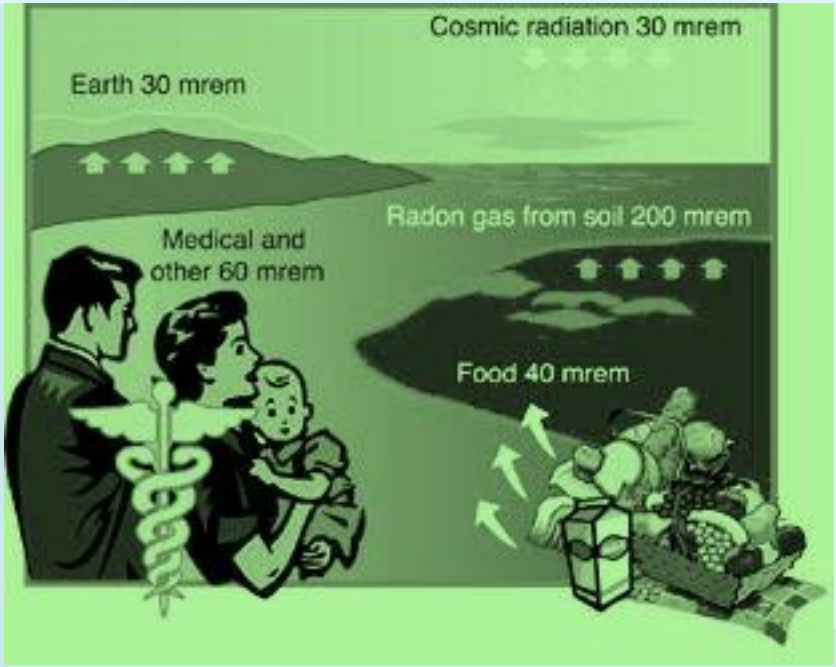
Using Today's Reactors for Tomorrow's Renaissance

Eric P. Loewen, PhD
President
American Nuclear Society

2011 TRTR Annual Meeting
Idaho Falls, ID

September 15, 2011

Michelle Blanchard, Associate Director
Photo by: Michael Forster Rothbart



GREEN

YELLOW

RED

WHAT IS ALARA?
J.A. Auxier and H.W. Dickson

To be presented at Edison Electric Institute's Health Physics Committee Meeting, September 10, 1981, Hartford, Connecticut.

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MASTER

WHAT IS ALARA?

J. A. Auxier

H. W. Dickson

Industrial Safety and Applied Health Physics Division
Oak Ridge National Laboratory*
Oak Ridge, Tennessee 37830

Nuclear energy: *Not* a Faustian bargain, but a near-perfect providential gift

BY THEODORE ROCKWELL

A nuclear veteran encourages those in the industry to get serious and put nuclear energy in the positive light it deserves.

THE 33RD ANNUAL World Nuclear Association (WNA) Symposium, held September 3–5, 2008, in London, attracted a record-breaking 800 participants to the gleaming, modern Queen Elizabeth II Conference Center, with its huge picture windows facing its neighbor, the venerable Westminster Abbey.

On September 4, WNA Chairman Andrew White, president and chief executive officer of GE-Hitachi Nuclear Energy, and WNA Director General John Ritch, former ambassador to the International Atomic Energy Agency, bestowed awards on three people chosen to represent the educators, the innovators, and the pioneers of the international nuclear enterprise. The awardees were, respectively, Alan Waltar, of Pacific Northwest National Laboratory and former head of the Nuclear Engineering Department at Texas A&M University; Jacques Bouchard, of the Commissariat à l'Énergie Atomique, and head of the Generation IV International Forum; and me, Theodore Rockwell, of Radiation, Science & Health and MPR Associates. (See page 50, this issue.)

Mingling with the crowd of international nuclear professionals for three days gave me a chance to escape from the U.S.-centered bubble for a moment and get a wider view of the nuclear world. In the WNA and the associated World Nuclear University, John Ritch has built up two new substantive organizations and gotten important people involved, from inside and outside the corporate world. This creates arenas in which basic nuclear issues can be addressed, transcending the national institutions and technical "islands" in which many of these issues are bogged down. We have not yet taken full advantage of this situation.

