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1. National Grid's North West Coast Connection (NWCC) project seeks new double-circuit 400 kV lines running both north and south from the proposed new 3.4 GW nuclear power station at Sellafield. The new lines will create a north-to-south 400 kV coastal loop from Harker near Carlisle to Heysham near Morecambe, replacing existing 132 kV lines which will be removed, thus reinforcing the national grid for net north to south flow at the same time as connecting new nuclear and wind power.

2. A general map and other documents can be found from the 'Documents' key on the project web site. These documents include general explanations of the whole process from strategic options through route options to eventual application, as well as a general assessment of technical grid line options, including OHL, UGC, GIL and HVDC, with cost analysis.

3. NG's emerging route preference for NWCC includes a tunnel across Morecambe Bay. It shows what can be done when necessary. But a wholly offshore option is not preferred. The project is at a consultation stage until 28 November, prior to selecting a preferred route corridor.

4. Revolt news376 reviewed the study by Bunch et al earlier this year which found a decline from the 1950s to the 2000s in an association of childhood leukaemia risk with proximity of birth address to powerlines in the UK. A paper published yesterday from the same group sets out to test whether the corona ion hypothesis might account for this. In doing so, it does rather pitch so as to appear to test the hypothesis itself, and that pitch is taken up strongly by the Institute of Physics (IOP) in its press release. The pitch eagerly dismisses the corona ion hypothesis, although the test is entirely unsuitable for that purpose. It is almost like saying that Einstein's gravitation theory fails to explain the Bunch results so that should cast doubt on Einstein's theory!

5. Ironically, given the IOP position, there is a rather fundamental error of physics at the centre of the model used to test the corona hypothesis. An explanatory technical note is appended below. It also appears with a Powerwatch UK article.

6. Unfortunately the Bunch et al study does not have data of sufficient quality and statistical power to provide a meaningful test of the corona hypothesis. Its surprising findings of a decline in the association with childhood leukaemia raise many questions, and it was reasonable to see if the corona hypothesis might explain the decline. But the lack of such explanation tells us very little about either the decline or the corona hypothesis.

7. Rather than throwing doubt on the corona hypothesis, based on valid physics which would apply in any decade or country, doubt might be cast on the findings of decline, which is not shown in other countries.

8. Further to notes in news384 and 395 about the EU Renewable Grid Initiative (RGI), Andrew Hope was not invited in time for the RGI Workshop 24th October. He

has been looking into the background documentation on strategic aspects and reporting back. There was a session on EMF in the Workshop, though with the negative positions of TSOs (Transmission System Operators) in some countries it seems unlikely to get very far very soon in this forum. The UK National Grid may be something of a leader in the field.

9. Another EU funded PR project is Bestgrid, like RGI designed to promote faster permission and to overcome local opposition to grid development to serve renewable energy. RGI and Bestgrid both promote best practice and stakeholder engagement, seeking support from the multi-national corporate environmental groups. Of four pilot projects, one is in the UK, a post-evaluation of the now rather advanced Nemo Project interconnector from Kent to Belgium.

10. Bestgrid held its second Workshop on 23rd October, with a similar EMF session to that at the RGI workshop. A presentation from Dr Dirk Manthey of 50Hertz, "*Collaboration on an emotionally sensitive topic*", set out an industry PR approach to win over concerned residents. It included this: "*Ignorance of EMF causes avoidance reactions and leads to regulations containing technical restrictions, such as the obligation of underground cables, or more extensive precautions (e.g. distance, limit values).*"

11. Sadly that "deficit model" (news269) for public engagement – blame and educate the ignorant public - is seriously outdated and discredited. It tends to antagonise informed opposition. It could equally be said that the ignorant industries (and their lawyers) and politicians are often to blame, for taking an unreasonable denialist approach in the face of genuine evidence, out of fear of conceding some liability. We have reported such instances in Revolt news this year.

12. A much better approach would be to admit there is a genuine evidence-based concern, not just irrational fears. Only then can the concern be put into proper perspective. And with a proper and balanced perspective, it may be possible to bring the sides closer to establishing common ground. Following National Grid's initiative, to its credit, the UK SAGE group made some progress in this way and produced some useful, if limited, reports. But it's not easy and prejudices don't fade quickly. One side blaming ignorance of the other is only likely to exacerbate conflict.

APPENDIX A Comment on Swanson et al ion transport model
MJOC 31-10-2014

Swanson et al [1] seek to test a corona ion hypothesis as a possible explanation for their findings of increased incidence of childhood leukaemia near powerlines that declines from the 1960s to the 2000s. Their test is based on a four-stage model outlined in section 3.1.

The idea is to sum up all the ion concentration arriving at the object point (birth address) from along the length of all lines within 600 m. In the model, the lines are replaced by point sources every 10 m along them.

The model represents the transport of corona ions from a point source to the birth address, by multiplying together four factors: source strength; a distance function; proportion of time the wind is in the right direction; and average wind speed.

In effect (apart from a fundamental error) the model treats the ion transport from each source point as if by linear convention from source to object. A better model might account for lateral diffusion related to wind speed and distance.

Figure 2 in [1] shows a model ion concentration profile perpendicular to a powerline, said to model "*the observed average variation of the concentration of ions with distance from the power line, when the wind is transverse to the line*".

