2009 ICNIRP risk assessment conference

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Overall Summary

The risk assessment conference hosted by ICNIRP in Salzburg on the 23rd and 24th of November 2009 was based around the nature of risk assessment, risk communication and the terminology used by various organisations to describe the state of scientific evidence.

If anything, the conference made a very clear argument that electromagnetic field science is not adopting / applying modern tools and techniques for objectively assessing the totality of the evidence.

It was clear, time and time again, that other areas of science manage to incorporate various quantities and degrees of uncertain science into risk assessments and cost benefit work, something sorely lacking for some time with EMFs. There were a number of risk assessment experts stating that "lack of certainty" over a given cause and effect does not provide justification for inaction.

There has been a lot said of the precautionary principle. In many ways, it is wrongly applied in two separate directions – firstly, following the European Commission communication in 2000 it has become clear that it is not appropriate to set precautionary policies "just in case" when there is indications that harm may be possible. The EC state that precaution is only warranted when a risk assessment shows justification for its implementation, taking the benefits into account proportionate to the downsides (normally in cost) for the action. There is no hard and fast guidelines on how the positives and negatives should be costed, and this could well provide useful approaches for cost benefit analyses that demonstrate the need for action, but a cost benefit risk assessment must be performed.

The other misapplication, used frequently by the industry and to some extent EMF standards setting bodies across the world, is rather more subtle. Their argument is sound, but based on the false premise that certainty of an effect is required before it can be quantitatively used in a cost benefit analysis. Therefore the "negative cost" of inaction is greatly underestimated, as only health effects accepted beyond doubt are allowed into the costings.

This meeting made it very clear that this was out-dated thinking, and that it was a failing of the EMF community not to have made more of an effort to cost the various morbid and uncertain outcomes associated (with varying degrees of certainty) to both RF and ELF exposure. It is clear that a lack of plausible mechanism is expected to weight the value of the evidence in according to a risk assessment, but it is not appropriate to use a lack of plausibility to dismiss any observational evidence.

The next section will address the various speakers talks, both from a content and an applicability point of view, with feelings I have taken from what was said summarised at the end of the summary.

Monday, November 23, 2009

Session 1 - Current approaches to protection against NIR - Setting the scene

The ICNIRP perspective of NIR health risks: facts, uncertainties, public perception and need for action - Paolo Vecchia

Paolo's talk came across as primarily defensive, but also raised some important and relevant points. It was clear that there was a big challenge in the Risk Assessment arena with how to accurately represent and assess the impact of uncertainty. Currently, it is clear from existing documents that they have published that they do not include effects in their standards settings procedures where any level of uncertainty remains – i.e. the guidelines they have set are based on effects "established" beyond uncertainty only.

He came out with two corkers of quotes however, neither of which were credible nor justifiable:

"Long term (/chronic) effects cannot form the basis for guidance levels", and
"There is limited evidence for biological effects from non-ionising electromagnetic fields, but no evidence for health effects"

I asked a public question to Paolo on how such long term effects can be controlled in the general population if standards settings bodies cannot legislate against them, to which he replied that it is for policy makers to decide how to evaluate an unacceptable level of risk and to act accordingly – This obviously didn't really answer the question, but there was no chance to follow this up publicly.

On a slightly more positive note, he did acknowledge that the guidance levels were based on adverse health effects only, and recognised the possibility that it may be considered appropriate to include "annoyance", "discomfort", and other morbid effects.

WHO needs in view of upcoming reviews (EHC-document) - E van Deventer

Emilie presented what amounted to a rousing endorsement of the general practice of the World Health Organisation in the world as it stands. The first 50% of the talk barely seemed to cover EMFs strangely enough!

She usefully elucidated some of the key components of "uncertainty", for example the separation of the confidence that an effect is true, and the uncertainty in the occurrence / prevalence of an effect.

I asked a public question about mobile phone base station studies, and how in the light of the proportion of studies in the WHO EMF database they could state that further research doesn't seem warranted. Her response was that none of the positive epidemiological base station studies were of high enough quality to believe in the results, and that a forthcoming review was coming out of WHO that would address each paper individually explaining their flaws.

Session 2 – Challenge

Descriptive vs quantitative risk assessment: is there a best practice - H Bolt

This talk was from someone with a chemical pollutant background from the European Commission's Scientific Committee on Occupational Exposure Limit Values (SCOEL). There were a number of interesting analytical arguments raised at the meeting, particularly for how to decide what sort of dose relationship was the most likely and appropriate one to apply to an unknown risk association. Covering some simple numerical risk assessment practices, he explained how a linear no-threshold model is a default appropriate model to take, until evidence demonstrates that there is an apparent threshold effect or lack of dose/response linearity.

