RADIATION PROTECTION STANDARDS IN THE UNITED STATES

Mills, W.A.; Arsenault, F.J.; and Conti, E.F.
Oak Ridge Associated Universities

Standards to protect workers and members of the general public against any harmful effects of ionizing radiation are numerous and complex in the United States. Many Federal agencies have protection responsibilities, our Congress limits the discretionary authority given to these agencies in providing for this protection, and our court system appears at times to render judgments that are illogical to our sense of the degree of radiological protection required. To many our standards appear to be overprotective in that they have, at best, marginal health benefits and without question are costly to implement. Government agencies, the Congress, industry, professional organizations, and others have expressed their concerns and interests regarding standards in a variety of ways:

* Need for consistent radiation policies;
* Need for mutually consistent and coordinated radiation regulations and standards, particularly those involving multiple agencies and jurisdictions;
* Establishment of radiation levels below regulatory concern (de minimis);
* Coordination of U. S. policies and positions on radiation issues at international meetings;
* Clarification of an ALARA policy;
* Need for scientifically-based standards;
* Examination of "umbrella" dose limits, dose commitment methodology, collective dose application, etc.; and
* Introduction of a risk-based standard system, standardizing risk estimation techniques and approaches to risk comparability.

It is against this background that the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) undertook a project to enhance its knowledge and understanding of the principle standards in the United States that limit and control radiation exposures. CIRRPC is a committee of eighteen Federal agencies, represented by senior policy makers, and complemented by a Science Panel whose membership is senior radiation scientists from fourteen of the member agencies of the policy body. Oak Ridge Associated Universities provides the necessary administrative and technical support to CIRRPC and was tasked to develop a compendium of U.S. radiation protection standards that would include the major legal and technical facts or requirements contained therein.

Fact Sheets (FS) have been developed for twenty-three "standards" (generally enforceable regulations or Federal guidance approved by the President) and two proposed revisions to existing regulations-NRC's 10CFR20 and DoL/MSHA's 30CFR57, NRC's basic protection standard and DoL's underground mining standard, respectively. Of these twenty-three standards, nine are in the form of guides and fourteen are enforceable standards. Seven enforceable standards have been promulgated by the U. S. Environmental Protection Agency (EPA), four by the Nuclear Regulatory Commission (NRC), two by the Department of Labor (DoL), and one by the Food and Drug Administration (FDA). Five of the seven Federal Guides, presently in-effect and Presidentially-approved, were promulgated by the former U. S. Federal Radiation Council (FRC) and the remaining two by the EPA Administrator, who was given the responsibility to "advise the President on radiation matters directly or indirectly affecting health" in 1970.

Selection of a "standard" to be in the compilation required that it be (i) published in the U. S. government's Federal Register as a proposed or final "standard"; (ii) provide basic public health protection requirements, i.e. not implementing requirements; and (iii) not be limited to controlling exposures within the agency promulgating the standard. This latter criterium excludes, for example, those requirements published as "orders" by the Department of Energy (DoE) that control exposures in facilities owned by them. It is noted, however, that intraagency requirements are expected to be in accord with Federal guidance, such as that published by the FRC in 1960 which places limits on population exposure and that published by EPA in 1987 which provides the basic protection requirements for occupational radiation protection.

The following information is addressed in each Fact Sheet:

* Short and full title;
* Authorizing statute: purpose and radiation protection provisions;
* Responsible agency(s);
* Description of standard: effective dates and background, general radiation provisions, rationale for detailed requirements, description of detailed requirements;
* Related standards.

Exposure concerns addressed by a specific standard or by multiple standards are:

* Occupational and general population;
* Occupational;
* Radon in underground mines;
* Levels of certain internal emitters in the environment, including TRU nuclides;
* Protective action guides for certain radionuclides;
* Specific standards to control air emissions;
* At-the-tap drinking water;

* Uranium fuel cycle, excepting mines and Rn from uranium mill operations;
* U and Th mill tailings: active and inactive;
* Mining effluents and underground injections;
* High-level and TRU waste operations and disposal;
* Ocean dumping;
* Low-level waste;
* ALARA design for commercial light-water reactors;
* Electronic consumer products: TV receivers, x-ray diagnostic and security systems.

Review of the Fact Sheets shows no clear intent to be consistent in either the statutory language or the explicit or implicit protection objective of the standard. For example, while the Atomic Energy Act, under which most of the EPA and NRC standards are established, leaves to the regulatory agencies the manner in which the objective is achieved to "protect health or minimize danger to life or property", the Clean Air Act and the Safe Drinking Water Act administered by EPA requires them to set limits that would avoid "any adverse effect on the health of persons" and "with an ample margin of safety." As a result of the wide interpretation of these "instructions" to agencies, agencies use an equally wide range of rationales in developing and promulgating standards. Control technology capabilities and cost (ALARA) may or may not be a consideration; current emission levels may be the basis; or a level of health risk expressed as annual or lifetime risk may be the operative criterium. Overall ALARA and non-degradation appear to be the principle criteria for protecting members of the general public and a level of lifetime risk no greater than that found in other industries for workers.

"Standards" are of the "umbrella" (general) form, such as an annual population limit for all sources of 5 mSv [0.5 rem] in the proposed revision of 10CFR20, or very source specific, such as ca. 0.7 Bq/m(2)-s [20pCi/m(2)-s] limiting radon emission from a disposal site for uranium mill tailings. The standards may be expressed in a variety of ways: activity per unit volume or mass, dose equivalent or effective dose equivalent, exposure or emission rate, total activity released over a period of time (e.g. 10,000 years), or activity per unit of annual electrical power produced. Standards to control exposures in the work place are near identical, limiting the workers annual exposure to 50 mSv [5 rem]. However, numerical limits for the general public are highly variable and in some instances quite low, for example, the limit for beta particle and photon emitters in drinking water is 0.04 mSv [4 mrem] per year.

Details of the information contained in the Fact Sheets and how the information might be used in examining standards applicable to a specific source can be illustrated by comparing standards related to controlling the environmental releases from commercial light-water nuclear reactors licensed by the U.S.N.R.C.

Shown below are the whole body dose equivalent limits for members of the general public. Not shown are the specific requirements in the actual operating license that controls the emissions from a given nuclear power plant. These requirements are stated in the plants Technical Specifications and together with the operators' actual procedures further control emissions.

Designation	Rationale	Whole Body Annual Limit
Federal Guidance (FRC#1) (1960)	No "undue hazard"	5 mSv
NRC's 10CFR20 (1960)	No "observable health effects, ample margin of safety	5 mSv
EPA's 40CFR190 (1977)	Cost control/ risk reduction ratio	0.25 mSv
NRC's 10CFR50, App. I (1975)	ALARA:Design and operation	0.03 mSv liquid 0.05 mSv air

The compendium of radiation standards provide CIRRPC with the data base necessary for a more detailed evaluation of U. S. standards and vital information useful to its policy coordination responsibilities.