharge from service.⁵⁹

Drug abuse was not considered a major issue in the past, but in the last several years its presence has been well documented. Drug addiction has become a problem, and drug-related crimes and medical emergencies are widespread.⁶⁰

Drug importation from abroad is a less important source of supply than the vast hemp and poppy growing territory that extends across Soviet central Asia and southern Russia. In Afghanistan hashish and opiates were readily available to many soldiers. The precise extent of drug use in the military has not been reported, but a survey in Georgia disclosed that drug addiction was present among soldiers as well as civilians.⁶¹

A written description of Soviet guidelines for ensuring nuclear personnel reliability is not available. Initial allocation to training programs is based on a review of a candidate's dossier, so that only intelligent recruits with "sound" political backgrounds have been designated for demanding duties such as the air force and strategic rocket forces.⁶²

Nuclear personnel are also selected for ethnicity. Russians, who comprise barely half of the Soviet population, occupy most of the sensitive nuclear weapon positions.⁶³

Screening and monitoring similar to the US PRP are probably in place for personnel assigned to nuclear weapon duty. There is certainly awareness of and concern about the psychological-physiological stress to which these personnel are subject. The importance of psychological testing in an era of complex military technology has been emphasized.⁶⁴ Data on disaffiliation

rates from the nuclear weapon corps have not been published or made accessible.

FRANCE

French military recruits undergo a variety of physical, mental, and psychiatric examinations upon enlistment, including written tests and interviews by psychologists or psychiatrists. These tests are designed to detect unstable personnel and to determine whether individuals are suitable for particular kinds of duty.⁶⁵

There is no evidence that a complete survey of drug use in the French military has been performed. In 1980, over 2,000 instances of drug abuse had come to the attention of the army health services, as compared with 880 in 1975⁶⁶ out of an army population of about 330,000.⁶⁷ Seventy percent of those identified are dismissed from the military. Others are apparently given professional counseling and may be suspended temporarily from duty.⁶⁸

Nuclear weapon personnel are further screened and monitored in an effort to ensure stability. They receive specialized training, after which they are subject to a security clearance investigation, a physical examination, and a written psychological test. They are re-examined twice a year.⁶⁹ Launch officers for land-based missiles (which are under the control of the strategic air force) are volunteers who possess good records, a minimum of four years experience, and the rank of at least senior lieutenant. For command positions and aviators, applicants must have high professional qualifications, and hold the rank of senior captain or major.⁷⁰ Nuclear submarine personnel are selected on the basis of mental, psychological and physical criteria designed to determine their capacity to serve in a stressful environment.⁷¹

BRITAIN

Britain does not employ any special screening of nuclear weapon personnel beyond the normal procedures used to determine fitness for service in the armed forces.⁷² In response to a perceived increase in drug abuse, the British army introduced urinalysis for those suspected of drug use in 1986.⁷³ Officials estimate that one third of the 30,000 annual recruits have used drugs before

entering the service,⁷⁴ but there are no comprehensive surveys of incidence.

Alcohol abuse affects all ages and ranks. The military has instituted preventive education programs and alcohol treatment units,⁷⁵ but is still ambivalent on the subject, which is reflected by the availability and widespread use of alcohol.⁷⁶

Clearly, both drugs and alcohol take their toll. In the period 1971–1983, seventeen service members died from abuse of volatile substances such as glues and fuels.⁷⁷ Between 1968 and 1977, at least 203 off-duty soldiers and 11 on-duty soldiers died in alcohol-related incidents.⁷⁸ If the British take steps to control or measure the extent of such incidents among nuclear weapon personnel, they have not made this information public.

CHINA

The Chinese military is concerned with the political reliability of all its recruits, and especially so for nuclear weapon personnel. For positions not requiring a great deal of technical skill, this goal can be furthered somewhat by recruiting preferentially from the more politically orthodox rural population. Officials examine the background and record of an individual before assigning him to sensitive duties.⁷⁹ Neither drug addiction nor alcoholism appears to be a significant problem in the military.⁸⁰ While there is no evidence that China possesses PALs,⁸¹ the government apparently feels there is little danger of a deranged individual making an unauthorized launch because missiles are not prearmed with warheads. Carrying out a launch would require two hours of effort by a missile crew. Nevertheless, the wide dispersal of weapons, poor communications, lack of safeguards, and the potential political instability may well affect the future of the secure control of Chinese nuclear weapons.

