Investigation To Examine Electromagnetic Interference On Bio-Products: Past And Current Perspectives And Activities

Abhijit Dey[1]
M.Tech (RF & MWE)

Peta Venkateswararao [2]
M.Tech (RF & MWE)

Vijay Kambam [3]
M.Tech (RF & MWE)

Department of Electronics and Communication Engineering
GIT, GITAM University, Visakhapatnam, India.

Abstract: *In this paper the biological prospects of electromagnetic interference is carried out. Various experiments on bio-products are impletemented, to verify the impact of electromagnetic interference .Electromagnetic interference (EMI) from radio frequency sources may cause variety of devices to malfunction. As a result, an investigation to examine the bio-products due to interference from electromagnetic was carried out. The outcomes are considered for better modifications of electromagnetic compatibility or equipments susceptible for interference.*

Keywords: EMI, Bio-products, Radiofrequency, Electromagnetic compatibility, genetic engineering.

1. Introduction:

What are Bio-products-

Bioproducts are products that are made from biomass. Biomass is any type of organi**c** material that is available on a renewable or recurring basis. It includes such things as crops and trees, wood and wood wastes, aquatic plants and grasses.

Bioproducts today include everything from electrical power and liquid fuels to products, such as shampoos, plastics, fabrics and solvents. They are manufactured using energy, chemicals or processes derived from biological materials (living organisms and dead matter). In large measure, they come from forestry, agricultural and aquatic sources. They may or may not involve the use of advanced technologies, such as **genetic engineering**.

Electromagnetic interference (EMI) is any type of interference that can potentially disrupt, degrade or interfere with the effective performance of an electronic device. Modern society is dependent on the use of devices that utilise electromagnetic energy such as power and communication networks, electrified railways, and computer networks. During the generation, transmission and utilisation of electromagnetic energy, the devices generate electromagnetic disturbance that can interfere with the normal operation of other systems.

Electromagnetism may affect organisms in both negative and positive manner which includes acceleration of growth and metabolism. This paper however focuses on the facilitative effects of Electromagnetism on various organisms and bio-products.

Electromagnetic interference has been responsible for malfunction of many bio-products in many ways. The medical devices malfunctions due to EMI.However the incidence of unreported EMI malfunctions is unkown.In 1994, a radiofrequency susceptibility test on medical equipments was carried out by Medical Devices Bureau in Canada. Between 1984 and 2000, Health Canada's Medical Devices bureau received thirty-six reports of medical device malfunction attributed to EMI. Some kinds of medical equipment, such as ventilators, infusion pumps, defibrillators with an electrocardiogram (ECG) monitor and fetal monitors, were found to be quite susceptible to EMI within the frequency band of interest. The Experiments on medical equipments includes report on Interference of an electrosurgical device with the electrocardiogram signals displayed on the monitor of an automated external defibrillator; Complete inhibition of pacing signal of a pacemaker by pulsating magnetic field from a video display terminal.

Dr Ulrich Warnke of the Institute of Technical Biology and Bionics in Saarbrücken described the biological effects of certain microwave frequencies on plants. Depending on the frequencies, their intensity and modulation and the length of exposure, scientific studies demonstrated stress reactions and disruptions of gene expression. Recent

studies by the cellular biology laboratory of Clermont- Ferrand University (2007), for example, clearly show the effects of mobile telephony microwaves on plant genes, in particular tomato plants.

Other scientific international studies show comparable stress reactions in certain types of beans, as well as deciduous and coniferous trees exposed to various frequencies (relay antennas, TETRA frequency). the ICNIRP when that private association was set up near Munich at the beginning of the 1990s.

2. Methadology:

Medical Equipments:

Ad hoc Testing for the Susceptibility of Medical Devices to EMI from Wireless telecommunication Devices

Portable medical devices were tested in a vacant hospital room while permanently mounted ones were tested on site. Each device was used under normal operating conditions. Four models of analog cell phones with maximum power of 0.6 W and 4 models of two-way radios with powers varying from 2 to 5 W were tested. The susceptibility of the device to EMI from wireless telecommunications devices was first tested at a distance of 3 m from the telecommunications device. When EMI was not observed, testing was repeated at shorter distances until an effect was observed or until the telecommunication device was within 2 cm of the medical device. At each distance, tests were first done with the antenna in a vertical position and at different heights from ground level to the height of the medical device. All tests were repeated with the antenna in a horizontal position and at the back, top, and both sides of the medical device. All distances were measured parallel to the ground from the base of the antenna on the telecommunication device to the face of the medical device under test. After each test, the medical device was checked to confirm that it had not been permanently damaged or reprogrammed by EMI.

