



27 January 2015

Rainbow Farms objection to the proposed Isundu 765/400kV sub-station, Ashburton, KZN (DEA EIA Ref: 14/12/16/3/3/2/745; 12/12/20/1397/AM2)

1. Project Proposal

As part of Eskom KZN's strengthening Programme, Eskom intends to improve the electricity transmission network to the KZN Midlands and Southern KZN. Investigations have been underway since 2009 into the development lines from the existing Venus sub-station near Estcourt, to a proposed sub-station (Sigma) to be located in the KZN Midlands. Once the proposed sub-station has been completed, two additional 400kV lines will be constructed from this sub-station to the existing Hector and Ariadne sub-stations.

The proposed substation is a MAJOR substation and the impacts will be commensurate with its size.

The Environmental Impact Assessment was completed and Environmental Authorisations were issued on 11 June 2012. However, subsequent geotechnical investigations on the proposed Sigma substation site have determined that the earthworks and foundations required on the site will be prohibitively expensive and therefore Eskom commenced investigations into alternative sites. Sixteen sites were investigated, and the Isundu site proved to be the only viable site.

Acer (Africa) has commenced an Environmental Impact Assessment Process for the proposed Isundu sub-station and Eskom is applying for amendments to their Environmental Authorisations for the re-routing of the proposed powerlines.

This report forms part of the Rainbow Farms input into the Environmental Assessment process for the substation site and it is assumed that they will also be contacted as part of the amendment process for the powerline authorization amendments.

2. Rainbow

There are 11 Rainbow Farms operations in the vicinity of the proposed development.

Farm Number	Type of Farm	No of Chickens	Distance from Proposed Development
L1	Layer	42 000	0.76km
L2	Layer	42 000	0.52km
L11	Layer	42 000	1.64km
L12	Layer	42 000	1.34km
L13	Layer	42 000	1.24km
L14	Layer	42 000	0.33km
L15	Layer	42 000	1.33km
B14	Broiler	378 000	1,9km and 2.5km
B13B	Broiler	124 000	3.7km
B12	Broiler	434 000	3.5km
B13A	Broiler	434 000	3.9km

The sites closest to the proposed substation (the laying farms) were originally chosen (as with all laying farms) for several critical reasons:

- Water availability and rights
- Farm size (approximately 500ha)
- Isolated from other poultry farms and other biosecurity risks
- Isolated from activities generating noise/dust
- Good road access
- No land claims
- Accessible to other Rainbow operations

Obviously the proposed development will change some of these criteria for the existing farms.

There is therefore a potentially significant impact on the laying farms, which are all within 1.5km of the proposed substation site.

It is submitted that the issues related to the effects of EMFs on the birds and staff, lighting, noise and disturbance during and after construction and biosecurity are potentially significant issues in the project proposal when considered in relation to surrounding land use (the Rainbow Laying Farms). These issues are explored in more detail in the following report.

The exact location of the powerlines and associated servitudes has not been provided in the Background Information Document and comment cannot be made on these at this stage. The potential impacts on the Rainbow operations must be considered when the lines are sited.

3 Impact of the Proposed Development on the Rainbow Farms Operations

Laying operations (ie those which produce the eggs, rather than broiler operations which is where the chickens are made ready for the market) are extremely sensitive to disturbance.

Laying hens are highly susceptible to any form of disturbance and can stop laying for up to two weeks as a result of a single incident (disruption of water supply, loud noise etc).

The financial and supply chain implications of a disturbance are massive to Rainbow and the large percentage of South Africa's population for whom chicken is the main source of protein.

A study undertaken for the Roodewaal Breeding farm illustrated that the loss of one breeding farm, assuming that it could be re-established within 1 breeding cycle, had a financial impact of about R540 million. This is obviously a significant potential impact should the operation be adversely affected by the proposed substation. The logistical and financial implications of having to move a Rainbow farm as a result of incompatible land uses are even greater.