SECURITY IMPLICATIONS OF SUBSTANCE ABUSE AND PSYCHIATRIC DISORDERS

What kind of security risk is posed by drug-related and psychiatric disorders?

Both the substance and the pattern of use determine the impact of drug and alcohol abuse. The more “social” drugs such as marijuana or alcohol gen-

erally slow reaction time and impair judgment. Harder drugs, such as LSD, heroin, or PCP, may cause more bizarre behavior. Because of the altered perceptions they produce, the hard drugs represent an important security concern. Excessive use of any substance may dangerously diminish reliability.

The risk may also depend on the level of the individual's responsibilities. Unreliable personnel in the nuclear release system, such as launch capsule officers for silo-based ICBMs, are a potential hazard. The checks and safeguards on them are tight: once the authorization code is sent, a total of four officers in two separate launch control capsules in the same squadron still need to decide individually to launch the ICBMs before they can be fired. When a launch has been ordered, any other capsule can send out an "inhibit" command.⁸² While the consequences of an unauthorized ICBM launch would be disastrous, the likelihood is low.

Perhaps the greatest threat to security has involved unstable individuals who have access to tactical and theater nuclear weapons. While short-range weapons can do less damage than strategic weapons, the controls over these weapons are also looser. During a crisis, such controls are apt to loosen even more as commanders issue release codes to personnel in order to avoid delay should the use of the weapons be ordered. The President's authority to use nuclear weapons "may be delegated to subordinate officers in the chain of command virtually without limitation."⁸³ This creates "unacceptable risks that irresponsible people or people who might panic in a crisis might obtain authorized power over their use."⁸⁴

Even mentally unstable individuals may be utilized for short-term duties by line commanders facing a personnel shortage. "While theoretically this should not occur, in reality it has happened and undoubtedly will in the future."⁸⁵ The ultimate determination of whether someone presents a human reliability risk lies with the line commander rather than with a physician or psychiatrist.

The possibility of one serviceman "running amuck at the controls" is far less significant than the problem of psychological disorders leading to reduced efficiency and reliability. In the belief that officers closest to the troops have the most comprehensive view of the drug problem, 167 military commanders in Europe, the US, and the Pacific were surveyed. Forty seven percent of the commanders recognized some lowering of combat readiness due to drugs.⁸⁶

A commander may lose necessary personnel if he employs enforcement measures strictly. He risks alienating his troops and lowering morale through frequent drug searches. Hence, he may prefer to tolerate drugs rather than enforce discipline. Many commanders felt that alcohol abuse imposed a greater challenge to readiness because senior officials were more likely to be involved.

Unreliable crew members on ballistic-missile submarines also present a security risk. Because the navy maintains no PALs on its SLBMs, the captain and several officers on board have the physical capability to launch a nuclear weapon without higher authorization. Given a determined submarine crew, the navy would have no way of stopping it from launching its missiles. PALs are also absent on aircraft carriers and other vessels that carry nuclear weapons.

It is not unstable Americans alone who may pose a threat: the other nuclear powers are also at risk. The British and the Chinese have no PALs on their nuclear weapons,⁸⁷ while the French apparently do.⁸⁸ The Soviet Union has electronic locks on its strategic weapons,⁸⁹ but it is not certain that tactical weapons are equipped with PALs.⁹⁰

In the not-so-distant future, the nuclear club may become an even larger and more diverse group. India, Israel, Pakistan, and South Africa* may have already joined. Several parties to the 1970 Nonproliferation Treaty (NPT) are thought to be working to develop a nuclear capability: Iraq, Iran, Libya, and North Korea. It is by no means clear that these countries will have permissive action links or the "two man rule" that help prevent unstable or fanatical personnel from initiating unauthorized launch. In general, safety and control lag behind offensive capability as new nuclear forces are created. In these countries, "command and control at the outset may be more capable for launching an attack than for effective control or restraint under crisis conditions."⁹¹