Other countries now seem to be more urgently intent than the United States on building nuclear plants, which is good, especially when they speak with greater governmental authority. But they seem even more obsessed than the United States is with making nuclear "safer and safer." What's wrong with that? Can a plant be "too safe"? How do we know what's "safe enough"?

First, let me note that in the real world, no member of the public has ever been killed or seriously injured—or even exposed to a serious health threat—by a nuclear power plant or its fuel or waste.[1] So, what excuse is there for deciding that all sorts of extreme safety provisions must be applied to nuclear facilities that would never be considered for non-nuclear facilities, even those where lethal accidents have occurred and continue to occur?

That important policy decision is seldom acknowledged, and yet it is crucial to the future of nuclear. What became apparent from discussions in London is that the nuclear community seems bent on making its product ever more esoteric—kind of a fantasyland, where 200 years of mundane engineering experience and judgment seem out of place. In the 1970s, New Age gurus from Baba Ram Dass to Margaret Mead told young people that their elders had not experienced the coming age, did not understand it, and therefore could not advise them on how to live in it. Experience in the dying age was declared inapplicable to the New World.

At the same time, nuclear gurus were applying the same philosophy to the Nuclear Age. Alvin Weinberg, longtime senior spokesman from Oak Ridge, did not invent this idea, but in 1971 he approvingly characterized nuclear energy as a "Faustian bargain"—a miraculous gift, but with the devil to pay if we slip up.[2] I was in Oak Ridge not long before he died, and when he heard I was there, he asked me to come to his house. He urged me to carry that message onward. "You people in Admiral Rickover's group understand the absolute necessity for unprecedented excellence. To keep nuclear technology from slipping inexorably into mediocrity, we need to keep the Faustian threat alive." I told him I agreed fully with the

Theodore Rockwell (<tedrock@olarpower.net>) is the author or coauthor of five books on nuclear technology, including The Rickover Effect *and* Creating the New World. *His latest book is a work of speculative technological fiction titled* The Virtual Librarian.

[1] The Chernobyl incident in 1986 is only peripherally relevant to this question. It did not kill or seriously injure anyone *outside the plant*, with the possible exception of the 10 or 12 children with thyroid nodules, whose deaths could have been prevented. But more relevant is the fact that the type of accident that occurred there is not physically possible in the types of reactors being considered for the large-scale construction of new nuclear plants.

[2] Discussed in detail in Weinberg, Alvin M., *The First Nuclear Era: The Life and Times of a Technological Fixer*, published by Springer, 1994. Weinberg first discussed this analogy with his laboratory people in 1970, then "went public" in 1971, a date that he usually used in referencing it.

Ted Rockwell

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Historical Origins of ALARA

U. S. Department of Commerce • Sinclair Weeks, Secretary
National Bureau of Standards • A. V. Astin, Director

Permissible Dose From External Sources of Ionizing Radiation

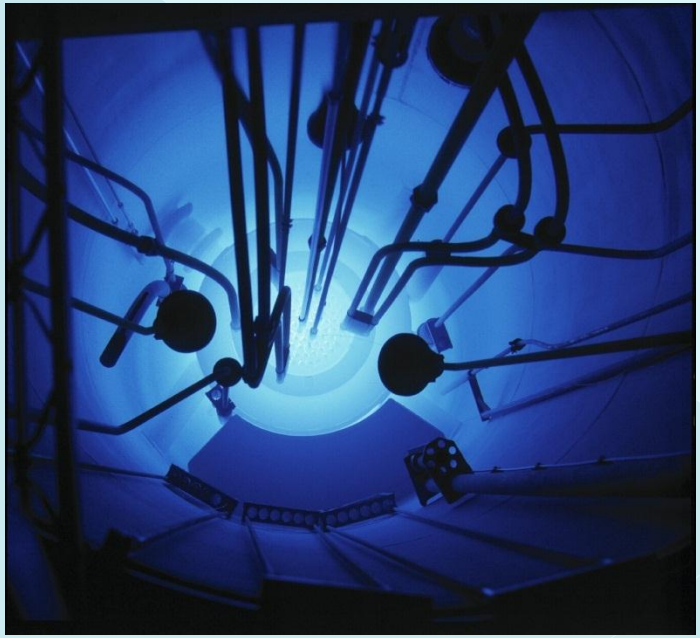
Recommendations of the
National Committee on Radiation Protection