Risks to Rainbow poultry operation

Rainbow's sustainability Report 2010 lists the following as being sustainability risks to the business:

- Fires
- Air pollution
- Natural Resource depletion
- Hazardous chemical, diesel and gas spillage
- Odours from processing plants and mills
- Poultry disease outbreaks on farms
- Energy consumption
- Ground and surface water pollution
- Waste disposal
- Water shortages and water quality.

Not all of these threats are relevant to the proposed substation development, but the key threats relating to the proposed substation in such close proximity to Rainbow's farms include:

- **Effects of EMFs on breeding birds**
- **Light pollution**
- **Traffic**
- **Noise**
- **Air Quality/Land Use**
- **Biosecurity**

These are explored in more detail below:

3.1 Effects of electrical emissions on breeding birds

High Voltage Transmission Lines and associated substations generate several types of emissions, these include electric field effects and magnetic field effects. The electric and magnetic effects are known cumulatively as EMFs (electromagnetic fields). Electricity transmission in this country is carried out at 50 cycles per second, so the substation should not produce microwaves.

A great deal of research has been undertaken on the effects of EMFs on various animals and people. Most studies indicate that EMF exposure in birds generally changes (although not always consistent in direction or effect) the behavior, reproductive success, growth and development, physiology and endocrinology and oxidative stress under EMF conditions.¹

¹ Journal of Toxicology and Environmental Health, Volume 8, Issue 2, 2005. The Effects of Electromagnetic Fields from Power Lines on Avian Reproductive Biology and Physiology: A Review. Kim J Fernie and S James Reynolds.

The study goes on to state that:

'Given the multiple roles that melatonin plays in the body, and the circadian and circannual rhythms of birds, some of which are critical to survival, research needs to identify the ramifications of suppressed melatonin concentration and altered seasonal patterns as a result of EMF exposure. For birds, the timing of reproduction, multiple aspects of migration, seasonal metabolism, circadian physiology, feeding and sleeping patterns, plumage colour changes that relate to mate selection, growth and development, and the oxidative stress of an individual may all be expected to change when melatonin is altered under EMF conditions. Changes in melatonin and moult seen in the captive kestrels raise interesting questions regarding how birds perceive EMFs from power lines. Are they seeing EMFs as light? What other wavelengths in the light spectrum are detectable by birds and do they influence their biology and physiology? What physiological mechanisms do birds use to detect EMFs?

Finally, more research is required in relation to the protracted and continuous exposure to some avian species to EMF producing power lines throughout their lives, and the probability that they experience persistent elevated immune responses and oxidative stress'.

These issues are critical to determine in order to predict any potential impacts of such a large substation and associated powerlines in close proximity to the Rainbow Laying Farms.

Birds seem particularly susceptible to the effects of EMFs, as the results for humans is less conclusive. In 'Biological and Medical Aspects of Electromagnetic Fields' (Frank S Barnes and Ben Greenbaum – Eds) there are reports of teratogenesis in chick embryos which are exposed to high EMF flux densities.

Farrell et al (1997) found that steady, oscillating EMFs increase the rate of neural abnormalities in chicken embryos by a factor of approximately 2.5.

In 'The EMF Biochip Technology-Neutralising the effects of EMF Field' Klintestam and Bak found that EMFs doubled the activity of Ornithine Decarboxylase (OCD – an enzyme involved in DNA and cell reproduction) in chick embryos. This has been linked to an increase in abnormalities in the spinal cord.

In their paper on the mortality rates of chicken embryos exposed to EMFs from mobile phones, Youbicier-Simo et al found that the mean total death rate for embryos exposed to EMFs from the mobile phones was six times higher than the control group.

It should be noted that there is a significant amount of literature available on the subject of the biological effects of EMFs. It appears conclusive that birds are more susceptible to the effects of EMFs than other species, but the effects vary with factors such as the distance from the source of EMFs, the frequency of the EMF and if the EMFs were constant or variable in frequency.