To obtain the ion concentration from a point source, a further factor of 1/distance (i.e. 1/r) is applied. The explanation is "*in order for them to sum (at distances that are large when compared to the separation of the individual points) to this overall variation*". That appears to be requiring a 1/r factor for point sources to enable line-integration to recover the Figure 2 model for the line.

However, that is an error, and it does not sum to the "overall variation", as a simple calculation shows.

The error seems to confuse convection point-sources with radiative point-sources. Two-dimensional radiation from a point would attenuate like 1/r over an increasing circumference, whereas convection (as reflected in the wind-rose model used) would be unidirectional and not attenuate in the same way. Convection would have attenuation, e.g. by recombination and absorption, but that would be incorporated in the model already in Figure 2.

Leaving out the wind part of the calculation, by taking the wind factors to be uniformly 1, we can test the idea that the 1/r factor would enable the point source effects to "*sum ... to this overall variation*". See the appended sketch for a diagram and mathematics. For the purpose of a simple test, take the "overall variation" as a function of distance d of the object point from a straight line to be

$$f(d) = 1 \text{ for } d<600 \text{ (m) and } 0 \text{ for } d>600$$

This is constant over a finite range, similar to Figure 2 and the same as the alternative calculation (Section 3.6). Then the distance function in the model (representing

concentration at distance r from the source) would be f(r) / r. Integrating along a line of such sources for the concentration C at a point distant d from the line, gives

$$C = \int f(r) / r \; dx$$

where x is path length along the line. The non-zero range of the integrand is from –X to X, where $X^2 = 600^2 – d^2$. Symmetry can be used so that C is twice the integral from 0 to X. Hence:

$$C = 2 [\ln (x+r)]$$

where the bracket is taken between 0 and X, so

$$C = 2 \ln ((600+X) / d)$$

This result for C is certainly not the original overall variation, which was constant for d in the range 0 to 600. Here C falls from infinity at d = 0 to zero at d = 600. Even with the qualification "*at distances that are large when compared to the separation of the individual points*" the point source effects do not sum to the overall variation.

Further testing, both with the above piecewise constant model for f(d) and with the piecewise linear model in Figure 2, using a spreadsheet to sum effects from sources at 10 m intervals, confirms the fact that the point source effects fail to sum to the overall variation (or anything like it), and the 1/r factor fails to "work" as intended.

Distance d from line (m)	50	100	200	400	600
f(d) constant to 600 m	0.634	0.497	0.352	0.192	0.000
f(d) from Figure 2	0.597	0.457	0.312	0.130	0.000

Table 1 Calculated sums of effects from point sources

Note: The units for the model are arbitrary as acknowledged in [1]. The results show the shape of the calculated exposure profile which radically differs from the given f(d).

So, in short, the factor 1/r seems misconceived and should simply be removed. Whether that makes much difference in overall results is another matter, but it is an important issue for closer comparisons of this version of the corona hypothesis with a simple distance model. The use of the 1/r factor distorts the convection effect by greatly suppressing effects at longer distances, including the 200 to 600 m category relative to the 0 to 200 m category.

Returning to the idea of lateral diffusion, it might be argued that a radial (1/r) attenuation would apply by virtue of expansion in a narrow sector from the point source. But that is not how the wind rose part of the calculation is constructed. Such sector attenuation would require consideration of sectors from neighbouring sources along the line, within an upstream sector from the object point, as well as the distribution within sectors subtended at the object point; in effect this is already accumulated in the model in Figure 2 and does not require a further 1/r factor to be applied. So I cannot rescue the 1/r factor by appeal to sectors.

Another error in the use of physics is multiplying concentration by average wind speed along the relevant bearing, whereas wind speed may have the effect of elongating and thinning the plume.

In order to test the corona hypothesis, it would seem perverse to base the test on the distances 0 – 200 m, which may be confounded by magnetic fields. Granted, the original data for 200 – 600 metres, which would otherwise better isolate the corona effect to be tested, fail to show the decadal trend significantly, but this should signal the general unsuitability of the data for testing the corona hypothesis.

In the same way, reverting to using > 600 m (instead of > 1000 m) for the reference category also seems perverse, given the acknowledgement of ions measured even at "several kilometres away". Surely retaining the previously used category of > 1000 m should be preferred for such a test.

Figure 5 seems, strangely, to compare a categorical RR with a trend RR, rather than like with like. The comment "*Because there are four quartiles of exposure, the trend RRs are plotted on an axis expanded by a factor of 4, to allow a very approximate visual comparison*" is not supported theoretically. If a further ad hoc expansion were applied, with a factor of about 2 to reflect the radically different reference categories, the graphs would give a much better appearance of matching.

I suspect that, given the very rough approximation of the model and the potential for confounding, correcting the main error by removing the 1/r factor may not materially affect the inconclusiveness of the test. Even so, the authors and the journal hopefully might prefer to have a corrected calculation.

[1] Swanson, J, et al. *Childhood cancer and exposure to corona ions from power lines: an epidemiological test,* J Radiological Protection, 2014
http://iopscience.iop.org/0952-4746/34/4/873/article

Appended sketch