WHO Policy Framework

A Case Study on Electromagnetic Fields

Drs MH Repacholi and TE van Deventer
Radiation and Environmental Health
World Health Organization, Geneva Switzerland
Electromagnetic Fields

Trigger many outrage factors in people:

- Strongly held and different views about potential health impacts; may cause cancer, a dreaded disease, and maybe in children?
- EMFs are ubiquitous; even small risks may have significant public health impact?
- EMF cannot be detected by natural senses; perceived as a radiation that pollutes (electro-smog)
- Potential risks are subject to speculation as well as political and media attention
- Many exposures are involuntary and people feel the lack of any control over the exposures they receive
- Exposure are associated with new technologies that are not well understood
- The benefits of exposure are perceived as being inequitable.
Electromagnetic Fields

- New EMF emitting technologies constantly being introduced; scientists unable to conduct studies fast enough to evaluate safety.
- EMF exposures to people can change with new technologies.
- Science unable to give complete assurance of safety about EMF exposure; unrealistic expectation that science can resolve all issues.

EMF provides an excellent challenge to the Framework
IS IT RISKY?

• A risk is **known** if its existence has been established by evidence generally accepted as proof of cause, according to conventional scientific standards.

• Otherwise a risk is **uncertain**, but may still give rational grounds for **concern**.

RF fields from mobile telephony  Cases  ELF Magnetic Fields  
IARC Class 2B carcinogen
WHO Policy Framework

Health issue in Context
- Known health issue
- Uncertain health issue

Risk Assessment
- Measured risk (risk assessment)
- Uncertain risk (individual and societal values)

Engage Stakeholders

Action Evaluation
- Monitoring compliance
- Monitoring health effects

Action Implementation
- Enforcement of regulations
- Individual and societal actions

Option Assessment and Selection
- Cost-benefit analysis to meet regulations
- Cost effectiveness analysis to reduce exposure/effect

Option Generation
- Technical solutions to meet regulations
- Measures to reduce exposure/effect

Existing Risk Management Frameworks (known risks)
WHO Policy Framework (uncertain risks)
# Health Issue in Context: ELF

## Present Situation: IARC (2002)

| • Childhood leukaemia and ELF magnetic fields | • 2B carcinogen  
  • Warrants thorough consideration of precautionary measures with detailed cost-effectiveness analysis |
| --- | --- |
| • Other childhood cancers  
  • Adult cancers  
  • Other health outcomes (provisionally)  
  • Electric fields | • Class 3  
  • Consideration of precautionary measures limited to low-cost interventions, if any |
Health Issue in Context

Social and health context
- Disease affects children
- Disease is perceived with dread
- Exposure largely involuntary
- Exposure burden sometimes on lower socio-economic status groups

Sources of exposure
- Transmission and distribution circuits of electricity
- Wiring in buildings (homes and schools)
- Domestic appliances, electric transport systems …
Risk assessment

- Epidemiological evidence suggest a RR of 2 for long-term average fields in homes of 0.4 μT or more
- Uncertainty as to causality
  - bias, confounding, misclassification,
  - absence of supporting evidence from in vivo and vitro experiments
  - consideration of mechanisms

Key uncertainties and gaps in knowledge

- Relevant aspects of metrics of exposure
- Exposure-response relationship
- Period and duration-response relationship
Precautionary measures

- Do nothing
- Research
- Communications
- Engineering measures
  - Enforcement of existing approved wiring practices in distribution systems and buildings
  - Changes to distribution wiring practices to reduce ground currents
  - Other engineering changes to distribution or transmission systems
  - Changes to design of appliances
- Planning measures
  - Building new lines away from population centres and schools
- Exposure limits

Options selected will depend on the country
Power in the legislature

WOODBRIDGE - Answering the outcry from their constituents, state Rep. Themis Klarides and Senator Joseph Crisco introduced legislation last week restricting power line installation near schools, playgrounds, preschools, licensed day care centers and religious institutions.

In the past two months, parents, along with town officials, have expressed their concerns over the adverse health effects of electro magnetic fields (EMF) on children.

Each of Woodbridge’s six school facilities lie within a few hundred feet of the existing power lines. The power companies are proposing a 345-kilovolt (kV) line
Cost-effectiveness consistent with risk

- Uncertainty as to causality, exposure,…
- Full range of costs of each measure, both financial and non-financial costs and any redistribution of the burden of exposure
- Incidence of childhood leukaemia and fraction attributable to ELF magnetic fields is very low
- Number of children a given precautionary measure would benefit

**Cost-benefit analysis:** compare cost of a measure with notional figure expressing the value the society places on preventing a fatality or case of disease: CANT DO!!

**Cost-effectiveness analysis:** compare effectiveness of a measure with alternative ways of achieving similar benefit
<table>
<thead>
<tr>
<th>Option</th>
<th>Relevant Factors in considering Benefits</th>
<th>Relevant Factors in considering Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do nothing</td>
<td></td>
<td>No possibility in reducing burden of disease</td>
</tr>
<tr>
<td>Research: Precautionary option?</td>
<td>Ability to remove uncertainties and allow better future decision making</td>
<td>Opportunity cost of research into other risk factors not carried out</td>
</tr>
<tr>
<td>Remove wiring errors</td>
<td>May have safety benefits (including lower exposure)</td>
<td>Significant part of the cost may be in identifying instances</td>
</tr>
<tr>
<td>Changes to grounding practices</td>
<td>Benefits from reducing fields should be set against other safety factors (e.g. electric shocks)</td>
<td>Costs may vary greatly between new and existing installations</td>
</tr>
</tbody>
</table>