If it cannot be proven that the frequency, distance and type of EMFs which will be produced by the substation and will not have any effect on the laying chickens, the precautionary principle must be applied and the substation placed away from the Rainbow operations.

3.2 Light Pollution

It is anticipated that the substation will have security lighting. This will be a significant issue for the Rainbow laying farms which are located in close proximity to the proposed substation. This will affect the photostimulation of the breeding birds for reproduction, as the chickens rely on several factors, including lighting to reproduce. If, as stated in several research papers, EMFs affect the melatonin levels in the birds, this will exacerbate any light pollution issues by further confusing the circadian rhythms upon which the birds rely for reproduction.

3.3 Traffic

There will be a significant increase in traffic past several of the farms as a result of the development, particularly during the construction phase. This could have a significant impact on the chicken operations as the additional traffic on the road will affect dust, noise and biosecurity at their operations.

3.4 Noise

Chickens are extremely sensitive to any unusual activity (Rainbow ensure that the same people, dressed in the same clothing enter the houses to do the same jobs at the same time to prevent stress to the chickens – pers com K Stoltz – Rainbow operations).

Noise levels associated with the proposed activities may be significant and the noise and disturbance will have an effect on the chickens.

A study undertaken in 2008 (Stress in Broiler chickens Due to Acute Noise Exposure) revealed that broiler chickens are severely affected by sudden loud noise, their plasma corticosterone levels (stress hormone) increased significantly when exposed to sudden noises of 80dBA and above (Chloupek P et al, University of Veterinary and Pharmaceutical Sciences in Brno, Czech Republic).

Loud noises and extreme stress in chickens can also result in ‘bundling up’ and ‘smothering’, where the chickens huddle together, causing suffocation and injury.

Construction activities (the substation will be built very close to the Rainbow Laying Farms) and the presence of the substation within such a short distance of the chicken farms will increase the noise levels in the area. Substations are known to emit a low frequency electrical hum from the transformers which may affect the chickens in the long term. Upset conditions, such as a short circuit at the substation, or a fire, for example, could produce significant short term noise.

3.5 Air Quality/Land Use

As discussed previously, chickens are highly susceptible to disease. Therefore any reduction in air quality (increase in dust and pollutants) or increase in stress, is likely to increase the risk of disease (respiratory diseases or airborne microorganisms).

Many activities increase the levels of dust in an area and also increase the prevalence of airborne microbes (more people in the area, more contact with other animals, birds etc). Dust in the air also acts as a carrier for diseases. Therefore the proposed activities (particularly during construction) will have a negative effect on air quality in close proximity to the Rainbow operation. This, in addition to the increase in stress, could have a catastrophic effect on the chickens, significantly increasing mortality rates etc.

Source: NSW Agriculture 1993

“Any increase in the number of land users in proximity to an existing poultry farm will increase the potential for conflict because of an increase in the number of odour, dust, noise and light receptors, an increase in the number of people viewing the site and the potential for collective action by those people” Cessnock DCP.

There is a great deal of research and guideline information available from Australia with regard to the conflicts between poultry farming and other conflicting land uses. The Cessnock report refers to the ‘Zone of Affection’ of existing poultry farms – an area where serious planning consideration must be applied to ensure the minimization of potential future conflict. The zone of affection is determined by factors such as topography, vegetation, wind directions, type of chicken farm, management practices etc.

The proposed substation will increase the cumulative impacts on these parameters, as it is in such close proximity to the Rainbow establishment. These impacts will also affect the Rainbow operation.

3.6 Biosecurity

‘Prevention is better than cure’ is a concept which permeates biosecurity policy (IUCN 2000; Defra 2004). This must be considered throughout this document.

3.6.1 What is Biosecurity?

According to the US Environmental Protection Agency (EPA), Biosecurity is the protection of agricultural animals from any type of infectious agent -- viral, bacterial, fungal, or parasitic. People can spread diseases as they move within a facility and from one facility to another. Animals or equipment introduced into a facility can bring pathogens with them. Among the many biosecurity procedures that can prevent these types of disease transmission are such measures as showering of personnel, use of protective clothing, waiting periods for new animals and visitors, and cleaning.