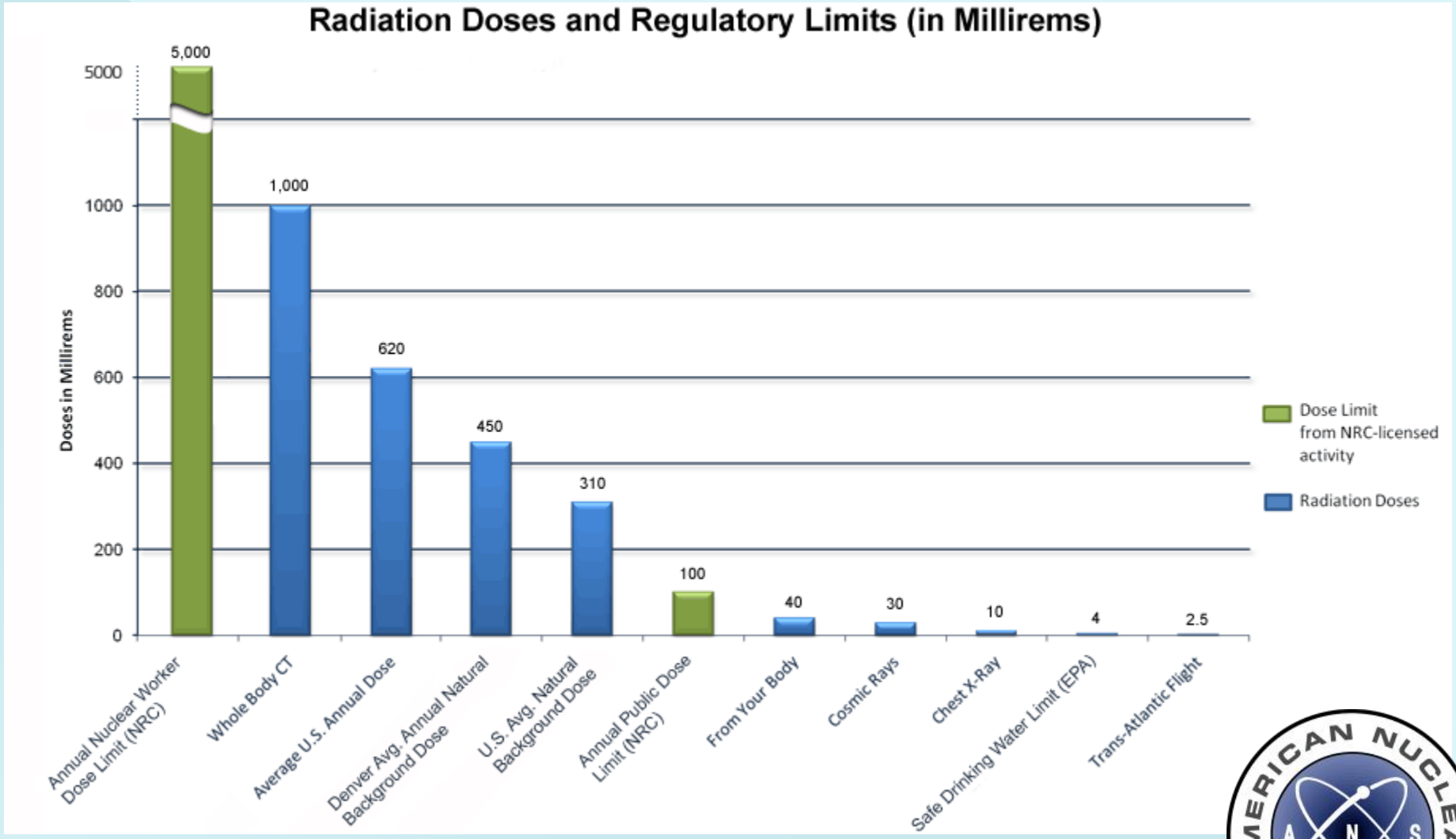
National Bureau of Standards Handbook 59
Issued September 24, 1954

