A U.S. PERSPECTIVE ON CHERNOBYL

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In the United States, perspective of the April, 1986 Chernobyl disaster is still evolving as new information emerges and the Soviet Union's report to the International Atomic Energy Agency (IAEA) in August, 1986 is analyzed.[1] Our medical perspective is based on the 40-year history of radiation incidents worldwide and especially in the United States, which is maintained in a registry at the Radiation Emergency Assistance Center Training Site (REAC/TS) in Oak Ridge, Tennessee.[2]

REAC/TS REGISTRY

Until the Chernobyl disaster, only 284 radiation incidents had been recorded; these involved approximately 620 persons, 31 of whom had died from radiation-induced injuries (eight persons in the U.S.) (Figure 1). From the viewpoint of emergency medicine and traumatic surgery, this is a remarkably safe record, particularly when it is compared to that of emergencies and injuries not related to radiation exposures. Because of their rarity and bizarre nature, radiation injuries have been studied in great detail, and the medical records form a basis for training in the management of a radiation injury victim.[3] These records also serve as a benchmark from which to observe the medical aspects of the Chernobyl explosion and evaluate the adequacy of the medical response.[1] From the perspective of previous experience, we salute Soviet physicians for their extraordinary response that dwarfs all previous experiences in the medical management of radiation injury victims.

In the Chernobyl disaster, more than 135,000 persons were at risk of exposure to life-threatening levels of radiation. A remarkably engineered evacuation of this population prevented the medical consequences from becoming worse than they were. A rapid and efficient medical triage identified 203 persons whose radiation injuries required hospitalization among 24,000 who received significant radiation exposures according to accepted criteria in the United States. Figure 2 shows how the Chernobyl experience greatly expanded the numbers in our Registry, which now total 24,819 persons who received significant exposures. Among the 203 Chernobyl victims who required expert medical care and management, the record shows that 29 apparently died in hospitals in Kiev

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and Moscow from the effects of radiation exposure. Two other victims are not included because their deaths occurred from thermal burns and blast effects.

As shown in Figure 3, the Chernobyl experience requires addition of another type of radiation injury to the Injury Criteria of the REAC/TS registry. This type, called "combined injury," encompasses cases in which non-radiation-related trauma occurs simultaneously with total body irradiation. Among the Chernobyl victims, the Soviet report[1] suggests that skin burns may have complicated the clinical course of 45 of the 203 victims and contributed to the deaths of at least 23 of the 29 who died. The reported histories are still too incomplete to be certain that all of the skin burns were thermal in origin, but it appears that many of them were. Some were undoubtedly secondary to beta irradiation, which also may have been combined with thermal burns.

A growing amount of medical literature substantiates the clinical observation that thermal burns of an extent insufficient to be fatal can cause death when combined with nonlethal levels of total body irradiation.[4-7] More detailed case reports[1] are needed to determine the relative roles of the types of trauma in these deaths. Except for the two early lethal radiation injuries in Los Alamos in 1945 and 1948,[8] thermal injuries combined with radiation exposure rarely have been noted in the literature. Obviously we must assess the consequences of thermal and radiation burns combined with total body irradiation more closely.

There is a significant rise and fall in the number of radiation injury cases from local exposure to radioactive devices (Figure 4). This dramatic incidence contrasts with the rarity of criticality (reactor) and other types of total body radiation exposure injuries. Compared to other types of traumatic accidents, radiation injuries are rare events that seem to require a minimal degree of medical preparedness. The Chernobyl experience, however, is the rare event that belies that complacent concept, since it demonstrates the extent of medical preparedness that modern technology requires.

MEDICAL PREPAREDNESS

The Soviet medical response to the Chernobyl catastrophe was impressive and demonstrated an enviable level of radiobiologic competence. It also afforded the first opportunity to test the usefulness of bone marrow transplantation as lifesaving therapy for heavily irradiated patients under emergency conditions.[1,9] It underscored the immediate need for radiation health physics, dosimetry, and environmental and population monitoring, for which the United States is well prepared. Our unnerving perspective, however, indicates that the medical community in the United States is ill-prepared to carry out its important role in a Chernobyl-like emergency.

