Regional Project Concept Template (Category A)

The information contained in this template should be uploaded to the PCMF IT platform by the Chair of the relevant regional cooperative agreement or the NLO of the Member State submitting the concept by **31 May 2014** at the latest. Based on this information the IAEA will assess whether this project concept is in line with the TC quality criteria and requirements. Concepts positively appraised will be further developed into full project documents during the design phase.

<table>
<tr><td>Region:</td><td colspan="3">Latin America</td></tr>
<tr><td>Regional/Cooperative agreement (if applicable)</td><td>ARCAL</td><td>Priority no. given by regional/cooperative agreement (for concepts proposed under the auspices of regional cooperative agreements)</td><td></td></tr>
<tr><td>Title</td><td colspan="3">Integrated parasite management strategies for control of gastro-intestinal nematodes through enhanced host genetic resistance, improved parasite epidemiology and targeted selective treatment in livestock.</td></tr>
<tr><td>Field of activity</td><td colspan="3">22 - Livestock production</td></tr>
<tr><td>Regional project category[1]</td><td colspan="3">☐ Transnational
X Regional standard setting
☐ Capacity building for developing countries XXXXXXXXXX
☐ Joint TC activities with a regional or international entity</td></tr>
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[1] See the document entitled “Policy and Procedures for TC Regional Projects” at: http://pcmf.iaea.org/DesktopModules/PCMF/docs/2014_15_Docs/notes/Regional_TC_Project_Policy.pdf.

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Analysis of regional Gap / Problems/needs	Gastro-intestinal parasitic infestations such as *Haemonchus contortus, Trichostrongylus colubriformis, Teldorsagia circumcincta, Ostertagia, etc.* impose severe constraints on livestock production in many developing countries especially those reared by marginal farmers under low external input system. These parasites incur heavy losses to farmers in terms of body weight loss, direct cost of anthelminthic drugs, loss due to mortality, etc. Emergence of strains resistant to anthelminthic drugs has further complicated the management of parasitic diseases mainly in small ruminant. Two broad strategies viz. chemical and non-chemical strategies are normally followed in most countries for the control of gastro-intestinal nematode parasites in animals. Chemical strategies for the control of parasites include drenching the animals with anthelmintic drugs to remove the parasites. Various drugs are being used by farmers in different countries for the routine management practice of deworming in their animals. Non-chemical strategies include pasture and grazing management that minimizes exposure of grazing animals to infective larvae such as sheep and cattle alterations, rotational grazing and alternative approaches like breeding for enhanced host resistance, better feeding practices to improve the plane of nutrition of animals etc. Integrated parasite management (IPM) is the coordinated application of all suitable methods of parasite control including chemical, non-chemical and alternative strategies so as to suit social, economic and environmental aspects of the livestock production system prevalent in a particular region/country. Integrated parasite management program can utilize all available existing tools to reduce the dependence on anthelminthic drugs, save cost of parasite control and improve the productivity. Three major areas that needs to be focussed in the integrated parasite management programs are (a) Use of epidemiological (parasite) and ecological (seasonal) information of the region for strategic management of parasites (b) Targeted selective treatment to reduce selection pressure for drug resistance in parasites (c) Alternative approach of selection and breeding of males for enhanced genetic resistance against parasites. Epidemiological information on the species/sub-species/variants of the nematode parasites is very essential in formulating effective control

	strategies. For example, three different sympatric species of *Haemonchus* are infecting ruminants viz. *Haemonchus contortus, Haemonchus placei and Haemonchus longistipes*. Apart from these sympatric species, different variants of *Haemonchus* species and their diversity have been reported in various countries. Similarly, differences in the epidemiological distribution of different variants/species among the ruminant hosts. viz. cattle, sheep, goat and camel have also been reported. The level of anthelminthic resistance in different species/variants of *Haemonchus* differs and the fact that the process of genetic recombination among the nematodes transfers anthelminthic resistance to susceptible worms further adds complexity to the problem. The correct identification of various species/variants, as well as knowledge regarding the epidemiology and genetic characteristics of the principal circulating species/variants, is essential for the establishment of sustainable control strategies. Hence, it is important to characterize the parasites to understand the species infecting a particular geographical region and the variants involved in different hosts. Comprehensive sequencing of selective targets in parasite genome helps to better understand the genetic diversity and epidemiological characteristics of gastro-intestinal nematode parasites. With the availability of next generation sequencing technologies, it is possible to perform large scale targeted re-sequencing of wider regions of parasite genomes. Managing drug resistance is one of the major issues in formulating strategies for the control of gastro-intestinal parasites. Anthelminth resistance in parasites has been reported from almost all parts of the world including Latin America, Asia, Europe, Australia and Africa. For example, in Latin America, drug resistance has been reported in many sheep and goat farms from almost all classes of anthelminthic like benzimidazoles, imidazothiazoles and macrocyclic lactones. The possibility of emergence of new class of drugs is very limited although few like Monepantel and Derquantel have been released recently. Hence, reducing the pressure for selection of drug resistant parasites in ruminants is one of the major focus areas, which may be achieved through targeted selective treatment approaches. Selecting animals for treatment and not treating a large part of the flock is the basis for the concept of refugia to reduce selection pressure. Many aids including fecal egg count, FAMACHA guide, body condition score, live weight change are available for making decision whether or not to select the animals for drenching. Among these, FAMACHA has been found farmer friendly and successful in making such decisions based on the anaemic level of animals and also aids in selection of animals for parasite resilience. Breeding programs with the goal of enhancing host resistance to parasites is one of the important alternative approaches in the control of parasites. Selection and breeding of resistant/resilient males would be sustainable and long term strategy to alleviate the menace of parasites. Worm egg count is a moderately heritable trait and grazing of resistant animals leads to a reduction in the number of infective larvae in the pasture. Formulating an index selection method with a balance of resistance and production characteristics would be optimal in implementing the breeding program for improved genetic resistance against parasites. Advances in the DNA marker technology based on DNA microarrays and other methods would also help to identify animals with better resistance characteristics. Thus, integration of different strategies will be a holistic and sustainable approach to control the gastro-intestinal parasites in livestock.
Why should it be a regional project?	There have been several programmes and projects conducted in the region, which collectively have been making substantial contributions in performing molecular epidemiological investigations, use of FAMACHA guide and DNA marker based selection of indigenous livestock breeds. IAEA support

