

Learning from History: Evacuation Criteria

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In any decision involving radiation a risk-risk or risk-benefit comparison should be done. This can be either explicit or implicit. When the adverse effect of an alternate action is less than the planned action, such as medical use of X rays or nuclear power in ordinary operation, the comparison is simple. But in this paper I argue that with the situation faced by the Japanese in Fukushima, the assumption that the risk of an alternate action is small is false. The risks of unnecessary evacuation exceeded the risk of radiation cancers hypothetically produced by staying in place. This is, of course a general problem including non nuclear accidents such as spills of toxic chemicals.

It has been known, at least since 1945 by those who studied the subject, that we are all exposed to radiation from natural radioactivity as well as artificial radioactivity. It has also been known that there basically two effects on health. Firstly an acute, prompt (within a few weeks) effect due to large prompt exposures and a later chronic effect (such as possible cancer, heart disease, genetic effects) due to long term exposures. This is called Acute Radiation Sickness. The nuclear community consistently pointed out that in the case of an accident the important step is to ensure, in so far as possible, that acute effects are minimized. This is distinct from minimizing long term effects for which there is usually time to think and determine the best procedure.

The distinction between acute and chronic effects was not properly accounted for in Japan by those that had to make a decision within hours. These people included the Prime Minister, his advisers, TEPCO management, the TEPCO operating crew at the reactor site. This realization suggests important changes in the guidelines for radiation protection in accident situations. These changes should be world-wide. We now know that NO ONE got Acute Radiation Sickness, and that the prompt evacuation was unnecessary and indeed caused many calculated deaths. If workers had been allowed a higher dose they would have been better able to cope with the immediate consequences and prevent escalation of the accident. According to reports a worker struggling through a unlit tunnel to open a valve to flood the reactor number 3 (the proper action in an emergency rather than allowing gas to build up and venting it) was pulled off the job when his exposure reached 1 rem - half what I got from CAT scans that year without comment from anyone. This stupid action by TEPCO allowed the meltdown to take place and if the worker had continued he could have prevented the release of hydrogen, the explosion and meltdown. I have no such specific information about preventing meltdown in the other two reactors, but it is likely the situation would not be as bad as it was.

It is also important to realize that the understanding of long term effects on health from lower doses of radiation depends on calculations using a "model" rather than on direct epidemiological data. There is another model that must be considered. Stress such as unnecessary evacuation can increase cancer rates more than radiation. This was formally stated in the US government report (Kemeny Commission) Such calculations on stress that we have suggest that the evacuation from the area around the reactor at Fukushima resulted in more calculated deaths than if everyone stayed in place. This probably still applies 2 years later as we consider whether to cope with the measured radioactivity deposition (mostly

Cesium 137) that exists and will stay for many more. There is a procedure for thinking about such questions and issues suggested by Professor Norman Rasmussen and colleagues in 1975. (The Reactor Safety Study). But there are political reasons this is not followed. For example dumping the contaminated water into the sea at a time when the currents will take it further out to sea is not now considered but it should be.

I personally was thinking about the tsunami and concerned about my friends particularly in Sendai, and talking to anyone interested including newspaper reporters who were asking intelligent questions. Bad though the failure to immediately rebalance risks on the Saturday of the accident was, I am appalled that on the following Thursday morning President Obama went out of his way to recommend evacuation up to 50 miles from the reactor for American citizens implying that it would be wise for Japanese to evacuate also. This shut down intelligent discussion both in the US and Japan. Any balanced letter or newspaper report could no longer be published in the USA and seemingly would not be published in Japan. I have repeatedly apologized to my Japanese friends for my failure to bring sense to our government but feel very strongly that President Obama should formally and publicly apologize to the Japanese Prime Minister and the Japanese people

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