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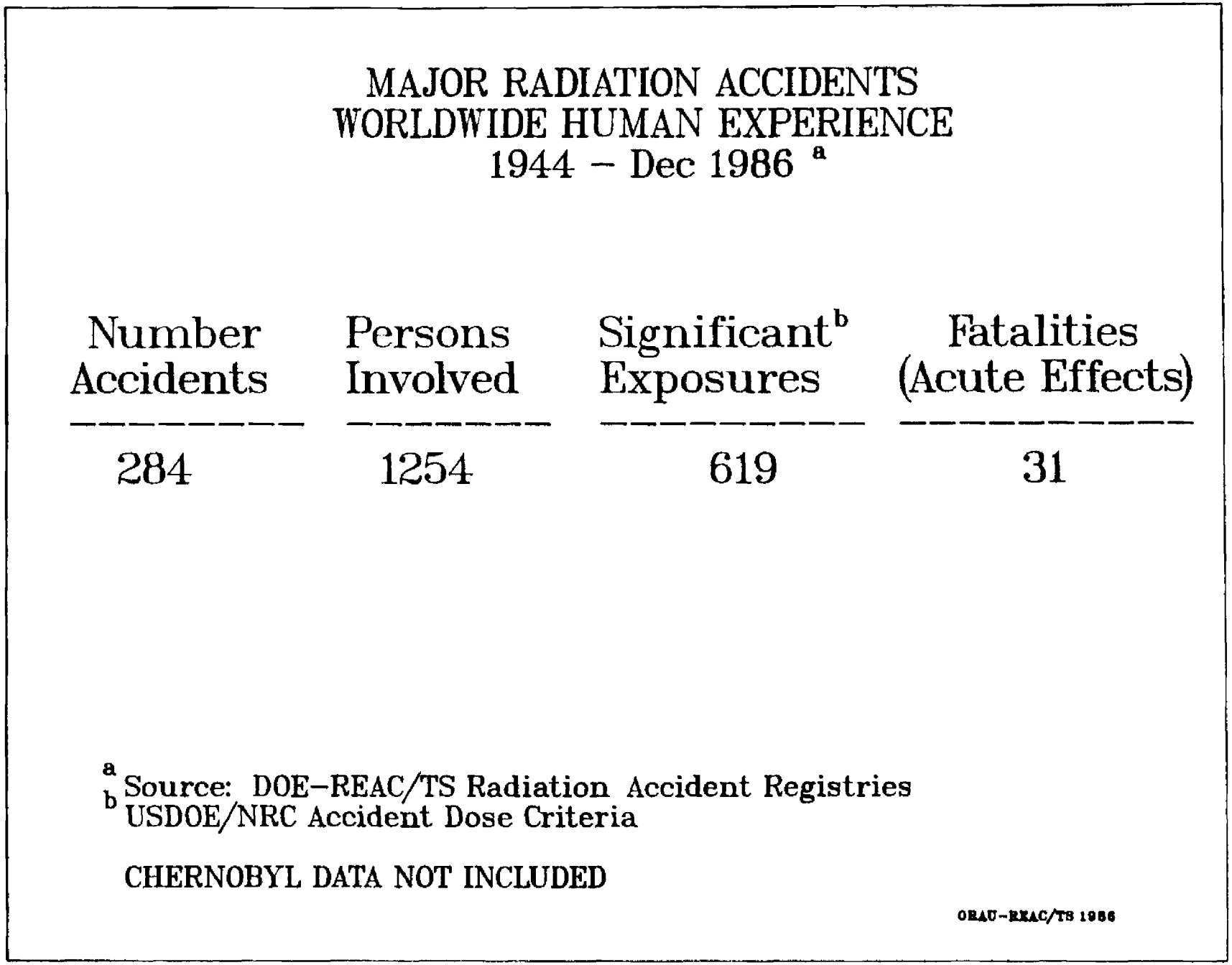

Figure 1. Pre-Chernobyl tabulation from 1944 to date (1986) in the REAC/TS Radiation Accident Registry of 284 accidents that involved approximately 620 persons of whom only 31 died of radiation effects.