He raised a very interesting case example where acrylonitrile, a generally accepted carcinogen, has very little human epidemiology supporting its status. However, the reason for this is complex: The animal evidence of its carcinogenicity is very strong, and it is known to metabolise into cyanide in humans, and therefore it has been already restricted from human exposure as the danger of cyanide is well recognised.

I asked a public question about how other response possibilities are catered for within SCOEL methodology, such as window or bi-phasic dose relationships. His response was rather vague and non-committal, but resolved to state that linear no threshold is always a default view, and that more complicated models must be supported by the evidence before they are acceptable possibilities. There are interesting implications of this with regards to RF, where work such as Salford's indicate a very complex potential dose-response relationship – the idea that it is not acceptable to start with a complex theoretical model until the linear model has been falsified could make it very difficult for the "establishment" to accept a more complicated reality than the one they are used to with electromagnetic energy.

Session 3 - General concepts in risk assessment

Weight of evidence and uncertainty assessments: more quantification may not be the answer - D Weed

Douglas Weed came with a risk assessment orientated law background from the United States, and spoke about the clarity of information provided when trying to explain issues in areas of uncertainty. He started by demonstrating how much uncertainty there are around even basic facts (such as "is there a McDonalds in Cambridge?"), and even those you'd expect to know (for example, people that live there) are often uncertain. It comes as no surprise therefore that the range of possibilities and uncertainties where science is so close to the edge of existing understanding are much greater.

He then spent some time discussing the term "weight of evidence". He conducted a review of 40 scientific reviews in different disciplines that claim to have used a "weight of evidence" method to assess the quality of science. Of them, he said that only 5% (2) made any attempt to explain what that entailed. None of the other reviews covered how the science was weighted / graded, on what criteria, what would have been necessary for exclusion from the review, nor how any of these weights and grades affected the final evaluation of the evidence. He concluded this section stating that weight of evidence is often used as a tag-line that indicates "proper procedure" but is both highly ambiguous and often not supported by the well defined methodology it implies. He then went on to say he suspected it was very rarely that "weight of evidence" was ever used in an objective manner.

His final points were that the criteria which we still use in EMFs to assess the quality of the totality of the evidence are still largely based on the Bradford Hill "criteria", something which is now nearly half a century out of date and never intended to be used as an instruction manual for assessing evidence. If any research is urgently needed, it is work into the methodology for the synthesis of data, required to bring it up to date in a way that vast quantities of multidisciplinary data can be assessed, including large variations in uncertainty, in a meaningful manner.

I asked a public question about what level of uncertainty in the data is acceptable for communication to the public about science, and his answer was quite controversial. Essentially, he stated that uncertainty mustn't be defined in subjective terminology. It is quite acceptable to say that you believe an association to be true, or that you don't, but not using terms that are by their nature ambiguous and open to being interpreted differently by those receiving the communication.

Evaluation and expression of variability and uncertainty - A Hart

Andy Hart, a representative of the UK Food and Environment Research Agency, gave an outstanding talk on quantifying uncertainty in risk assessment methodology. The first stage was to separate out variability and uncertainty – variability in populations due to "natural" heterogeneity is outside of the calculations around uncertainty – equally important with regards to overall risk assessment, but important not to confuse the two. He categorised the various sources of uncertainty as falling roughly into the following categories: measurement, sampling, extrapolation, model adequacy, disagreement, ambiguity, ignorance. This was followed by another comment supporting previous speakers observations that there are two very distinct and different areas that these uncertainties apply with regards to their overall impact on risk assessment: the uncertainty on the chance any given possible outcome is to be true, and the uncertainty on the proportion of the population they are likely to affect and to what degree.

There are various methods to qualitatively evaluate evidence, each of which have varied levels of objectivity and uncertainty. Andy gave 4 examples of methods in ascending levels of apparent objectivity as follows: Expert judgement (mostly subjective but rationally based on professional experience), conceptual models (objective in principle but constrained by the subjective nature of designing a model based on what is likely to be expert judgement again), logic (mostly objective but constrained by the subjective experiences that determine what constitutes a logical judgement), and Weight of Evidence (an extension of logic that attempts to create consistent qualitative values to maintain consistency across large bodies of evidence).