For sale by the Superintendent of Documents, Washington 25, D. C. - Price 35 cents

In 1977 ALARA Became Law

General Discussion




Radiation Doses and Regulatory Limits (in Millirems)
Doses in Millirems
5000
1000
800
600
400
200
0
5,000
1,000
620
450
310
100
40
30
10
4
2.5
Annual Nuclear Worker Dose Limit (NRC)
Whole Body CT
Average U.S. Annual Dose
Denver Avg. Annual Natural Background Dose
U.S. Avg. Natural Background Dose
Annual Public Dose Limit (NRC)
From Your Body
Cosmic Rays
Chest X-Ray
Safe Drinking Water Limit (EPA)
Trans-Atlantic Flight
Dose Limit from NRC-licensed activity
Radiation Doses

A.L.A.R.A.

As Low As Reasonably Achievable

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			Table 1 Occupational Values			Table 2 Effluent Concentrations		Table 3 Releases to Sewers
			Col 1	Col 2	Col 3	Col 1	Col 2	
Atomic No.	Radionuclide	Class	Oral Ingestion ALI (µCi)	Inhalation ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	Monthly Average concentration (µCi/ml)
1	Hydrogen-3	Water, DAC includes skin absorption	8E+4	8E+4	2E-5	1E-7	1E-3	1E-2
		Gas (HT or T_2) Submersion[1]: Use above values as HT and T_2 oxidize in air and in the body to HTO.						
4	Beryllium-7	W, all compounds except those given for Y	4E+4	2E+4	9E-6	3E-8	6E-4	6E-3
		Y, oxides, halides, and nitrates	--	2E+4	8E-6	3E-8	--	--
6	Carbon-11[2]	Monoxide	--	1E+6	5E-4	2E-6	--	--
		Dioxide	--	6E+5	3E-4	9E-7	--	--
		Compounds	4E+5	4E+5	2E-4	6E-7	6E-3	6E-2
6	Carbon-14	Monoxide	--	2E+6	7E-4	2E-6	--	--
		Dioxide	--	2E+5	9E-5	3E-7	--	--
		Compounds	2E+3	2E+3	1E-6	3E-9	3E-5	3E-4
9	Fluorine-18[2]	D, fluorides of H, Li, Na, K, Rb, Cs, and Fr	5E+4 St. wall (5E+4)	7E+4 --	3E-5 --	1E-7 --	-- 7E-4	-- 7E-3
		W, fluorides of Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, As, Sb, Bi, Fe, Ru, Os, Co, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, V, Nb, Ta, Mn, Tc, and Re	--	9E+4	4E-5	1E-7	--	--
		Y, lanthanum fluoride	--	8E+4	3E-5	1E-7	--	--
11	Sodium-22	D, all compounds	4E+2	6E+2	3E-7	9E-10	6E-6	6E-5
11	Sodium-24	D, all compounds	4E+3	5E+3	2E-6	7E-9	5E-5	5E-4
12	Magnesium-28	D, all compounds except those given for W	7E+2	2E+3	7E-7	2E-9	9E-6	9E-5
		W, oxides, hydroxides, carbides, halides, and nitrates	--	1E+3	5E-7	2E-9	--	--
13	Aluminum-26	D, all compounds except those given for W	4E+2	6E+1	3E-8	9E-11	6E-6	6E-5
		W, oxides, hydroxides,	--	9E+1	4E-8	1E-10	--	--
15	Phosphorus-32	D, all compounds except phosphates given for W	6E+2	9E+2	4E-7	1E-9	9E-6	9E-5
		W, phosphates of Zn^{2+}, S^{3+}, Mg^{2+}, Fe^{3+}, Bi^{3+}, and lanthanides	--	4E+2	2E-7	5E-10	--	--
15	Phosphorus-33	D, all compounds except phosphates given for W	6E+3	8E+3	4E-6	1E-8	8E-5	8E-4
		W, phosphates of Zn^{2+}, S^{3+}, Mg^{2+}, Fe^{3+}, Bi^{3+}, and lanthanides	--	3E+3	1E-6	4E-9	--	--

