ESKOM HOLDINGS SOC LIMITED

ENVIRONMENTAL IMPACT ASSESSMENT

FOR THE

PROPOSED ISUNDU 765/400 KV SUB-STATION

AND TURN-IN TRANSMISSION LINES

DEA EIA REF: 14/12/16/3/3/2/745; 12/12/20/1397/3/AM2

Veterinary Specialist Report

Report prepared for:

ACER (Africa) Environmental Management Consultants

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Report prepared by:

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1st October 2015.

Dr Horner Experience.

Veterinarian registered with the SA Veterinary Council and registered with the Royal College of Veterinary Surgeons, London.

Thirty years connected with the South African Poultry Industry. Twenty years as a Registered Specialist Poultry Veterinarian. Work within RSA both in the public and private sector and extensive experience with many poultry operations outside of RSA.

Brief CV:

Dr. R. Horner is a Registered Specialist Poultry Veterinarian with extensive field and laboratory experience in the detection, diagnosis, containment and control of outbreaks of poultry diseases including highly pathogenic avian influenza (HPAI). Dr. Horner was a specialist member of the **United Nations FAO Avian Influenza Control Strategy** program. He co-authored the first **South African National Avian Influenza Contingency Plan. Deputy Director - Veterinary Laboratory Services, KwaZulu-Natal, Department of Agriculture, 1997-2005. Specialist Poultry Veterinary Consultant. 2005-present.** Provider of a wide range of poultry pathology and diagnostic services and flock health advice to poultry industries in South Africa and 13 countries internationally.

B.V.Sc. University of Pretoria, Onderstepoort Faculty of Veterinary Science, 1977.

Awards: **1. Theiler Medallist**, (Biological Society of South Africa Award for top veterinary student);

2. Clinical Sciences Prize; **3.** Poultry Diseases Prize; **4.** Virology Prize.

M.Med.Vet (Aves) - Cum Laude, Medical University of Southern Africa 1995.

SAVC Reg NO: S96/0088.

Conflict of Interest.

I confirm that I do not have any conflict of interest with this assignment.

DECLARATION OF INDEPENDENCE

I, __R F Horner_____, declare that –

- ❑ I act as the independent specialist in this application.
- ❑ I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant.
- ❑ I declare that there are no circumstances that may compromise my objectivity in performing such work.
- ❑ I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity.
- ❑ I will comply with the Act, regulations and all other applicable legislation.
- ❑ I have no, and will not engage in, conflicting interests in the undertaking of the activity.
- ❑ I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- ❑ All the particulars furnished by me in this form are true and correct.
- ❑ I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

1st October 2015.

Signed……. Date……...

1. Introduction.

The proposed Isundu sub-station development site lies some 15 km south east of Pietermaritzburg and some 5 km east of Ashburton along the P477 road.
The proposed Sub-Station may thus be constructed in the vicinity of seven broiler breeder parent layer farms and 4 broiler farms owned and managed by Rainbow Farms.
The Breeder layer and broiler farms are to the West and North West of the Sub-Station. The breeder Layer farms range from 416 to 1694 m away and the Broiler farms range from 1452 to 2142 m away from the substation.

A number of specialists have considered possible impacts upon Rainbow from various perspectives such as electromagnetic fields, noise, lighting, blast vibration and noise.

I have been asked as an independent Specialist Poultry Veterinarian to provide assistance in identifying, separating and grading the key issues raised which could impact Rainbow Farms. This to better understand the risks and feasibility of any mitigation options. Details and various measurements applying to the key issues have been presented by specialist groups so that I will only comment on the general principles applicable to these issues as potentially affecting the Rainbow breeder layer and broiler flocks in the area concerned.
A large part of my time has therefore been spent on reading the following specialist reports:

- Rainbow-Eversheds Objections.
- JKA720r004 Noise Impact Assessment Report Second Draft
- 15EDC01 Isundu Substation Air Quality Specialist Input 0_2 (16 September 2015).
- Metamorphosis Rainbow Farms report.

2. Key areas of concern raised by Rainbow Farms and Comments.

Rainbow are concerned that various aspects of the construction and subsequent operation of the proposed sub station will have a detrimental effect on both their parent breeder stock and broiler stock production. This in turn will have direct and indirect significant economic effects on their entire operation as all of their upstream and downstream activities throughout the country are closely linked.