...
<table>
<thead>
<tr>
<th>Option</th>
<th>Relevant Factors in considering Benefits</th>
<th>Relevant Factors in considering Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changed planning regime</td>
<td>Might facilitate building of new facilities and thus save money</td>
<td>Costs may include sterilization of land use, devaluation of property, and compensation payments (dependent on regime in each country)</td>
</tr>
<tr>
<td>Changed appliance design</td>
<td>From epi studies, no clear link and thus any benefit should be appropriately reduced to reflect this uncertainty</td>
<td>Increased cost (or size, weight, ...) may be offset by providing choice to customer along with information</td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Precautionary measures

- Voluntary codes, encouragement and collaborative programmes seem most appropriate
- Stakeholder involvement
  - Government, industry (electricity, appliance manufacturers), academics, citizen groups, planners, school officials, real estate professionals
Action Evaluation

- Monitoring compliance (mandatory measures) or uptake (voluntary measures)
- Monitoring health effects (cancer registry, …)
- Monitoring most recent information (Ministry of Health, commission of experts, international organization, …)
Process is iterative
Ever more sophisticated RF technologies with different exposure situations
Increasing # of mobile phone users; exposures close to the body
Increasing # of children using mobile phones
Increasing # of base stations; 24 h/day exposure
Concern from the public about consequences of long-term RF exposure
# Health issue in context

<table>
<thead>
<tr>
<th>Sources</th>
<th>Relevant characteristics of exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Broadcast transmissions</strong></td>
<td>Virtually all the population exposed, at relatively low level, continuously, for many decades</td>
</tr>
<tr>
<td>Radio and TV broadcasts at frequencies from roughly 100 kHz to 100 MHz, at relatively high power from a small number of fixed locations</td>
<td></td>
</tr>
<tr>
<td><strong>Cellular communications infrastructure transmissions</strong></td>
<td>Virtually all the population exposed, at relatively low level, continuously though at varying strengths, with exposure growing from zero to present values over roughly one decade</td>
</tr>
<tr>
<td>Principally for mobile phones, at frequencies from 400 MHz to 2 GHz, but also including a growing range of other cellular systems. Base stations operate at low power from a large (and rapidly growing) number of locations each serving a small area</td>
<td></td>
</tr>
<tr>
<td><strong>Cellular communications handsets</strong></td>
<td>Large number of relatively high individual exposures, principally to the brain, approaching (and in earlier years probably sometimes exceeding) ICNIRP exposure limits, but only intermittently (during use of the device)</td>
</tr>
<tr>
<td>Principally mobile phones. Usually operated in close proximity to the body, but only intermittently</td>
<td></td>
</tr>
</tbody>
</table>
Mobile phone networks are replacing land line systems in developing countries
Many hazards are known

Children?
Public concern about base stations, has continued for some years in many countries. Possible health consequences being the main reason.....
Base stations on WHO buildings
Microcells are also installed, both and inside buildings, in locations with high numbers of mobile phone calls.
Our perceptions can be wrong. This is why we need good science to confirm the facts.
Risk Assessment

- Peer-reviews of science have not indicated health consequences below international guidelines
- Insufficient studies to ensure safety of children
- Gaps in knowledge (WHO research agenda)
- Likelihood mobile phones causes cancer or effects on mental functioning, is probably small, but cannot be completely eliminated
- Global burden of disease from small effects could be large since significant fraction of the world population potentially affected
Assuming evidence for cancer from RF is below an IARC 2B classification (unlikely to be carcinogenic to humans), and since other health effects have not been established, can only consider very low cost or no cost interventions.
Precautionary measures

- Do nothing.. Not popular option with a concerned public. May be expensive if issue becomes political
- Research.. Needed to reduce uncertainty.. level of research?
- Communications.. Essential to maintain public confidence, SAR?
- Engineering measures
  - Enforce existing requirements to keep people away from antennas
  - Sensitive areas? Co-location of antennas? Blend antennas into environment?
  - Measures to keep exposures to those needed for application..
    - Personal.. Hands free kits, call times, others
    - Engineering design…ALATA
- Planning measures
  - EMF radiating structures away from people.. Not facing their appt window??
- Exposure limits.. Should not be lowered arbitrarily in name of precaution
  - Swiss have lower device limits.. not to be confused with exposure limits (ICNIRP)
## Precautionary Approaches

### Examples

<table>
<thead>
<tr>
<th>Approach</th>
<th>Country</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prudent Avoidance</td>
<td>Sweden, Australia, New Zealand</td>
<td>Use ICNIRP values + Low-cost measures to reduce exposure</td>
</tr>
<tr>
<td>As low as technically achievable (ALATA)</td>
<td>Switzerland</td>
<td>Use ICNIRP values + Minimize emission levels</td>
</tr>
<tr>
<td></td>
<td>Italy, Greece, Belgium</td>
<td>Lower ICNIRP values using arbitrary factors</td>
</tr>
</tbody>
</table>
Option Assessment and Selection

Cost-effectiveness consistent with risk

- Uncertainty as any health effects, so keep exposure as low as possible at no or very low cost...
- Review full range of costs of each measure, both financial and non-financial costs and any redistribution of the burden of exposure
- Actions selected should have legal certainty and predictability
Precautionary measures

- Voluntary codes, encouragement and collaborative programmes seem most appropriate
- Stakeholder involvement
  - Government, industry (mobile operators, manufacturers), academics, citizen groups, planners, school officials, real estate professionals
Action Evaluation

- Monitoring compliance (mandatory measures) or uptake (voluntary measures)
- Monitoring health effects (cancer registry, …)
- Monitoring most recent information (Ministry of Health, commission of experts, international organization, …)
Challenge

• Purpose of this meeting is to challenge to procedures, usefulness and practically of the Framework
• What are the weaknesses and strengths
• Are there flaws that need addressing?

Look forward to your critique, help and input

Merci!