“In less than a day, a single microbe (germ) can reproduce and multiply to a number greater than the number of people on earth” Thepoultrysite.com.

The objectives of biosecurity are:

- To prevent the introduction of infectious disease agents to poultry,
- To prevent the spread of disease agents from an infected area to an uninfected area,
- To minimize the incidence and spread of microorganisms of public health significance,

Biosecurity is about managing the risk to meet the objectives stated above.

Disease control is also significantly affected by stress management with the birds, as stressed birds are far more susceptible to disease than non stressed birds. Therefore biosecurity also includes the management of stressors within and around the chicken farms.

3.6.2 Diseases in chickens

Dr Ivan Dinev, in his book 'Diseases of Poultry', lists over 40 common diseases which afflict poultry. The Poultry site.com lists over 140 poultry diseases and conditions. These include bacterial diseases such as *Escherichia coli* infections, salmonellosis, paratyphoid infections, fowl cholera, Infectious coryza (*Avibacterium paragallinarum* – the main infection carried by people and equipment) infections, mycoplasma, necrotic enteritis, botulism and avian tuberculosis.

Viral diseases include Newcastle disease, infectious bronchitis, swollen head syndrome, fowl pox, reovirus infections, laryngotracheitis and avian influenza.

Fungal risks include aspergillosis which can be introduced by spores (from contact for example for sugar cane etc). There are also several diseases caused by protozoa and parasites (intestinal worms, lice, mites etc).

All of these diseases are infectious and the chickens must be protected by the biosecurity provisions within the chicken farming area.

It should be noted that microbes (bacteria and viruses) can travel hundreds of kilometers on vehicles, people etc and that many can survive for days and weeks on other vectors. Mycoplasma can survive for months without a host (Abolnik C and Gouws J "Extended survival times of *Mycoplasma galloisepticum* and *Mycoplasma synoviae* on kanekalon synthetic hair fibres").

3.6.3 What are the implications of disease outbreaks?

A number of high profile disease outbreaks have occurred in recent years, according to Wade and Mumford (2008), the 1997 outbreak of swine fever in the Netherlands cost the country about R41 billion, the foot and mouth disease outbreak in 2001 cost the UK approximately R119 billion, whilst the outbreak of bovine spongiform encephalopathy in Canada and the USA is estimated to have cost each country about R68 billion in lost trade.

The economics of disease outbreak cannot, therefore, be refuted. Chickens, and in particular, laying chickens, are highly susceptible to disease and biosecurity is therefore absolutely critical to the industry.

The Rainbow operation relies on a chain of activities, from the importation of 'grandparent' chicks from the UK (and sometimes the Netherlands) on a 5 week basis, through the rearing and growing of the chicks, when they are transferred to laying farms where they mate and produce eggs. The eggs are hatched and the process is repeated at the parent breeding farm. The eggs produced by the 'parent' generation are hatched and taken to 'broiler' farms where they are grown for the meat market.

The laying and rearing portions of the operation are the most susceptible to stress and disease and loss of a large number of chickens in either of these parts of the process will have a significant 'knock-on' effect though to the meat production phase of the process.

It should be noted that if there is any breach in biosecurity anywhere along the supply chain, the export licence for that particular chain will be revoked and this will result in the prohibition of exports (eggs, chickens and meat) from that line until it is proven to the state veterinarian that the biosecurity has been satisfactorily re-instated.

From: thepoultrysite.com:

Swedish Newcastle Disease Outbreak Affects Egg Layers

20 June 2014



SWEDEN - The Swedish veterinary authorities have reported an outbreak of Newcastle disease at a poultry farm located in Östergötland County (or Östergötlands län), situated in southeastern Sweden.

The World Organisation for Animal Health (OIE) received an immediate notification on 19 June. According to the report, the outbreak was initially observed on 17 June at an establishment with 24,000 laying hens kept indoors. The OIE reports that there was a history of egg drop.

