IAEA
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PROGRAMME OF COORDINATED RESEARCH ACTIVITIES

Webpage: cra.iaea.org

PROPOSAL FOR RESEARCH AGREEMENT

PLEASE SEND YOUR PROPOSAL FOR RESEARCH AGREEMENT TO research.contracts@iaea.org
ONLY DULY FILLED AND SIGNED PROPOSALS WILL BE PROCESSED.

1. CODE OF THE COORDINATED RESEARCH PROJECT (CRP) UNDER WHICH THE RESEARCH AGREEMENT SHOULD BE PLACED:
E35010

2. TITLE OF THE COORDINATED RESEARCH PROJECT (CRP) UNDER WHICH THE RESEARCH AGREEMENT SHOULD BE PLACED:
Applications of Biological Dosimetry Methods in Radiation Oncology, Nuclear Medicine, Diagnostic and Interventional Radiology

3. TITLE OF THE PROPOSED RESEARCH AGREEMENT (should reflect the proposed research work):
Multi-parametric approach & inter-comparison of biodosimetry techniques for dose assessment and clinical applications

4. CONTRACTING INSTITUTION:
(The contracting institution can ONLY be an institution with independent legal personality)

Inst. Name: Bhabha Atomic Research Centre

Street: Trombay
P.O. Box:
Postal Code: 400085
City : Mumbai
Region/District : Maharashtra
Country: India
Tel.: 91-22-25593968
Fax: 91-22-25519209
Email: nageshnb@barc.gov.in

5. IMPLEMENTING INSTITUTION:
(Where the research is performed - can be the contracting institution or a sub-institution, a branch of the main institution or a laboratory)
If not the contracting institute, please provide:

Inst. Name: Same as contracting institute

Street:
P.O. Box:
Postal Code:
City :
Region/District :
Country:
Tel.:
Fax:
Email:

6. SUMMARY OF PROPOSED RESEARCH:
Simulation of complex exposure scenarios relevant to radiological accidents and clinical exposures using cytogenetic responses and ability to address non-uniform exposures with better estimates using multi-parametric approaches.

7. PROJECT PERSONNEL (If space provided below is insufficient, please attach additional sheets)

A. Chief Scientific Investigator (CSI)

Family Name :	First Name:	Gender: M/F	Date of birth yyyy-mm-dd:	Nationality:
Bhat	Nagesh	M	1972-07-22	Indian

Telephone (office):	Fax (office):	Email (office):	Position held:
91-22-25593968	91-22-25519209	nageshnb@barc.gov.in	Scientific Officer 'F'

Academic degree:	Subject:	Institution:	From:	To:
M.Sc.	Physics	Mangalore University	1993	1995
Ph.D.	Physics	Mangalore University	1996	2002

Related scientific experience: 14

Recent publications related to the project (within the past 2-3 years): 5

B. Secondary CSI (if applicable)

Family Name :	First Name:	Gender: M/F	Date of birth: yyyy-mm-dd	Nationality:

Telephone (office):	Fax (office):	Email (office):	Position held:

Academic degree:	Subject:	Institution:	From:	To:

Related scientific experience:

C. Main additional Scientific Staff

Family Name :	First Name:	Gender: M/F	Date of birth: yyyy-mm-dd	Nationality:
Chaurasia	Rajesh	M	1983-12-01	Indian

Telephone (office):	Fax (office):	Email (office):	Position held:
+912225592643	+91-22-25519209	rajeshc@barc.gov.in	Scientific Officer 'D'

Academic degree:	Subject:	Institution:	From:	To:
M.Tech.	Biotechnology	IIT, Guwahati	2009	2011
Post Graduate Diploma in Life Sciences with specialization in Nuclear Science	Life Sciences	Homi Bhabha National Institute, Mumbai, India	2011	2012

Related scientific experience: 4

D. Main additional Scientific Staff

Family Name :	First Name:	Gender: M/F	Date of birth: yyyy-mm-dd	Nationality:
Yadav	Usha	F	1989-06-25	Indian

Telephone (office):	Fax (office):	Email (office):	Position held:
+912225593968	91-22-25519209	yusha@barc.gov.in	Scientific Officer 'D'

