THE DEVELOPMENT OF THE AMERICAN NATIONAL STANDARD, "CONTROL OF RADIOACTIVE SURFACE CONTAMINATION ON MATERIALS, EQUIPMENT AND FACILITIES TO BE RELEASED FOR UNCONTROLLED USE."

Jacob Shapiro

Departments of Environmental Health and Safety, Harvard University Health Services, and Environmental Health Sciences, Harvard School of Public Health, Cambridge, MA, U.S.A.

In January, 1976, the Health Physics Society Standards Committee (HPSSC) submitted to the secretariat of the American National Standards Institute (ANSI) Committee N13 (Radiation Protection) the completed standard, "Control of Radioactive Surface Contamination on Materials, Equipment, and Facilities to be Released for Uncontrolled Use," with the recommendation that it be forwarded to the Board of Standards Review (BSR) of ANSI for final processing and publication.

CHRONOLOGY

This standard had gone through the many steps required in the development of a standard under ANSI. The first was the appointment of a chairman in September, 1971, with the charge to organize a subcommittee on surface contamination under HPSSC to develop the standard. The subcommittee held its first meeting in July, 1972 at the annual meeting of the Health Physics Society to discuss the approach to the standard. Four months later, the second meeting of the subcommittee was held at offices of the Atomic Energy Commission in Washington, D.C. The subcommittee first met with regulatory personnel of the AEC for an exchange of views and a review of their experience and policies on contamination control. This was followed by a session to prepare an outline for submission to ANSI as the first step in the development of an ANSI standard. The outline attempted to cover all the basic considerations in hazard evaluation and control of surface contamination and as a result was quite ambitious. Drafts prepared by the subcommittee members were reviewed at the third session during the annual meeting of the Health Physics Society in June, 1973, and led to a first draft of a standard one month later. This draft emphasized basic properties and data on surface contamination rather than specific conditions for release of contaminated equipment. It appeared to be of limited practical use and was rewritten as a performance standard. The approach was based in part on a position paper prepared by the Standards Committee of the Southern California Chapter of the Health Physics Society. The draft was submitted to ANSI N13 and N42 (Nuclear Instruments) for comment in September, 1973. The subcommittee continued to work on the standard during the same period, in particular on limits for surface contamination. It met at the Atomic Industrial Forum office in New York City in December, 1973 to consider the comments. The Atomic Industrial Forum at that time served as the secretariat for the development of standards under N13. Comments were reviewed

and voted upon, and those accepted were incorporated into the standard. All persons who submitted comments were informed of the subcommittee action and reasons. The revised standard was approved unanimously by the subcommittee, and sent to HPSSC in July, 1974 for transmittal to ANSI. That same month, HPSSC submitted the standard to ANSI N13 for letter ballot action. The standard was sent out by ANSI for letter ballot action in September, 1974. The returns included three negative ballots. Two of these were resolved by changes in the standard. The third, which was cast because the limits were felt to be too low, could not be resolved. All action on the balloting was completed by the end of 1975 and in January, 1976, the standard was sent by HPSSC to the ANSI N13 secretariat (which by that time had been transferred from the Atomic Industrial Forum to the Health Physics Society) with the request to send it to BSR for final processing. The voting action reported was 28 affirmative and 1 negative. Three committee members did not respond despite follow up.

The standard provided criteria for the release for uncontrolled use of materials, equipment and facilities contaminated or potentially contaminated with radioactivity. Permissible contamination limits were specified as well as methods for assessing the levels of contamination. While more precise phrasing was given in the standard, the limits applied essentially to the following categories of radionuclides.

GROUP	TOTAL dpm/100 cm^2	REMOVABLE dpm/100 cm^2
1. Long lived alpha emitters except natural uranium and thorium	100	20
2. More hazardous beta-gamma emitters	1000	200
3. Less hazardous beta-gamma emitters	5000	1000
4. Natural uranium and thorium	5000	1000

The condition for placing a radionuclide in Group 1 was that the nonoccupational maximum permissible concentration in air (MPC_{air}) applicable to continuous exposure of members of the public be 2×10^{-13} Ci/m^3 or less and the nonoccupational MPC_{water} be 2×10^{-7} Ci/m^3 or less. (There had been considerable discussion on whether to use 4×10^{-13} or 1×10^{-13} for the MPC_{air} and 2×10^{-13} was adopted as a compromise. The value chosen determined whether all, or only a portion of the more hazardous alpha emitters would be in Group 1.) The upper limits for Group 2 were 1×10^{-12} Ci/m^3 air and 1×10^{-6} Ci/m^3 water. Acceptable sources for MPC values were those published by ICRP, NCRP, or NRC. The standard specified that the levels could be averaged over 1 m^2 provided that the maximum activity in any area of 100 cm^2 was less than 3 times the limit value. The criteria for the standard put some beta emitters in Group 1 and ^{210}Po in Group 2, but otherwise, the breakdown was as shown above.