Rainbow Farms have raised the following key concerns:

- Impact of Electro Magnetic Fields.
- Light Pollution
- Traffic
- Noise
- Air Quality – during construction and operation.
- Biosecurity.
- Vibrations.
- Water quality and supply,

1. Electro Magnetic Fields.

I have no direct experience of the effects of EMF on commercial poultry production. This is a more difficult area in which to find specific practical field effects of EMF on chickens or on production parameters. The Metamorphosis Report outlines various areas of research but without giving specific examples of the direct effects on commercial layer or broiler flocks. Research on bird migration has proposed the ability of birds to detect EMF for navigational purposes.

According to Kim J. Fernie & S. James Reynolds in The Effects of Electromagnetic Fields From Power Lines on Avian Reproductive Biology and Physiology: A Review" in Journal of Toxicology and Environmental Health, Part B. 2005:

"A great deal of uncertainty surrounds the findings on the effects of EMF exposure on birds. Most of the uncertainty exists because there has been a limited number of studies involving birds. Despite the limited numbers, much of the research has found that EMF exposure has generally affected birds, and most of the effects have been adverse. EMF exposure, either in the field or at environmentally relevant levels in laboratories, has altered the behavior, physiology, endocrine system, and the immune function of birds, which generally resulted in negative repercussions on their reproduction or development"
However they also state that "Numerous raptors, particularly ospreys (*Pandion haliaetus* L.), are breeding successfully on pylons and towers under EMF conditions".

The Metamorphosis Report indicates:

"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

It should be noted that there is a significant amount of literature available on the subject of the biological effects of EMFs. It appears 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.
Can it be proven that the frequency, distance and type of EMFs which will be produced by the substation will not have any effect on the laying chickens".

I am not aware of definitive information on the effects of EMF on commercial poultry production parameters in South Africa. Perhaps the potential is there for it to be a problem but it appears to be an uncertain risk at this stage and unlikely to significantly affect production.

2. Light Pollution.

This is potentially a very important factor as birds are extremely sensitive to light both with respect to its intensity (lux to measure dimness or brightness) and duration (hours of light per day).
Commercial poultry are subjected to a controlled lighting programme involving both light intensity and light duration throughout both the rearing and laying periods. Likewise broilers also are subjected to controlled lighting programmes throughout their relatively short lifespan.
How effectively the poultry-breed recommended programmes are applied depends greatly on the type of operation involved and the type of housing available. Rainbow use both light –tight and open type

housing. With open type housing light length can be extended by using artificial light sources but can't easily be reduced or shortened. However with controlled environment (CE) housing such as used by Rainbow light brightness and duration can be easily manipulated. These CE houses are called "light-tight houses" and allow the most efficient production parameters from the genetic stock used. Any upset or sudden or unprogrammed change in lighting to which the birds are exposed may have a marked detrimental effect especially on egg production.
The issues with respect to extraneous lighting arising from the sub station would obviously occur at night. In theory with "light tight" housing light generated from the sub station should not find its way into the houses. However in practice light could enter through fan and ventilation openings and hence have an effect on the birds. Open-type housing however would be directly susceptible to effects frorn outside lighting sources.
Light emanating from the sub station should not therefore be directed towards the farms but downwards. L 14 being the closest layer farm at 450 m.

3. Noise and Vibrations.

I agree with the following in the Metamorhosis Report:

"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 etc 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".

Normal background sounds from the birds themselves as well as those from equipment and management procedures are constantly present in the poultry house. However any sudden and strange loud noise or vibration can lead to an immediate reaction from the birds. Chickens either immediately go quiet and then gradually return to normal movement and vocalization or they panic. The latter case may see birds flapping, squawking, running in any direction and in the worst cases a few birds piling on top of one another resulting in shock, heart failure and mortality. This applies to either laying or broiler flocks. Different flocks may well respond in different ways according to the type and magnitude of noises to which they are more used to.

The important issues here are unaccustomed noises or vibrations and those of a sudden onset. Blasting operations would obviously create sudden noise and vibration readily detected by birds. Whether this could be considered different to that as would occur in a thunder storm is a debatable point. A close/overhead flash of lightning and thunder clap would certainly startle birds and could result in some losses from panic and piling and perhaps a temporary small drop in egg production. Different flocks and age groups may respond differently, some more tolerant than others and as this is a naturally occurring phenomenon adult flocks would be exposed to this during their lifetime. As mentioned in the Metamorhosis Report chickens are extremely sensitive to any unusual activity however they do get used to and recognize sounds from in-house machinery, in-house staff activities etc so acclimatisation to external stimuli appears to mitigate certain responses. An attempt at desensitising the birds to blasting by the gradual increase in blast noise may help in this regard?

In Applied Animal Behaviour Science 91. (2005). Effects of specific noise and music stimuli on stress and fear levels of laying hens of several breeds: J.L. Campo*, M.G. Gil, S.G. Da´vila state that "The results of their present study indicate that specific noise stimulus (90 dB versus 65 dB) causes stress and fear in laying hens".