He also touched on the two primary methods of determining what endpoints to use to evaluate risk in a way of providing an overall risk assessment: deterministic methods and probabilistic methods. The former generally takes the shape of "what if" scenarios – e.g. worst case scenarios or scenarios that have been identified as a result of a particular set of "end of the scale" assumptions. The latter is an attempt to decide what levels of certainty can be applied to a number of recognised endpoints and weight the possibilities of them accordingly. The latter is generally a more objective and robust method, but requires a good understanding of the range of likely outcomes with reasonable estimations of certainty, and is subject to the effects of a number of assumptions on the model used that may themselves be uncertain. Deterministic methods can be very useful when uncertainty is two large to create a robust assessment with probabilistic methods.

I asked a public question to Andy on how it is possible to get around the issue of having an area of science where there is a huge amount of divergence between the opinions of experts within the field, to make sure that a fair representation of scientific opinion is catered for within any given assessment of the evidence of a whole. He responded that there are a number of papers published on how to identify the breadth of divergence and non-randomly select experts that attempt to give a proportionately representative view of the experts.

Session 4 - Approaches in use by organisations and committees

IARC´s approach to assessing the level of evidence - Vincent Cogliano, IARC

Vincent Cogliano has been on the IARC monograph committee for many years, and has a good understanding of how IARC assessments are made, leading to their corresponding classifications of carcinogenic agents. He gave a good background of IARC methodology and the way that various types of evidence come together to allow a consistent way of categorising agents, separating evidence broadly into "evidence in humans", "evidence in animals", and a further weighting effect from the plausibility of a biological mechanism.

Essentially, "sufficient" evidence in humans is required to achieve a classification of 1 (human carcinogen). Anything less than this limits the classification to 2A, regardless of the strength of the evidence elsewhere. If the evidence in humans is considered "limited", then 2A can be reached if the animal evidence is considered "sufficient", else a 2B classification will be given. If the evidence is considered "insufficient" in humans, then a classification of 3 will be given, upgradable to 2B if the evidence in animals is "sufficient".

In theory, strong evidence of non-carcinogenicity warrants a classification of 4 where the agent is considered likely to have no impact on human cancer, but in reality this classification is almost never used (currently only for 1 agent I think).

I asked two public questions. The first of which is what evidence is required to be considered "sufficient" in humans for extremely low frequency electromagnetic fields. The answer was that the evidence is undoubtedly seen in a different light due to the consistent failure to find an adequate animal model nor any good evidence of a plausible biological mechanism. Many of the epidemiological studies that have been carried out are not directly comparable to each other, leaving the overall state of the evidence simply not consistently strong enough over enough studies for sufficient evidence. It was accepted that even without the animal or mechanistic data, more of the same quality of evidence consistently demonstrating an association between ELF EMFs and childhood leukaemia will eventually be enough for category 1. The second question is how IARC handle the possibility of ELF EMFs not being a direct carcinogen in itself, so much as a promoter of the effects of other known carcinogens. There is now a steadily mounting body of evidence suggesting that EMFs are capable of increasing the carcinogenicity of other known toxic agents. I pointed out that the likely health impact of a universal promoter (e.g. acting on lowering the body's natural immune systems ability to prevent cancer) would be far greater than as an initiator for a specific cancer, and asked how IARC incorporated this possibility into their assessment. Vincent's answer was that the current system was designed before there was much understood about the difference between promoters and initiators,

and that they were not really catered for adequately. As things stood, they included evidence of initiators, but only up to a maximum of limited evidence, regardless of how robust and consistent the data was. He agreed that defining a universal promotor as a carcinogen in itself is probably not appropriate, and that it was possible a separate assessment should be used to assess the promotion qualities of a given agent.

EC – DG health and consumer protection (DG Sanco) - Recent EC activities on terminology - Katja Bromen, EC DG Sanco, SCENIHR and the SCENIHR risk assessment approach and its use in work on health effects of EMF - Matts-Olof Mattson, EC DG Sanco

The combined talk of the two DG Sanco employees was a really interesting insight into typical European Commission protocols on evaluating and weighting various types and strengths of evidence. The attempted scope of the organisation is very large, attempting in theory to assess evidence across multiple disciplines, including evaluating the impact of uncertainty, and have a qualitative definition of the terminology used. They recognised the necessity of clarity and transparency of their communications on risk assessments, both from the perspective of making sure their assessments were correctly understood, and for the sake of increasing trust in the quality of their judgements.

They have two meetings each year discussing the methods with which they perform this work, and the 2010 meetings are currently planned to discuss both the way weight of evidence is performed and the way it is communicated alongside their risk assessment, and also the way language and terminology are used and defined for both scientists and "lay" policy makers to understand, with the aim of having a unilateral use of terminology.