As the standard was being processed through the final stages prior to promulgation as an official standard, the chairman of N13 changed his ballot from affirmative to negative after concluding that the alpha limits were too low and not readily measurable with state of the art detectors. It was sent out for reballot to ANSI N13 in September, 1976. During this period, the limits were adopted in

Regulatory Guide 1.86 of the Nuclear Regulatory Commission and the standard was sent out to various laboratories of the Energy Research and Development Administration (ERDA) for implementation on a "trial and use" basis. In April, 1977 ANSI N13 transmitted the standard to BSR with a report of 20 affirmative votes, 3 negative votes, and 4 unreturned ballots. This was followed by a period of public review and comment which ended in August, 1977. Because of the unresolved negative votes, HPSSC requested that it be issued as a Draft Standard for a one year trial and use period. This period began in January, 1979. The limit of 100 dpm/100 cm^2 for the most hazardous group of alpha emitters was changed in the Draft Standard to "non detectable," with an accompanying footnote stating that the instrument utilized for the measurement was to be calibrated to measure 100 pCi of any Group 1 contaminants uniformly spread over 100 cm^2. The total activity limit for Group 2 beta or gamma emitters was also changed to read "non detectable" with an accompanying footnote that the instrument used for the measurement was to be calibrated to measure 1 nCi of any group of beta or gamma contaminant uniformly spread over an area equal to the sensitive area of the detector. The limits for removeable contamination were unchanged. The change in the wording addressed the concerns of those who did not want to have to account for a specific limit which they felt could not be measured accurately.

COMMITTEE DELIBERATIONS

At its first meeting in 1972, the subcommittee made plans to produce a standard that would serve as a source document rather than simply as a control document. As such, it would provide basic information on the nature of contamination, transport through the environment, and resultant doses. The standard would also deal with the determination of the contamination potential from both the history of use and the interpretation of monitoring results; criteria for release, test instrumentation and procedures; and decontamination methods. Other proposed sections were cost-benefit analyses and an annotated bibliography. The result would be an authoritative treatment of exposure risks associated with given types of surface contamination that would provide regulatory agencies with the guidance needed to set numerical limits for contamination levels in specific cases. Additional views on the features of a standard were obtained from representatives of regulatory agencies. Numbers proposed for contamination limits should be related to dose; the relationship could be based on experience factors. Healy's "decision level" approach was recomended for consideration. The need to keep levels as low as reasonably achievable(ALARA) should be incorporated. Did ALARA require some decontamination in all cases where contamination was found, or only at levels which were above the limits? It was possible that the requirements of industry, such as the photographic industry, could be limiting rather than the hazard to people. Should the levels depend on the number of people at risk? The standard should be readily incorporated into normal practice by industry. It should develop as a consensus rather than as a decree. Survey techniques presented should be adequate and clear. But how specific should the standard be? Should the number of measurements, or wipes be specified? Was it really desireable to present numerical limits?

Shouldn't one rather rely on best decontamination practice as shown by experience? The committee was advised to take a fresh look at setting limits without being influenced by the old numbers and to also determine what was as low as practicable.

It was obvious that the initial goals required a much greater effort than the committee could undertake. Also, the highly technical nature of the proposed approach to contamination evaluation would turn every case into a research project. In the end, the committee came to the conclusion that a workable standard had to be a performance standard. It was not possible to present a truly representative contamination level-dose curve. The standard would have to present specific limits and test procedures that could allow for uniform survey techniques. Technical analyses could be presented as a backup but not as a substitute for limits.

The following considerations were the basis for the preparation of the standard:

(1)The relative hazards of surface contamination produced by different radionuclides were given by the MPC's in air and water.

(2)For practical purposes, radionuclides were assigned to a small number of groups with given contamination limits, but this did not preclude the use of a graded scale based on the MPC's in air and water.

(3)A contamination reference level of 1000 dpm/100 cm^2 for ^{90}Sr was set as the basis of assigning limits to radionuclides presenting an ingestion hazard and other radionuclides were grouped based on the values of their MPC_{water} relative to ^{90}Sr.

(4)The contamination limit for ^{239}Pu was chosen as the basis for assigning limits based on MPC_{air} to radionuclides presenting an inhalation hazard. Values of 100 and 200 dpm/100 cm^2 were considered and 100 was adopted in the standard.

(5)An upper limit to surface contamination (i.e. the limit for the least hazardous group) was set on the basis of practicability of achievement and control rather than on MPC. Values of 2000-10000 dpm/100 cm^2 were considered, and a value of 5000 selected for the standard.

(6)Values of maximum scanning speeds for survey instruments were specified to provide the needed detection sensitivity. However, when contamination was detected, survey instruments had to be held stationary when recording readings.

Suggested values for removeable contamination varied between 10 and 20 percent of the total level. A value of 20 percent was adopted in the standard.

The current trial use of the standard should result in useful comments and documentation on the practicability of cleaning equipment to the limits in the standard, and on detecting those limits. It should be noted that the promulgation of the standard does not preclude release at levels above the limits. However, appropriate controls and restrictions would have to be observed until and if the limits in the standard could be satisfied.