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Impact of Variation in Environmental Conditions on the Thermal Performance of Dry Storage Casks

Comment On: NRC-2014-0273-0001

Impact of Variation in Environmental Conditions on the Thermal Performance of Dry Storage Casks

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General Comment

Impact of Variation in Environmental Conditions on the Thermal Performance of Dry Storage Casks
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This important topic, with potentially deadly repercussions, must be redone properly. It does not reflect its title or scope and what it does address is incomplete and often wrong.

It calculates max heat load as 34 kW (p. 10) whereas Holtec, 2014, gives it as 47.05 kW, which is 13.05kW higher, leading to a peak fuel cladding (PFC) temp approximately 255 F higher than stated. Failure to consider sun means the PFC temp may be 100 F or higher than stated. This is an underestimation of at least 355 F.

These casks have metal exteriors and sit in the sun on concrete or pavement. 120 F does not consider this. 120 F can be ambient temperature in shade. Low level wind is a mostly bogus concern.

The authors do not model real vent size for the casks. They pretend vents extend across top and bottom, which is false: The four vents in the bottom and top of the cask, respectively, were represented by one continuous inlet at the bottom and one continuous outlet at the top. (p. 27) The larger vents would mean better cooling than reality. For underground casks it fails to consider ground temp and impact of sun on lid and cask stacking. Holtec wants reduced helium circulation and broken fuel. This does not seem modeled. Was high burn-up fuel considered?

Humidity is modeled backwards. Humid air will make the casks more difficult to cool. The humidity has already absorbed heat, which is why it is in vapor form. It is why there are nuclear reactors - to boil water. Lack of common sense and basic thermodynamics by the authors is frightening. the [thermal] conductivity of water vapour is actually much less than that of dry air. So, if humidity (i.e. water vapour) has any effect on the conductivity of air, it would make it less conductive, not more.

SUNSI Review Complete

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Add= *George Galia (JXSS)*

http://www.weather.gov.hk/education/edu06nature/ele_air_e.htm steam does not transfer heat as well as liquid water, http://en.wikipedia.org/wiki/Boiling_water_reactor

With errors corrected the temperatures may exceed service temperature of new steel casks. With radiation and corrosion induced material degradation the risk of exceeding it increases.

Evaluations for sun need to be extremes and near summer solstice and in the hottest month (or modeled in this way).

This is not even as sophisticated as WetBulb Globe Temperature (WBGT), which takes into account: temperature, humidity, wind speed, sun angle and cloud cover (solar radiation). Limitations of WBGT are low air movement and high humidity which are problems with dry casks and their small, poorly placed vents and waterfront locations.

The lazy incompetence of this document could result in many deaths and abandonment of large sections of America. It's not to be played around with like it's a joke. You need to get competent people to work on this. The Federal government pays well. Even welfare to work people are expected to work. It's unfair that you make people do your work for you.

It says peak cladding temperature (PCT) increases 14.4F per 10F ambient temp. 80F in the sun metal adds approx. 68F, making temp 148 F. 100 F plus sun would add 168F and probably more from outside. Using the 14.4 to 10 ratio the spent fuel would be 100 F hotter (or more) US max of 134 F plus sun plus humidity plus contingency needs to be correctly modeled.

Table 4.17 day 21 PCT is 886.7 K (minus 272.15: 613.55 C / 1136.39 F) plus 255 F fuel temp kW underestimation is 1391.39 F; solar underestimation of 100 F or more is 1491.39 F plus, which is dangerously close to 316 steel max service temp of 1598 F (800 C) and can easily be exceeded by sun.

The authors are clueless re averages. Averaging the maximum temperatures for each year will be a higher number than averaging within summer months. The all time max in the sun, however, is the right number to use, plus contingency.

In the midday sun, the temperature 0.4 cm below soil surface may be 161F, when air temp 4 ft above ground was 108.5F <http://earthobservatory.nasa.gov/Features/HottestSpot/page1.php> This is soil. Concrete is hotter. This has not been considered for the underground cask lids or lower vents of above ground casks.

The transport rules discussed only consider -29C (-20F) and +38C (+100F), in the shade, which are not extreme conditions in North America, and are routine temperatures in parts of N. America. The record maximum in the US is 134 F and the record minimum is minus 70. Transport temperatures are inappropriate, because they are only very short-term. The old NRC Reg Guide from May 1977 called for 130F (54 C) in direct sunlight and -40F (-40C) in shade. The decade of the 2000s was about 1.5F warmer than the 1970s.

This NUREG must be withdrawn, redone and republished for comment by competent, hard-working, people with common sense.