In 1979, documents discovered after the downfall of Idi Amin disclosed that he was recruiting help and expertise from terrorist groups in a plan to build nuclear bombs small enough to fit into suitcases, which could then be carried worldwide into Ugandan embassies by teams of diplomats.⁹² This

* South Africa signed the Nonproliferation Treaty in July 1991. However, as of this writing, verifying its declaration of its stockpile of unsafeguarded nuclear-weapon material has not yet been worked out.

apparent science-fiction plot, code-named "Operation Poker," was unlikely to be realized outside of Amin's mind, but it suggests the kind of nuclear risk-taking and adventurism that might occur with the spread of nuclear weapons.

In view of the resources needed to build a bomb, stealing or seizing one might be considered an attractive alternative. Previous breaches of security indicate how difficult protection may be. A reporter, posing as a fencing contractor, was able to enter two SAC nuclear weapon depots, where he was shown gaps and weaknesses in the security systems and methods for disabling alarms. He came within a stone's throw of four hydrogen bombs, guarded by only one man. He also obtained blueprints showing the layout of nuclear weapons compounds and the alert areas where B52s carrying nuclear weapons were parked.⁹³

Peace protesters in Europe and the United States have gained access to and tampered with Trident submarines, as well as MX, Pershing II, Cruise, Minuteman, and Trident II missile components.⁹⁴ Vehicles carrying cruise missiles in Britain and Pershing IIs in West Germany have been obstructed or interfered with, sometimes causing accidents.⁹⁵

Radical changes in leadership may occur in emerging nuclear powers. Among these states, only India and Israel have well-established traditions of constitutional succession. The coming governments in South Africa or Pakistan might well ascend to power through violent means. Political change or instability could also threaten US weapons stored abroad. Nuclear states in crisis also represent a potentially serious risk if changes in control of weapons are imminent.

Most recently, internal instability has threatened nuclear weapons in the Soviet Union itself. Stockpiles are located in dissident republics such as the Baltic states and Azerbaijan. As various republics attempt to break away, and the military itself faces deep internal divisions, centralized political control over nuclear weapons might become tenuous.⁹⁶

Concern about this issue has led the Soviets to begin evacuating nuclear weapons from potentially dangerous areas of Europe and border regions such as Baku, and moving them to storage bunkers in the Russian interior.⁹⁷ The transport of the weapons complicates the task of protecting them, and heightens the risk of ambush and the acquisition of weapons by unstable individuals or groups.

In large measure, the major nuclear powers have done their best to insure that stable personnel operate their nuclear weapons installations. They have also developed technologically advanced safeguards and control systems designed to guard against unauthorized launch.

Even with the best methods of screening for stability, the evidence is unequivocal that many unreliable individuals remain in the nuclear weapons corps. Safeguards have worked thus far, but numerous instances of false warnings and potential breakdown in the control systems have occurred.

In a period of turbulence in the USSR, the control over nuclear weapons may not remain so firmly in the hands of civilian leadership. Republics in the process of change within the USSR might reasonably lay claim to weapons housed within their territory. Reliability screening of nuclear weapon personnel may be short circuited in turbulent situations.

What is clearly called for is a full exchange of information among all nuclear and potential nuclear powers on personnel reliability screening systems. This should begin with a re-examination by each country of its own personnel safeguards, and a comprehensive analysis both of the methods and of their strengths and pitfalls. Once that is accomplished, an international conference designed to clarify the steps necessary to strengthen screening should be convened. In parallel, every possible effort should be undertaken to exchange information on physical and electronic safeguards against unauthorized launch. These measures would help ensure that all countries with nuclear weapons understand the need for redundant safeguards and for the utmost reliability in nuclear weapons forces, as well as the measures required to achieve these objectives.

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