They receive questions from the European Commission, and they take on the task of assessing the evidence in accordance with the questions asked. Papers are selected via a combination of literature searchers (e.g. PubMed) and consultation with experts within the field that have affiliation with the European Commission (in the case of electromagnetic fields this will be SCENIHR). The papers are shortlisted based on an evaluation of their relevance, validity, adequacy and scope to the question being asked. They are also judged as to their quality based on the following criteria: peer-viewed, quality of journal (e.g. high impact journals weighted more favourably), robustness of experimental methodology, whether they agree with other work carried out in the field, their methods of analysing the data, and the reputation of the scientists and university / laboratory that carried out the work. They commented that replicating negative/null studies is just as important as replicating positive studies, and that they were well aware that papers of near statistical significance ($0.05 < P < 0.10$) should be considered as more than just "non-positive" results, but with the caveat that they would have to accept the expert's judgement on these in the context of plausibility.

I asked a public question regarding the proportionality of the experts selected to assess the evidence. Their response was that they have to rely on assumption that the experts selected have sufficient expertise to do their job. This of course highlights what we sort of already knew – SCENIHR have a position that almost has to be relied on, because no-one really has the remit to assess the experts. It would be interesting to look at the expert selection methods highlighted by Andy Hart to see if those on the SCENIHR committee represent a balanced representation of EMF experts!

U.S. approaches to the use of science in risk assessment - George Gray, Risk Science and Management

George Gray came from a 20 year career position as a director in the American Environmental Protection Agency. He gave some very interesting case studies into examples where the same risk was viewed very differently by both scientists and the public in the real world. He said that the presentation of all risk assessments should consist of the following: Restating the scope of the risk assessment, clearly express the results found (both what the data says and the calculated impact of risk), articulate the assumptions made, and where data was extrapolated for the sake of the assessment, and identify other interpretations of the data.

Dr. Gray focused very much on the perception of the risk as it is understood by the lay public following the communication of relevant risk assessments. He said that even amongst scientists the same summary classification (terminology and category) lead to different interpretations of risk. As an example, a number of environmental carcinogen researchers were asked about their perception of the carcinogenicity of DDT, Dioxin and Ethylene Dibromide. Despite identical EPA classifications, the results were 25% (+/- 15%) chance for DDT, 55% (+/- 20%) chance for Dioxin, and 85% (+/- 10%) chance for Ethylene Dibromide.

He also highlighted the comparative example of Bis phenol-A and Acrylamide, two known carcinogens of similar risk that were identified at approximately the same time. He says despite this, and no attempt to publicly classify them any differently to the public, very few people are aware of the risks of Acrylamide (a bi-product of a number of cooking processes in food, including frying and roasting and most "browning" processes, including toasting bread) and have therefore not adjusted their lifestyles. However, Bis phenol-A, a product found in trace amounts, for example in liquids stored in plastic sports bottles, have led some US states to ban the use of plastic sports bottles, favouring instead aluminium bottles. He says no-one can understand why what is conceptually the same risk is viewed so differently, but he suspects it may be the case that as primary exposure to Bis phenol-A is largely a product of corporate manufactured commercial items and primary exposure to Acrylamide is self-initiated home cooking, and this greatly affects the public perception of the "acceptability" of the risk.

GRADE´s approach of grading the quality of evidence and the strength of recommendations – Signe Flottorp, Norwegian Knowledge Center for the Health Services

This was a really interesting insight into the attempts of independent groups to standardise approaches to risk assessment, with scoring and weighting criteria that could be broadly applied across a range of disciplines. The purpose of the GRADE working group (http://www.gradeworkinggroup.org) was to assess evidence for medical evidence and the efficacy of treatments, but there is a general belief that it would be applicable to other areas of science, including chemical and environmental pollutants. Interestingly, she also stated that the World Health Organisation is beginning to adopt the GRADE system for some of their review work.

The philosophy of the GRADE approach is the idea that having a systematic and explicit method to approaching the evidence can mediate discussions between scientists and interested groups. Their method is a systematic review of the evidence based on the perceived problems, prioritised by severity. The first stage is to profile the evidence, and how the evidence applies to the identified outcomes. The next stage is to evaluate the quality of the evidence, both for and against the association. Their assessment of the evidence involves a numerical adjustment of the weight of each individual paper based on a number of areas – such as a clear dose response relationship or very strong / highly statistically significant odds ratios. The evidence categorisations for the overall quality of the evidence are then allocated, by the GRADE system as "high", "moderate", "low" or "very low". Essentially, these are designated as follows:

High: Further research is very unlikely to change our confidence in the estimate of effect

Moderate: Further research is likely to have an impact impact on our confidence in the estimate on the effect, and may possibly also change the estimate itself.