	and contribution have been extended to the region through CRPs and national TC projects. Capacities have already been built for the utilisation of DNA based technologies, artificial insemination technologies for breeding small ruminants, etc. The laboratories in these countries are now capable of extracting DNA samples from blood and tissues and of conducting polymerase chain reaction (PCR) based techniques in routine basis. The proposed project will utilise the capacity already built and additionally involves technologies like *in vitro* tests for survey of anthelminth resistance like fecal egg count reduction test (FECRT), egg hatch test (EHT), larval feeding inhibition test (LFIT), larval motility inhibition test (LMIT), PCR based resistant allele detection, etc. The project will also use techniques on electronic animal identification, animal selection, DNA marker based tests for genotyping animals in the region, a database that would allow the member states to store, retrieve, analyse and make reports with the epidemiological, performance (production and resistance characteristics) and animal breeding data. There was coordination between the IAEA and most involved countries through the CRP entitled "Gene based technologies for livestock breeding-Phase 2- "Genetic Variation on the Control of Resistance to Infectious Diseases in Small Ruminants for Improving Animal Productivity". This project envisaged to identify indigenous livestock breeds that have good genetic potential for resistance against gastro-intestinal parasites in sheep and goat and to identify DNA markers for selecting resistant animals for breeding.
Stakeholder analysis and partnerships	**National and regional counterpart institutions/stakeholders:** National Atomic Energy Authorities, Ministries of Agriculture, Breed organizations and AI Centres, Agriculture and Veterinary Universities and Institutes, research and extension centres, farmers associations, field veterinarians. **End users:** Ministries of Agriculture, Colleges of Agriculture and Veterinary Sciences, research centres and other involved institutions in RCA States party. **Beneficiaries:** Livestock farmers and population involved in livestock activities. **Partnership:** National institute experts, infrastructure, suitable building.
Overall objective (or developmental objective)	To improve livestock productivity through integrated management of gastro-intestinal parasites by (a) improved epidemiological status of different parasites infecting mainly ruminant livestock; (b) reducing selection pressure for parasites resistant to drugs through targeted selective treatment approach and (c) implementing alternative approaches of selection and breeding males and females with enhanced host resistance against parasites.
Analysis of objectives	• To establish/strengthen laboratory infrastructure required for implementation of DNA based technologies • To screen the indigenous/local breeds for identification of desired genotypes and selection of animals for breeding • To build capacity in utilizing DNA based technologies for genotyping and selection of animals • To improve mainly small ruminants productivity and farmer's income
Role of nuclear technology and the IAEA	Specialized instruments & materials related to nuclear techniques and reagents, tools for in vitro tests, PCR based tests, DNA Purification Kits, Radioimmunoassay and ELISA Kits for hormone determinations.

Project duration	Four years (2016 – 2019)
Requirements for participation	*Indicate the minimum requirements that counterpart institutions in Member States would need to meet in order to participate in this project, and how the fulfilment of these requirements will be verified.*
Participating Member States	*List the Member States expected to participate in this project that meet the requirements established above. Indicate the role of each Member State in the project.* *Country: Argentina, Uruguay, Mexico: x Resource (providing expertise)* *X Target (receiving expertise)* *Bolivia, Paraguay, Peru, Cuba, Chile, Ecuador.*
Funding and project budget	*Provide an estimate of the total project costs and the funding expected from each stakeholder:*

		Euro	Comment
Government cost-sharing			(to be sent to the IAEA)
Counterpart institution(s)			
Other partners			
IAEA Technical Cooperation Fund (TCF):	*Fellowships / Scientific visits / Training courses/ Workshops*	250,000	
	Experts	75,000	
	Equipment		
	TOTAL	325,000	