In vitro Testing on Implantable Cardiac Devices

The setup for testing the susceptibility of implantable cardiac pacemakers to EMI was identical except that a human torso simulator was used to simulate a human chest. It consisted of a plastic box filled with 0.18% saline solution (0.03 M). The plastic box was placed horizontally on top of a table for testing wireless telecommunication devices and vertically on a table with moving wheels for testing with electronic security systems. The pacemaker and its leads were mounted on a grate and were totally submerged in saline. The leads formed a semi circle with a diameter of about 20 cm in a form of a brass clef and were fastened onto a grate. Below figure 1 shows the schematic diagram of the experimental setup.

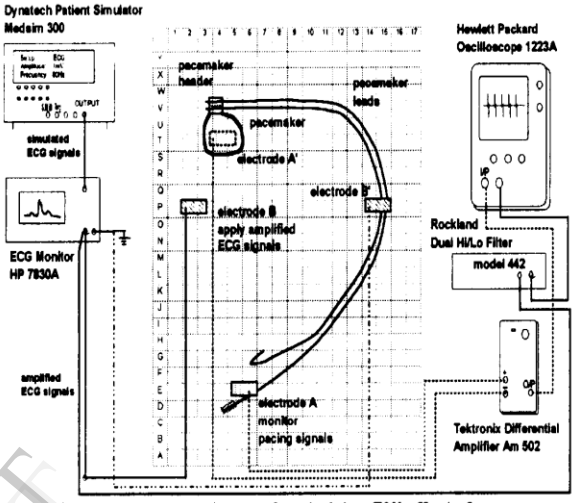

Figure 1 Experimental setup for studying EMI effects from radio-frequency sources on implantable cardiac pacemakers

Two stainless steel plates were used to monitor the electronic activity of a differential amplifier and the signal from the amplifier was displayed on a storage oscilloscope. Simulated electrocardiographic (ECG) signals from a patient simulator were display on an ECG monitor. The amplified ECG signals from the monitor were applied to two other stainless steel plates which were mounted perpendicular to the first two and were used to apply simulated ECG signals that would inhibit the pacemaker. Implantable defibrillators were tested using the same setups.

Animals:

Impacts on flora & Fauna:

Dr Warnke highlighted the innate magnetic compass used by certain animals or insects to orient themselves in time and space and which dictates the internal functioning of their organism, before going on to demonstrate how extremely weak artificial fields or waves could adversely affect the sense of direction, navigation and communication of certain animals or insects: migratory birds, pigeons, certain kinds of fish (sharks, whales, rays) or certain insects (ants, butterflies and especially bees).He suggested

that malfunctions induced by artificial electromagnetic waves might be one of the major causes – besides problems of exposure to chemicals – of repeated incidents of whales being washed up on beaches or the death or disappearance of bee colonies (colony collapse disorder) observed in past years.

The great multitude of scientific studies quoted during the hearing of experts should certainly prompt policymakers to reflect on their decisions and act accordingly. One final aspect mentioned during the hearing concerned the potentially pathogenic effects observed in livestock – calves, cows, horses, geese, etc. –following the installation of mobile telephone masts nearby: unaccountable deformities of new-born calves, cataracts, fertility problems. In the face of fast-growing concerns and opposition in many Council of Europe member states, the response of top executives of electricity companies and mobile telephone operators is to deny that their industrial and commercial activities have any adverse effect on human health.

At the hearing in Paris on 25 February 2011, the official representatives of French and European mobile telephone operators passionately argued that the official threshold values applicable in most countries in the world were adequate to protect human beings from the thermal effects of mobile telephones and that any biological effects, if these could be demonstrated, would not have any adverse effects on human health. To back up their argument, the experts quoted the scientific assessments carried out by associations such as the International Committee on Non-Ionization Radiation Protection (ICNIRP), a small private NGO near Munich, or by official organizations: the World Health Organization, the European Commission and a number of national protection agencies. It appears that these European and national organizations or international bodies have based their thinking on the threshold values and recommendations advocated by the influence of offshore wind farms on birds can be summarized as follows:

- Collision risk.
- Short-term habitat loss during construction phase.
- Long-term habitat loss due to disturbance from wind turbines installed and from ship traffic during maintenance.
- Barriers to movement in migration routes.
- Disconnection of ecological units.

The methodology proposed by Fox to support EIA of the effects on birds of offshore wind farms reveals the great complexity of the analysis. The relationships between offshore wind farms and bird impacts must be analyzed by gathering information about avoidance responses, energetic consequences of habitats modification, avoidance flight and demographic sensitivity of key species.