Low: Further research is very likely to have an important impact on our confidence in the estimate of effect, and is likely to change the estimate itself.

Very Low: Any estimate of effect is very uncertain.

Based on the totality of the evidence, a single recommendation should be made, graded either as a "strong" recommendation or a "weak" recommendation. Normally a strong recommendation is given when the course of action is considered to be either completely positive, or the positives are considered to far outweigh the negatives. A weak recommendation is given when there are comparable levels of negatives to be considered, but the positive action is still a valid choice where relative merits would outweigh the negative points in certain cases and should be down to the individual concerned. The intention is then to implement the recommendation, and after a given period of time assess the efficacy of the recommendation with with regards to the expected outcomes in the risk assessment.

Of course, as this approach is clearly designed around medical practice, where the strong recommendations make it medical common practice, whereas the weak recommendations make the information available to patients via their GP and allow them to make informed decisions. This is obviously not possible with areas of environmental practice where the aim is to set national or local policy. However, the idea of a standardised transparent approach to risk assessment will make it much more possible to understand the justifications for decisions being made in the EMF arena, and make it easier to identify where the differences of opinions between scientists have formed, and where those differences are justified by the evidence as opposed to just arbitrary decisions.

I asked a public question on why a dose response relationship is considered a positive for a study, when there are plenty of examples of non dose relationships within environmental health science. The response was that she had simplified for the sake of the talk, and in reality the positive weighting was intended to represent consistency of a dose response relationship(i.e. high accuracy in predicting the effect from exposure), regardless of what form it took.

Summary of Day 1

It was very clear from the various discussions on the first day that ICNIRP are genuinely of the belief that they address the science in as fair a manner as they are able, and believe that they have the "right" approach to do so. Some of the views expressed by Paolo (such as long term effects not being appropriate as the basis for guideline restrictions) I strongly disagree with, and I believe that most policy makers would feel the same way. Similarly, Emilie van Deventer believes that their approach to electromagnetic fields is currently not perfect, but robust and fair, and that their conclusions accurately reflect the state of EMF science.

I believe ICNIRP are only one piece in a very complicated jigsaw puzzle. This is not meant pejoratively, nor to undermine or cast out their views, but to be taken in context with what they are trying to do, so that chronic health effects can be properly assessed by a totally separate scientific body that are more prepared to do so.

I believe that for any progress on this issue we have no choice but to work hand in hand with the World Health Organisation, as I believe it is probably fair to say that their views are considered more than any other as the "gold standard" body regarding environmental exposures and health effects.

The risk assessment talks today were the core of what to take from the whole conference. It is clearly apparent that there is a large amount of work into advanced tools designed to assess risk over a wide range of environmental effects, including the vast amount of "uncertain" data, and ways of catering for areas of science where there is genuine and strong diversity of opinion without resorting to ignoring one side of the debate. I would strongly recommend that getting advice from other researchers in the field of risk assessment on the shortcomings of ICNIRP and SCENIHR methodology would be very useful, particularly with regards to convincing the EU parliament or the EC that SCENIHR are not currently providing them with complete information on the possible health impacts of electromagnetic fields.

Also, both the SCOEL and DG Sanco talks gave some interesting views into other areas of risk assessments that would apply to EMFs and provide useful information into how EMF risk assessment can be done differently – they also have the advantage of being bodies that are already trusted and acknowledged by the European Commission. It may be that liaison with these groups may give useful scientific input into ways that we can move forward with EMF science.

Tuesday, November 24, 2009

Session 5 - Round up Chair: Rüdiger Matthes, ICNIRP- Rapporteur: Adele Green, ICNIRP

Towards a consistent evaluation of scientific evidence and terminology in NIR risk assessment - Statements and open discussion. Also short talks: EMF-NET and EFHRAN approach, Bernard Veyret, ICNIRP and Risk terminology and communication at the Federal Institute for Risk Assessment, Stephanie Kurzenhäuser, BfR

I have combined these sections together as, in the conference itself, this session contained two brief talks introducing European and American approaches to their use of terminology (the former being for EMFs, the latter for chemical pollutants), followed by a one and a half hour plenary debate.

The debate outlined the various related issues: internal (risk assessment), external (risk communication and other forms of external advice), how risk relates to likelihood of impact, and the difference between quantitative and descriptive terminology, with their advantages and limitations.