NRC Occupational Dose Limits

Whole Body (TEDE)	5,000 mrem/yr
Any Organ (TODE)	50,000 mrem/yr
Skin (SDE)	50,000 mrem/yr
Extremity (SDE)	50,000 mrem/yr
Lens of Eye (LDE)	15,000 mrem/yr
Embryo/Fetus of DPW	500 mrem/yr
Member of the Public	100 mrem/yr

Note: 1,000 mrem = 1 rem

Briefing for Media

Recommendations

$$\lim_{x\to 1}\frac{x^3-1}{x^2-1}=\lim_{x\to 1}\frac{\left(x^2+x+1\right)(x-1)}{(x+1)(x-1)}$$

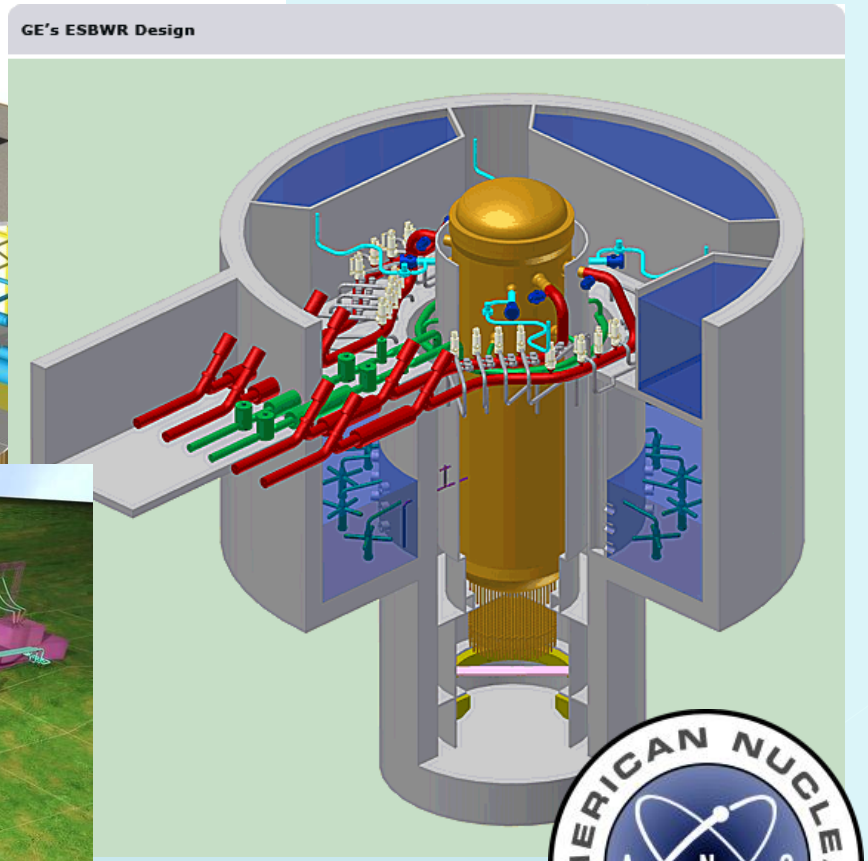
$$=\lim_{x\to 1}\frac{\left(x^2+x+1\right)}{(x+1)}$$

$$\lim_{x\to 0}\frac{\sin x}{x}=\lim_{x\to 0}\frac{d/dx(\sin x)}{d/dx(x)}$$

$$=\lim_{x\to 0}\frac{\cos(x)}{1}=\cos(0)=1$$

Fukushima


MIYAKO



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Only the strong will continue –
Do you have it in you?