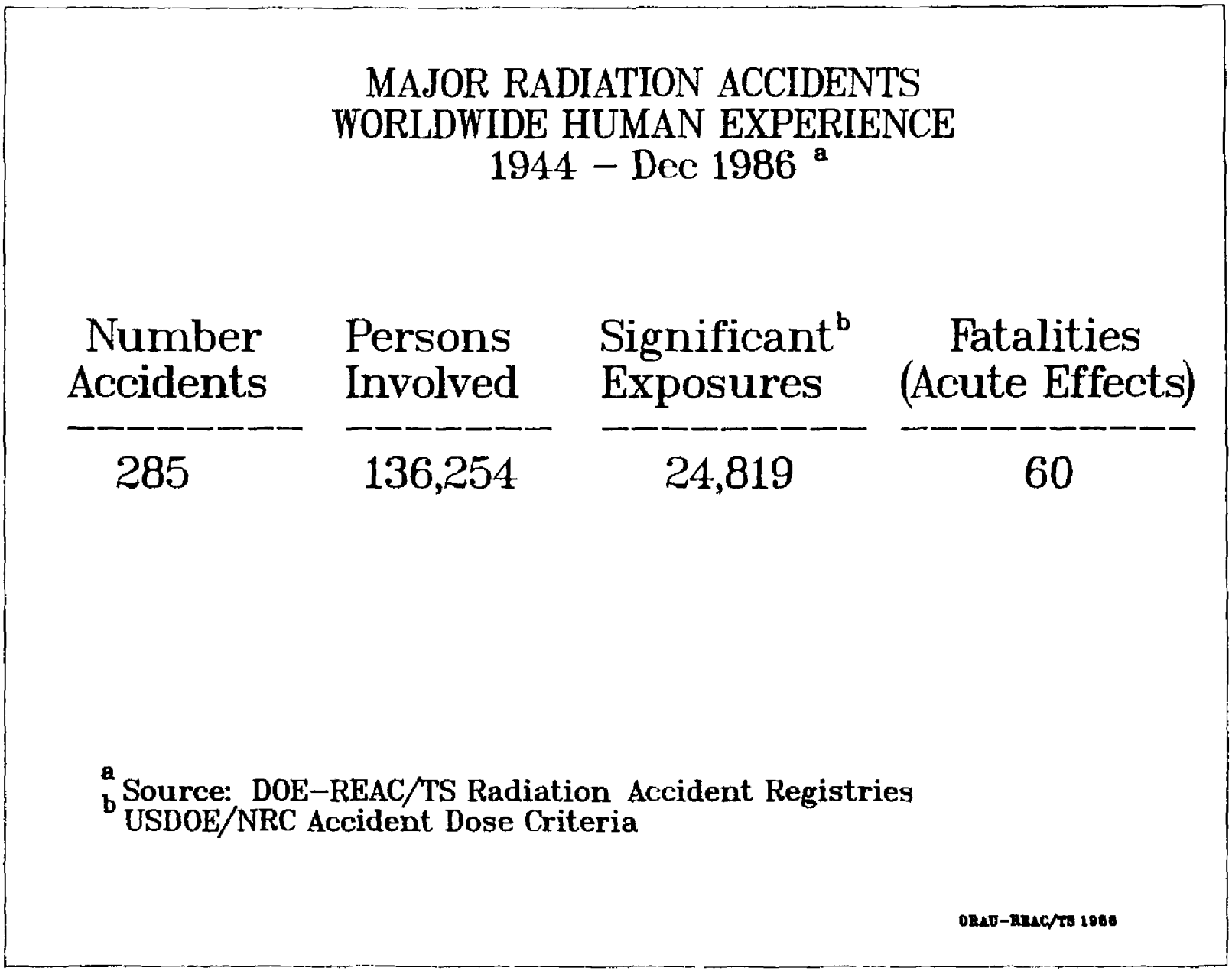

Figure 2. Post-Chernobyl totals of worldwide deaths in the REAC/TS Radiation Accident Registry show, in comparison with the data in Figure 1, that the single Chernobyl disaster greatly increased the number of radiation injury cases but only doubled the previous small number of radiation accident deaths from 31 to 60.