It also highlighted some crucial issues that were not adequately addressed in the EMF arena:

1) Methods used to objectively handle uncertain, varying and complex data in electromagnetic field effect reviews are now approaching 50 years old. Quality assessments are basically done by comparative judgements to the points raised in the Bradford-Hill criteria. There are a number of other modern ideas and techniques used that could apply to EMFs.
2) There is often an applied assumption that high "quality" journals, normally as recognised by impact factor, on publish "good" research, and thus papers published in them get weighted more favourably in review work. There is little evidence to support that this is warranted, and the quality of the individual study should be given much more weight than the journal it is published in. James Lin made a very convincing case that many high impact journals have experts only in certain areas of those that would apply to an EMF paper. He has had papers that have been submitted to his journal (BioElectromagnetics) that he rejected because, although the comet assay experiment involved was extremely well conducted and the statistical analysis was robust, the exposure metric was too poor to give a reliable result. He said that it was then later published that year in a higher impact factor journal with experts capable of assessing the comet assay methodology but with little to no understanding of potentially appropriate EMF exposure

metrics. I raised a question that it would be an interesting piece of work for someone to assess the quality of papers on individual merit and to see how it correlates to the impact factor of the journal they get published in.

3) It was discussed that most of the EMF assessment methodologies were developed before the idea of tumour promotion (instead of initiation) was really understood. As a result, many of the models (such as IARC's) don't have a system in place to assess the overall impact of tumour promoters and their public health impact.
4) It is important to define approaches to assess the quality of individual studies. There is a clear apparent disparity between scientific advisory groups in both the studies selected for a review, and the assessment of those studies. Transparency and clarity in communicating the studies included, the studies excluded, and the scores and reasons for those included, is much needed.

There was also an interesting discussion regarding the impact of subjective judgements on the quality of a study and how it affects the weightings. The primary points were best summed up with the final exchange:

John Swanson: Positive laboratory studies are around that technically have "ticked all the boxes", and should apparently have changed overall conclusions on the effects of EMF exposure, but they haven't. The reason for this is normally due to the expertise and individual experience of the assessor, who may have a number of unspecified judgement criteria that have had a significant impact on their perception of the quality of the study. The reasons for conclusions being as they are may fall outside an approach designed to standardise and objectively score each paper on broadly the same criteria.

Response: This is undoubtedly going to happen on almost all papers. However, even in assessments of papers that fall outside this approach, there should always be a logical explanation involved, even the one mentioned by JS. It is vital to explain exactly what this logical explanation is and how it affected the weighting, even if the judgement was subjective, to exclude the possibility of unjustified prejudice unfairly biasing the overall conclusions of the assessment.

Session 6 - Risk communication Chair: Jürgen Kiefer

Foci for better NIR risk communication - Peter Wiedemann, Research Center Jülich

The first talk on risk communication started by identifying the purpose of risk communication in science. He stated that risk communication is designed to inform the public and shape their belief to reflect the status of the evidence, in a way that aims to improve decision making processes. Much of Peter's academic work has focused around either the methods for communicating information in a risk assessment (and then analysing the results of different methods) or the effects of various forms of risk communication on the perception of risk from those receiving it.

He compared a number of theoretical methods for representing evidence on risk, from straight narrative text to tables of evidence and "evidence maps", where data is connected in a similar manner to a flow chart, leading towards a conclusion on the evidence and a subtext to the limitations and assumptions taken as part of the conclusion. The findings were nothing unexpected: that developing methods of displaying information in a more advanced manner than a simple text narrative enables those new to a topic to get to grips with the evidence more quickly and more clearly, and that evidence maps are beginning to develop a good track record of this.

The latter part of his talk was covering how communication of risk has not only affected the public perception of the risk itself, but also of the body or organisation communicating the risk. He claims there is good evidence to suggest that organisations admitting uncertainty within risk lose public confidence in their competence as a risk assessor. He stated that the four primary requirements of institutional trust are: Expertise, impartiality, trust, and transparency. This is usefully informative as to how we choose to assess evidence and present our message, including the justification for any recommendatory standpoints. Peter finished by saying that while it often cannot be avoided that judgements of the evidence are summarised with fundamentally subjective words (strong, weak etc), these must be used in a contextually linear manner. He gave an example where in one field of scientific assessment the words "suspicion" and "hint" were used to describe levels of evidence, and the perception was that suspicion was less strong than hint, even though the other way round was intended when the words were used.