4. Air Quality and Dust.

Poultry have a highly developed and sophisticated respiratory system and like any livestock are susceptible to respiratory infections caused by a wide range of bacteria, viruses and fungi which may be carried on dust particles. These infections may become more of a problem in domestication because of housing which usually involves an increase in stock density within an enclosed environment.
The creation of dust within a poultry house occurs all of the time and arises from the litter material on the floor of the house, feed and feed delivery systems, dander from feathers and from faecal material deposited on the litter. Dust may also be drawn into the house through ventilation fans of controlled environment houses or natural side openings in open-sided houses. Internally developed dust is mainly of an organic nature whilst dust from outside may be from organic sources or "hard" dust from inorganic sources eg inorganic particulate matter from sands, rock excavations etc.

Natural defence systems in the bird attempt to eliminate dust from the respiratory tract but in conditions of excess dust damage to the system can occur. Damage may be physical and/or from entry of infectious agents carried on dust particles. A common gas which develops in poultry houses is ammonia resulting from the bacterial breakdown of nitrogenous material in faecal material. House management together with natural or artificial ventilation is used to remove gaseous build-up (ammonia and CO2) and provide fresh air over the birds. Excess levels of ammonia can result in physical damage to the respiratory tract and also allow infectious agents easier entry into damaged tissues.

Hence production of "excess" dust directly towards a poultry house from a nearby operation could have a detrimental effect on a flock and also on the bearings of the fan bank used to ventilate a house. The amount of dust to which a farm would be exposed would depend on distance from source, material being excavated, weather conditions and season.

The presence of dust in a poultry house is a given as it is in the nature of the business. Ideally dust (and gas) levels in a house should be minimal, giving a sense of "clean air", but in practice the dust levels vary greatly. The amount of dust in the air over the birds will be directly related to the age and number of birds in the house, type and quantity of litter used, age of litter, moisture content of litter, time of year and humidity (dry/wet season, Highveld/Lowveldt), bird activity, use of in-house evaporative cooling systems, management activities and house ventilation etc. I can find no guidelines to recommended dust levels in the Cobb Breeder Manual.

5. Biosecurity.

Biosecurity involves both physical and managerial methods to prevent the introduction of infectious disease agents onto a poultry farm and to prevent the spread of disease agents from an infected area to an uninfected area.
This is basically achieved by the principles of isolation of farms, provision of physical barriers (perimeter fence and single access point) and entry control for all staff and vehicles, control of water supply, feed stuffs and all maintenance staff and materials.

Simply put biosecurity procedures that are routinely used include a change of clothing and showering-in

of all personnel, use of protective clothing and footwear before entering any house and waiting periods between visits to different farms. All vehicles entering farms are subjected to routine disinfection with drivers having to follow specified procedures. Each company will have specified procedures and strict controls in place to ensure their policies are adhered to.

One of the largest risk areas is with staff and vehicles coming onto sites as they may have been in contact with infectious agents and unknowingly bring such agents onto a farm. Hence the strict entry controls.

Airborne transmission of infectious agents can also occur and this would relate to the presence of disease in an area being spread via wind/air movement, wild birds/animals, passing human and vehicular traffic etc.

In general the more isolated a farm and the minimal staff and vehicles movements that occur the better is the control. The principles of biosecurity apply to both breeder and broiler production farms. However as the broiler has a very short cycle compared with the breeder any breakdown in biosecurity on a broiler farm (eg farm becoming infected with disease) is easier to control and eliminate than with the breeder farm.

In this case the sub station construction and operation should not unduly increase risk except for increase in vehicular traffic and construction staff in the vicinity. All construction staff must keep away from Rainbow property and access roads and not wander form the site. Proper toilet facilities must be available for and seen to be used by all construction staff.

The mention by Rainbow of a 10 km radius exclusion zone around their farms stems from the recommendation by the OIE that in the event of a major (List A disease such as avian influenza) disease outbreak all stock within a 3 km radius of the index premises would be slaughtered out and all other remaining stock within the 10 km zone be subject to quarantine and monitoring. Thus an ideal would be to have farms more than 10 km apart but in practice other livestock enterprises usually occur within shorter distances to one another. Rainbow themselves mention farms of at least 500 m apart. Again this is the principle of isolation as much as it can be achieved.