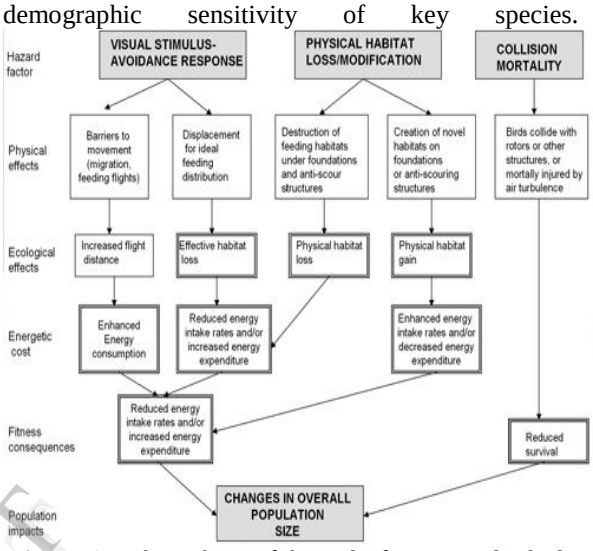

Figure 2: *Flow chart of hazards factors to birds by offshore developments. Boxes with solid frame indicate measurable effects. Boxes with double frame indicate processes that need to be modelled.*

Collisions have the most direct effect on bird populations.

Collision rates for wintering waterfowls, gulls and passerines on coastal areas in Northwest Europe range from 0.01 to 1.2 birds/turbine. No significant population decline has been detected. Direct observations from Blyth Harbour, UK, have demonstrated that collisions with rotor blades are rare events in this wind farm located within a Site of Special Scientific Interest and Special Protection Area, under the Birds Directive.

In poor visibility conditions, large numbers of terrestrial birds could collide with offshore wind farms, attracted by their illumination. This occurs only on a few nights. Passerines are the group mainly involved in these collisions. One of the most useful mitigation measures to avoid this type of impact is to replace the continuous light with an intermittent one. There is a lack of good data on migration routes and flight behavior of many of the relevant marine birds' species. But this data is essential for assessing the potential impacts of collisions and barriers to movements. The large scale of proposed offshore

wind farms together with the expected cumulative effects increase the need to fill in these gaps.

Disturbances during construction are produced by ships and/or helicopter activities and noise generated by ramming piles. After that, in the operation stage, disturbances by boat traffic have an impact on birds. The impacts of marine wind farms are higher on resident sea birds, coastal birds and migrant birds than those on onshore birds. The reasons for this higher impact at offshore developments is related to the larger height of marine wind turbines, the larger size of wind farms and the higher abundance of large bird species, which are more sensitive to disturbance.

During the last several years, a lot of methodologies on collision risk models, baseline surveys both using ship and aerial techniques and post-construction monitoring have been developed. This data is needed to properly assess and predict the future impacts of proposed wind farms. Several sophisticated technologies such as radars, infra-red cameras, etc. have helped to gather a better understanding. There is a common opinion on the need for more information about potential impacts of wind farms on birds. Further research is required on avian responses to wind farms, models to predict the future impacts of a new single wind farm installation and groups of wind farms on an area, the collection of information on bird movements to design the marine sanctuaries of birds, and data gathering standardization methodologies.

3. Conclusion

The potentially harmful effects of electromagnetic fields on the environment and human health have not yet been fully elucidated and a number of scientific uncertainties continue to exist in that regard. Nevertheless, anxieties and fears remain in wide sectors of the population over the health hazards posed by the waves, and also of the demands voiced by high-level scientists, by groupings of doctors and by the associations of concerned citizens which abound in many Council of Europe member states.

After analysing the scientific studies available to date, and also following the hearings for expert opinions organised in the context of the Committee on the Environment, Agriculture and Local and Regional Affairs, there is sufficient evidence of potentially harmful effects of electromagnetic fields on fauna, flora and human health to react and to guard against potentially serious environmental and health hazards.

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ABHIJIT DEY is presently pursuing M.Tech in ECE with the specialization of RF&MWE from Gitam Institute of Technology, GITAM University, Visakhapatnam, A.P, and India. . He has done his B.E in Electronics and Communication Engineering from S.S.G.B College of Engineering & Technology, Maharashtra, India.

PETA VENKATESWARARAO is presently pursuing M.Tech in ECE with the specialization of RF&MWE from Gitam Institute of Technology, GITAM University, Visakhapatnam, A.P, and India. . He has done his B.E in Electronics and Communication Engineering from S.S.I. of Engineering & Technology, AP, India.

VIJAY KAMBAM is presently pursuing M.Tech in ECE with the specialization of RF&MWE from Gitam Institute of Technology, GITAM University, Visakhapatnam, A.P, and India. . He has done his B.E in Electronics and Communication Engineering from Sri Kottam Tulasi Reddy College of Engineering, AP, India.