It would be interesting to know the reason behind the idea that uncertainty breeds a lack of confidence. It could be believed to be the case because there is such a long track record of governments and official organisations demonstrating "false certainty" giving an unreasonable public expectation that they should always fully understand the big picture, or it could be that the long track record is because this expectation that official organisations should just "know" is an intrinsic part of

human nature. If the latter is true it may be very hard to change the way uncertainty of risk is portrayed to the public! That said, if the uncertainty is handled as part of the risk assessment procedure, it is likely that by the time risk is presented to the public it is presented as an aggregated risk evaluation for the sake of decision making, with the levels of uncertainty not visible on the outside.

Disclosure of the risk assessment process information (COST model) - Eric van Rongen, Health Council, The Netherlands

Eric's talk covered a number of the issues involved in a risk assessment process, and the necessity of transparently explaining each step involved in the process with the impact that each step has had on the overall assessment. To do this, COST have attempted to answer three primary questions designed to ensure that an assessment provides the information expected of it:

- How does a scientific advisory group ensure it is free of bias and competent?
- How does it show a fair, open and reasonable approach to scientific process?
- How does it create an output that is both credible and reasonable?

They covered four separate aspects of the risk assessment process, categorised as "membership", "process", "evaluation" and "communication", as follows:

Membership: How the selection process of members for a scientific advisory group is carried out is important. The selection process (i.e. elected vs self-selection) and the vested interests (not always financial) need to be declared and explained, including a summary of the expertise and competence of each member with contextual relevance to the advisory group.

Process: Selection criteria of individual papers must be explicit, including those excluded for specific reasons. The way different pieces of evidence are weighted on relevant criteria needs to be transparent. Chosen methods for combining evidence should be clearly explained, both in why they are the most appropriate and how they affect the view of the evidence as a whole.

It is expected that any output of review work by subjected both to consultation involving stakeholders and expert peers as part of the process, and subject to a peer review at the completion of the review. Final judgements and recommendations given should be explained.

Evaluation: There needs to be a separation of assessment between biological effects, and adverse health effects. The former does not necessarily lead to the latter. It is important to present all sides of an argument, and how each argument leads to its eventual conclusions. It is also important to evaluate how the assessments have

incorporated uncertainties, including how they have described the scope and likely impact of those uncertainties.

Communication: Once complete, an assessment should seek to produce a summary designed for peers and experts, that must comprehensively summarise the work carried out in the report, and must show that the summary adequately reflects the findings in the main body. It must also produce a summary for the general public that is designed to be understood by the lay public.

Following these criteria, there is a COST project in place to assess a number of the EMF reviews from major bodies, including ICNIRP, SCENIHR, and the BioInitiative group. It would be very interesting to see both the findings and the reasoning behind them for this project.

Communicating scientific evidence to the media and the public - Tom Sheldon, Science Media Center

I found this to be by far the worst talk of the conference, and the only one I would have missed by choice. Effectively, the science media centre is a small organisation consisting of 6 relatively non-scientific sceptics whose sole job is to identify what they perceive as misrepresentation of the science by lobby groups or individuals, and respond with an equally strong representation in the other direction.

Despite the nature of the talk, there were certainly some interesting points raised: They believe that lobby organisations should generally know better, and that misrepresentation is likely to be manipulative as opposed to a mistake borne of ignorance, and they believe that anything not in line with the status quo must be inherently wrong. Their selection of "experts" to whom they approach for quotes are largely self-selected (i.e. the experts in the field select other experts in the field), which will lead to a very large bias of experts that believe the same view as each other. Tom was also very explicit that the purpose of the SMC is not to provide a balanced report of the science, but specifically to counter imbalanced science (with the obvious unstated fact that this requires a polarised unbalanced counter, equally likely to be misrepresentative of the science).

It is very apparent that contact with the Science Media Centre is a complete waste of our time, at least until they approach the subject they intend to address from a more scientifically robust direction.

IMBA Session - Omics: New tools for assessing hazards ?

Using microarray studies for hazard identification of potential carcinogens / RF-EMF - Ludger Klein-Hitpass, IFZ – BioChip-Labor

This talk was primarily a methodology talk on in vitro analysis designed to aid the identification of carcinogenic agents. Nothing to report.

EMF risk perception and communication - Franziska Börner, Research Center Jülich

This talk was very much about how the various factors around a possible risk manifest themselves in the public perception of that risk. The case example used was that of the steadily increasing perception of risk surrounding mobile phones. How risk communication is likely to be received by policy makers and the public needs to be understood in order to accurately communicate what the risk is.

