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DOSAGE REDUCTION FACTORS NOT USED IN THE SITE CRITERIA

The following is a short discussion of the factors not considered in the site criteria under consideration at the present time, all of which would tend to make the dose at any distance smaller.

1. The leak rate from the containment vessel will decrease as the pressure decreases, and the pressure should reach atmospheric in 1 or 2 days. Using this factor would reduce the doses by a factor of 5 or 10.

2. Protective devices within the containment vessel, such as cooling sprays, emergency cooling, air filters, and washdown of the containment vessel atmosphere. The reduction factor for these devices varies widely, from at least 10 to 1000.

3. Particles will settle and deposit on the walls and equipment within the containment vessel while some of the material is leaking through the walls. This would reduce doses by a factor of 3 to 10.

4. The actual leak rate from the containment vessel for radioactive material may be considerably less than for the air with which measurements were made, because if the leaks are all extremely small the rate is dependent on particle size even down to the molecular range. The reduction factor thus depends on the size of the radioactive particles and on the nature of the holes through which the material is leaking. If the major leak is through a few rather large holes (over 1/8 inch in diameter), the reduction factor is 1.0, while if the holes are all in the micron size range the reduction factor could be 2 or 3 orders of magnitude.

5. More accurate diffusion equations could be used to correctly represent the concentration of the radioactive effluent in the atmosphere at great distances on the order of 5 to 10 miles. It is well known that the Sutton equation overestimates the concentration at these distances. This correction would reduce the dose at 3 miles by a factor of 2 or 3, and at 10 miles by a factor of 5 or 10.

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6. The wind will not blow in a constant direction for more than a few hours at a time in most instances, that is, it has a tendency to shift direction. Since the doses are calculated on the basis of constant direction, this will produce a reduction in dose for the usual circumstance, although most sites have a finite probability of constant wind direction for as long as 2 or more days. The value of the reduction factor for this depends on the time assumed for the pressure to decay, and will vary from 2 to 50.

7. Another phenomena is the small variations in wind direction which happen in a few minutes' time. This is called wind meander, and makes the actual dose about a factor of 2 less than the calculated centerline dose used in the criteria.

8. Due to the much more rapid diffusion which takes place during lapse conditions, the dose during these conditions is insignificant compared to that which occurs during inversions. In general, inversions occur from 30% to 60% of the time at various locations, so this represents a reduction by a factor of 2 or 3.

9. Even though the particles which leak out of the containment vessel are very small, they will still have a tendency to fall out of the plume and deposit on the ground. This deposition will reduce the air concentration by a factor of 2 or 3, which will decrease the evacuation distance accordingly.

10. Reactors which are cooled by sodium will tend to release much less iodine, beacuse it will react with the coolant and not be released. There is also less probability that such reactors will produce much pressure in the containment vessel, especially if an inert atmosphere is used to eliminate the fire hazard.

11. Organic-cooled reactors have a lower probability of producing a pressure in the containment vessel in case of a large accident. Hence, there may not even be a driving pressure to cause the activity to leak outfrom these reactors.

12. Some reactors may have a type of containment which holds in the fission products better than is possible with a conventional steel vessel. For example, the vapor suppression system filters the fission products through a pool of water which prevents them from becoming airborne. In addition, the water also condenses the steam, which removes the driving force causing leakage in a short time. These two factors reduce the dose to the environs by a factor of 10 to 100.

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13. Another improvement in containment is the use of two concentric vessels, with the outer one vented to a high stack, so that all leakage from the inner, primary containment is channeled up the stack. In this way, one has an elevated release, rather than the ground-level type generally associated with other types of containment. This reduces the theoretical maximum ground concentration by a factor of 2.7, eliminates the close-in dose problem, and moves the maximum cut to such a distance that a number of other factors should be considered, such as those in items 5, 6, and 7 above.

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