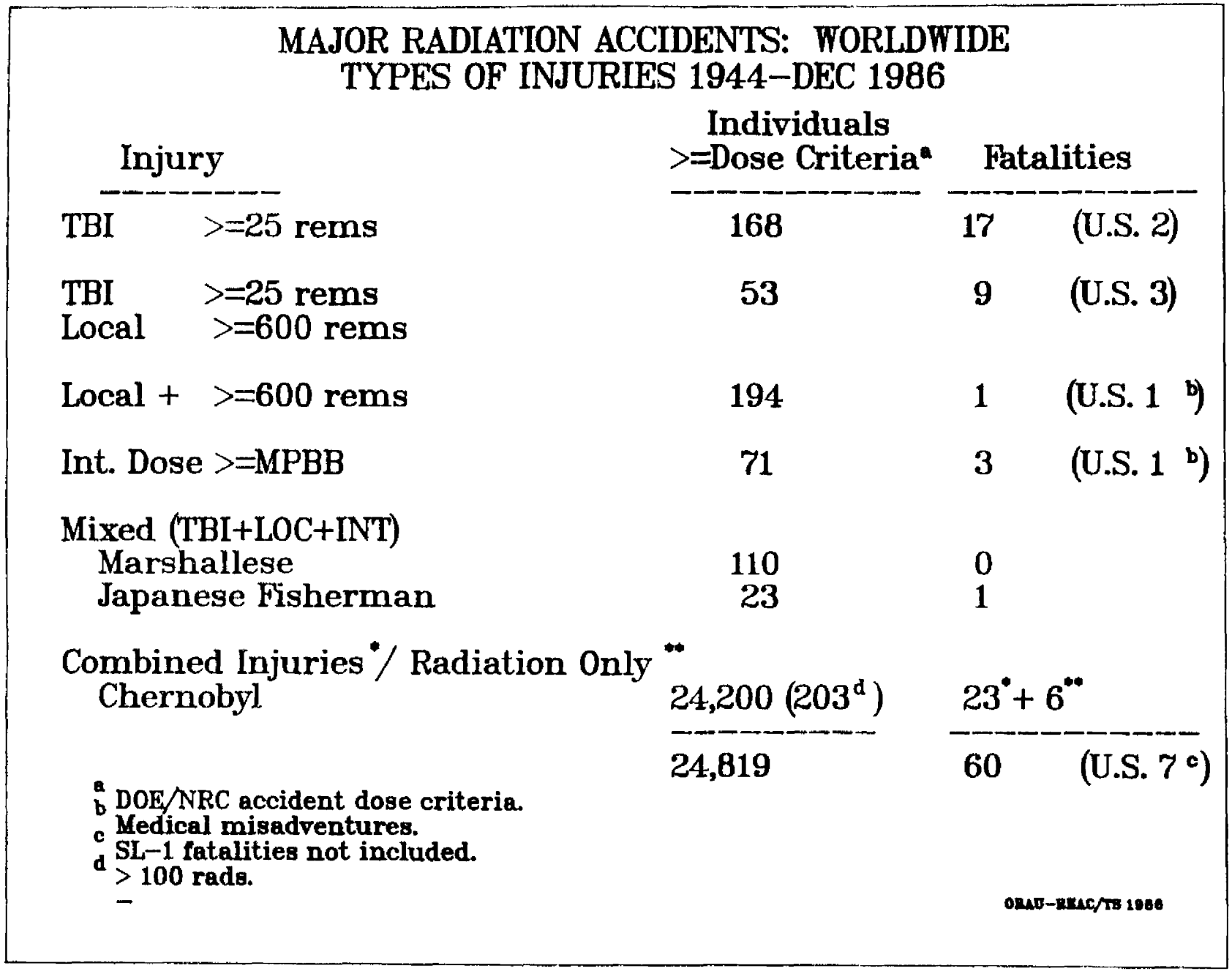

Figure 3. List of the types of radiation injuries and the dosage criteria that determine their inclusion in the REAC/TS Radiation Accident Registry