She added that there is a strong impact of a number of "hidden" factors on the perception of risk, that are very applicable to mobile technology. People have a natural dislike of exposures that are "thrust upon them", such as the exposures from mobile phone mast, regardless or not of whether the involuntary exposure constitutes a genuine health risk. Also, exposures that are hard to identify (e.g. by being invisible) generate greater concern than risks that can be easily avoided.

She also stated that when popular media cover a given risk, people begin to polarise to either believe that the risk is real or not early on mostly from their own intuition or perception of their experiences, after which it commonly becomes a vicious cycle where they ignore or dismiss evidence that does not support their belief and feel vindicated when evidence appears that supports the pre-existing perception. This is the most common reason for "cherry picking" of evidence on both sides of the debate.

I asked a public question on, considering the qualifications and background of many of the experts selected to pass judgement on EMF issues, why their opinions were not trusted by policy makers and the general public to the extent that the European Parliament has sought scientific opinions from other bodies such as the BioIniative working group. Her answer was that she didn't know!

Evidence maps as a tool for risk communication - Holger Schütz, Research Center Jülich

Following on from Peter Wiedemann's talk, Holger covered in greater detail the analysis of evidence maps as a risk communication tool.

He explained that there is a reasonable amount of literature demonstrating that evidence maps are an effective tool for peers and experts in similar fields, and proceeded to talk about work that he had carried out on using evidence maps to communicate risk to lay individuals – in this case university students (explicitly not in directly relevant text). The findings were that in general, both a narrative text and an evidence map succeeded in accurately explaining the evidence for a given cause and effect association. However, in certain key areas, such as readability, followability, and ease of understanding, evidence maps scored significantly higher.

It seemed, to me at least, that the conclusions were that "risk communication is already doing its job well enough, but evidence maps allow it to be done slightly better and slightly more efficiently".

Risk communication and cultural diversity

This final section was relatively short, and covered a brief talk explaining how India is the only country out of about 10 who perceive both mobile phones and mobile phone base stations as unlikely to affect public health (from a public perspective), and India being the only country who felt that national legislation of protective levels reduced public concern over the risk factor. A separate short talk from a Japanese representative covered how the EMF issue was viewed in Japan, including some very interesting and relevant points regarding the use of terminology – for example, the Japanese use the same word for precaution and prevention (which is much closer in definition to prevention than precaution), and because of this, special effort has to be made not only in terminology designed for English speaking audiences, but also to ensure that any communication in other languages is checked to ensure the same nuances in language exist in the translated text.

Summary of Day 2

The discussion session really started where day 1 left off, covering areas of scientific judgement. Areas of risk assessment difference between fields, and the varying levels of expertise of the sectors of EMF work were covered, including those of the journals publishing the papers. It was reiterated by a number of speakers how there are a number of techniques available to do really very advanced risk assessment work, and was also very clear that many of these tools were not being actively used by EMF risk assessments and scientific advisory groups in general.

There is also some ground to be made in having a standardised way of assessing the quality of a study in an objective manner that is clear to those reading the assessment on exactly how it has been evaluated, why, and how that adjusts its "weight" compared to other studies.

From the COST talk, it was also relatively clear that there are a number of shortcomings in the methodology of the BioInitiative report from the point of view of it being perceived as an authoritative scientific review. They have stated a few times that it was not intended to be a scientific review in the traditional sense, but it seems that a more formal, transparent, systematic approach to evidence assessment would be a much more productive format for BioInitiative 2 if it is to exist at some point. Many of the criticisms that have been sent in the BI group's direction are unfounded and unreasonable, but there are also some clearly justified criticisms that undermine to some extent the quality of the work that went into the report. It looks like it would be well worth the time of the BI group to work with other risk assessment authorities and scientific advisory groups to make sure that any methodology they use next time is as robust as possible, and has "pre-emptively" answered criticisms with good design if achievable.

It was painfully clear that the SMC are non-scientific in nature despite their grandiose name, and while borne of good intentioned people who feel that people are touting bad science to push their own agendas, in the end they are simply destructive to the public perception of what published science actually says. They are clearly very media savvy however, and make for a very difficult opponent in a head to head battle, both because of their experience in sounding "righteous" and media friendly, and the authority of the contacts they can use.

However, from both their talk and other risk communication talks, it seems that all organisations involved in communicating science to lay groups, be it the general public or organisational institutions responsible for setting policy, could benefit from an adherence to the principles that make a communication inherently "trustable", and follow a methodology that can survive expert scrutiny.