6. Water Quality and Supply.

Water is a fundamental part of the diet of any livestock species. In addition in order to maintain optimum health and production water must be of optimum quality both from a microbial and chemical perspective. Interruptions or contamination of water supply to a farm/flock would have severe detrimental effects on production of a temporary or permanent nature. Water supply would be from mains or on-site bore-hole and pumped into on-farm closed reservoirs with subsequent reticulation to individual houses header tanks and thus to the drinking system used for the birds.
Water intake of the flock is measured on a daily basis and is part of management records of a flock throughout its life.

3. General Comments.

To answer the question of farm occupancy and production procedures.

Farms are usually considered as a single production unit ie all houses on that farm are considered a single large flock. Each farm therefore contributes production along with other farms into a common pool. This ensures a more or less a constant and uniform source of product throughout the company.

Parent chicks (ex Grand Parent stock) are placed on the new farm and reared until about 21 weeks of age and then following a change in management practices (mixing males and females and introducing nest boxes, changing the lighting programme etc) the hens start producing hatching eggs. Laying takes place from about 26 weeks until depletion of the flock at about 60 weeks of age. The houses are then

cleaned and disinfected, repairs and maintenance carried out in readiness for the next cycle to start again.
Broiler chicks are hatched from eggs produced by parent stock and placed as day olds on the new broiler farm. They are subjected to specific lighting and feeding programmes and grown out to certain body mass then transported to an abattoir for slaughter at about 35 days of age. As above all houses are treated as part of a single large flock. Houses are then cleaned and disinfected, repairs and maintenance carried out in readiness for the next cycle to start again after about 10 to 14 days.

The questions have been asked:
1.
"is there a possibility that the chickens in a single layer farm or house could reduce laying during that particular cycle from 170 eggs to 160 eggs, or could any of the impacts and the levels being considered, particularly dust, noise or biosecurity, possibly result in a 50% or complete loss of production in one or more of the surrounding laying farms",

The possibility is always there as we dealing with a biological entity but in practice we could see temporary production issues which would be more dependent on the degree, suddenness and frequency of the offending action from eg noise, vibration whereas more prolonged stimuli such as light exposure and dust could have longer term production effects.

2.
"Would it be possible to monitor and determine if a specific construction, or operational, related incident had affected production levels".

This could be done in cooperation with Rainbow by examining production records up to and during any perceived dangerous operation. Sudden drops in production or sudden mortality from birds' piling/smothering etc would then tend to link the offending action timing with the production issue.

This same principle could apply to potential longer term effects if previous production records were available for the previous year or so for particularly affected farms. This would allow comparison with "normal production parameters" and "parameters during construction/operation".

4. Summary of Potentially Important Risks.

All of the concerns raised have merit and constitute risk but some are of lesser known effect such as the EMF.
The nearest farm is only some 450 m distant.

From a poultry farming perspective the more isolation (both physical and human) and less disturbance factors occurring the better. So one would prefer to retain the Status Quo.
However construction work in the area of the type envisaged will change the current status with the concerns to poultry production being as follows:

A. Important Risks.

Light.
In reality as houses are supposed to be "light tight" extraneous light shouldn't enter the houses. But if this light source did enter any of the houses during the flock's "dark period" this would significantly increase risk of disruption.
Hence there is a need to ensure no light is directed towards farms.

Noise and Vibration.
This could have significant effect depending on type, suddenness, volume and frequency. Bearing in mind the normal sounds within a poultry house from birds and machinery etc. Again it is the unaccustomed and sudden noises likely to cause more problems.
Comparison of ambient noise around or in poultry houses with exceptional noise of thunder storm (which could be at night during the bird's dark and quiet period) with construction and blasting noise/vibration. Thus any sudden loud noise/vibration during the hours of darkness may be more detrimental than that occurring during day light. (See possible effects of Noise and Vibration in Section 3 above).

B. Less Certain Risks.

Air Quality and Dust.
More from an inorganic dust point being abrasive to fans and increasing airborne dust within houses with consequent possible respiratory tract irritation leading to secondary infections.
Effect most likely on closest houses in direct path of "dust storms".
Compare with dust from local quarry.
Dust limitation measures.

Biosecurity.
Potentially of great importance. However farms are perimeter fenced and with strict entry control for all staff and vehicles. ESKOM staff instructed not to enter farms or loiter on boundaries of or access roads of. Proper toilet facilities must be provided. Theft would be a biosecurity issue by staff entering Rainbow houses to steal chickens.

Water Quality and Supply.
Potentially important if water supply to a farm was interrupted or contamination occurred of ground and surface water by construction operations.
Ensure this cannot happen by identifying all water reticulation systems in the area with potential impact on Rainbow Farms. Proper toilet facilities must be provided.

C. Unknown Risks.

EMF. ? Unknown effects in commercial chickens?

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