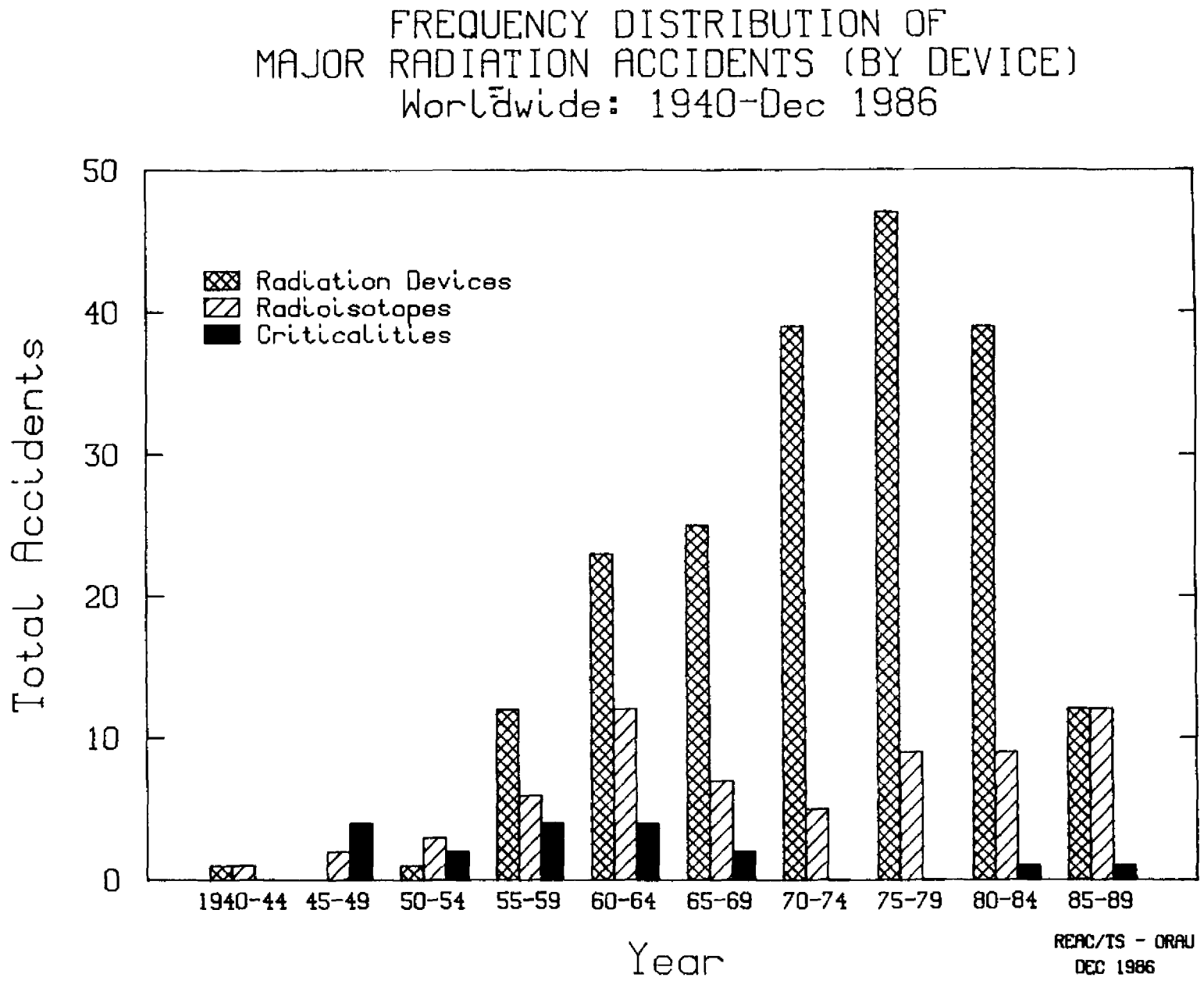

Figure 4. The temporal frequency distribution per five-year intervals since the advent of nuclear energy applications in 1940 shows a remarkable growth in those injuries where radiation devices caused serious local (skin) injuries. The advent of remote control and industrial automation before 1970 eliminated criticality accidents until the 1984 Argentinean and the 1986 Chernobyl disasters.