On 19 June, a real-time PCR test was carried out at the National Veterinary Institute. The test confirmed the presence of the causal agent, Paramyxovirus type 1.

A total of 24000 hens were found susceptible, out of which all birds were affected, indicating a 100 per cent apparent morbidity rate. All 24000 laying hens were destroyed.

According to the OIE, a protection zone (3km) and a surveillance zone (10km) have been put in place around the farm. All other measures according to Directive 92/66/EEC have also been applied as a precautionary measure.

Stamping out, movement control inside the country and zoning are among some of the control measures that have been applied to contain the situation. None of the affected birds received vaccination or treatment.

3.6.4 Major Routes for Disease and Pathogen Transmission in Poultry

Diseases are categorized by their ability to cause mortality, the rate at which they spread, the route by which they are spread and their economic impact on the industry.

Infectious diseases are most commonly transmitted by fomites.

A fomite is a mechanical transporter of an organism from one place to another. People, particularly their hands, hair, clothing, footwear and vehicles are the fomites which pose the greatest risk. Other fomites include dust, feathers, vermin and predators (especially carrion eaters such as crows).

Formites are listed below to give an indication of the number of risks to the chicken operation:

Animals

- Wild birds (carry Avian influenza, Newcastle Disease, Salmonella, Mycoplasma).
- Feral and domestic animals, including other livestock and pets (carry Salmonella, Fowl cholera, Psittacosis, Newcastle disease and Camplobacter).
- Insects (eg flies and mosquitoes) – carry Fowl pox, Newcastle disease, Salmonella, Bursal disease, Marek disease etc.
- Rodents – rats/mice (carry Salmonella and fowl cholera).
- Domestic birds (as wild birds).

People

- Farm personnel and family members living on site.
- Contractors, maintenance personnel, neighbours, service person, visitors.
- Disease can be transmitted by, for example, hands, boots, clothing and hair.

Equipment

- Any construction materials or plant and equipment brought from another location.

Vehicles

- Vehicles entering the site may have contamination internally and externally.

Air

- Transmission as an aerosol or dust.

Water Supply

- Water supplies may become contaminated with faeces from contact with avian or other animal species. Contaminated water can cause Avian influenza, Newcastle disease, Coliforms, Salmonella etc.

Feed

- Feed may be contaminated by the raw materials used, post-production and during transport, or by exposure to rodents and birds on the property. Bacteria and mould in poor quality or damaged feed may also be a concern. Contaminated food can cause Salmonella, Aspergillus and mycotoxin diseases.

Litter

- Transport of litter material on and off the farm site as well as storage of used litter on site may be a biosecurity risk due to bacteria in the litter and the attraction of rodents, flies etc.

Any additional activities in close proximity to a chicken farm will increase biosecurity risks by increasing the prevalence of formites in the area and increasing the stress levels in the birds.

4 Summary

The key potential impacts associated with the construction and operation of the substation in close proximity to the Rainbow Chickens operations are as follows:

- **Effects of EMFs on breeding birds**
- **Light pollution**
- **Traffic**
- **Noise**
- **Air Quality/Land Use**
- **Biosecurity**

6 Conclusion

Rainbow themselves require a minimum of a 500m buffer between their operations and other development activities. This distance is deemed to be sufficient to adequately reduce both the impacts of a development on the chicken operations and vice versa. However, as discussed previously the exact zone of affectation must be ascertained more accurately depending on the type of development, the type of chicken operation and the site conditions.

The potential issues relating to the Rainbow operations and the substation must be investigated through the EIA process and specific communication undertaken with Rainbow personnel in order to determine whether there are fatal flaws and identify mitigation options where applicable.

Other points to note, which do not affect Rainbow directly are the fact that the area is a tourism hub and the substation will have a significant impact on the aesthetics of the area and also that the substation is not in line with the municipal spatial development plan.



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