Academic degree:	Subject:	Institution:	From:	To:
M.Sc.	Zoology	Banaras Hindu University	2010	2012
Post Graduate Diploma	Life Sciences	Homi Bhabha National	2012	2013

in Life Sciences with specialization in Nuclear Science		Institute, Mumbai, India		

Related scientific experience: 3

8. PROPOSED RESEARCH PROJECT (if space provided below is insufficient, please attach additional sheets)

A. Description of Research Objectives and anticipated outcomes

Complex exposure conditions to radiation are very common in radiological accidents. In clinical applications of radiation too, majority of radiation exposures are non-uniform in nature due to localized area of exposure. Biodosimetry methods with dispersion analysis help to estimate non-uniformity, whole body dose as well as dose to exposed part. These analyses are based on dicentric assay. Most often in case of partial body exposures small fraction of lymphocytes receive high doses of radiation which may get undetected by dicentric method due to cell cycle arrest. Thus, due to varying kinetics of lymphocytes from exposed and non-exposed populations in cultures, the estimates are likely to be influenced by various extraneous factors such as culture method, duration, degree of non-uniformity and assay or protocol followed. These problems can be addressed by multi-parametric approach by using biodosimetry techniques with simulated conditions of non-uniform exposure. Human data from clinical samples of patients treated with fractionated external beam therapy with large fields and brachytherapy will further help to validate the simulated studies.

We have standardized all the mentioned biodosimetry assays. All the reagents and equipments required for the project have been in place and being used. Till date, we have analyzed more than 1400 over exposure cases as referred by regulatory authority as well as managed many small scale radiological accidents. We have also studied kinetics of dicentric assay for non-uniform exposure under in-vitro conditions. Preliminary or probing experiments are being carried out for other assays. Correction factors for low dose rate exposure and protracted exposure were also established and used in few cases. The lab is central lab in India performing biodosimetry since 1990.

B. Scientific Scope of the Project (scientific problems to be addressed with overall and specific objectives)

Simulation of complex scenarios of exposures by in vitro simulation and patient blood samples treated with various external beam field sizes as well as brachytherapy will help to address the various requirements of biodosimetry techniques. Multiparametric approach using multiple biological indicators of radiation with optimized SoPs for these techniques will help to address the need.

C. Detailed Work Plan for the first year (including proposed methods or techniques)

- In vitro simulation of non-uniform exposure by in vitro irradiation using dicentric and drug induced PCC assays
- In vitro simulation using mitotic fusion induced PCC assay
- In vitro imulation using Gamma H2AX assay.

D. Detailed Work Plan for the second year (including proposed methods or techniques)

- Inter laboratory comparison exercises and training
- In vitro simulation of non-uniform exposure using ex-vivo human blood samples and validation of data with patient blood samples (in vivo partial body exposure cases).
- Dicentric assay, drug induced PCC, mitotic fusion induced PCC, gamma H2AX foci and flow-cytometry based assays with different radiation bio-markers will be used to study the pattern of expression of radiation induced damages in simulated samples and actual non uniform exposed patient blood samples.

E. Detailed Work Plan for the third year (including proposed methods or techniques)

- In vitro simulation using FISH techniques in combination with above assays
- In vivo simulation of all the above mentioned assays using clinical patient blood samples treated for therapy by radiation
- Development of models and SoPs using multiparametric approach
- Intercomparison and training exercises with other participating laboratories
- Studies using blood samples from various therapy procedures including large field radiation therapy and Iodine therapy and diagnostic procedures..

F. Expected Outputs

- SoP for biodosimetry of non-uniform exposure by multiparametric approach
- Simulation of non-uniform exposure scenarios on dicentric, drug induced PCC, mitotic fusion induced PCC, gamma H2AX and FISH assays
- Better precision in dose estimates in case of acute exposures.
- Better detection efficiency for partial body exposure using PCC-fusion method
- Explore clinical application of biological indicators with multiple assays.

Please note that as a condition of an IAEA Research Agreement, all information, data and research results gathered during the course of the CRP are made freely available to other participants and other relevant authorized parties.

9. PLEASE LIST FACILITIES (building, equipment - including type and name of manufacturer, and materials) PRESENTLY AVAILABLE WHICH WOULD BE USED FOR THE PROJECT

Biodosimetry culture lab
Hanabi PIII metaphase harvester
Metapher-II automated scoring station
Fluorescent research microscope (manual scoring type)
Flow cytometer
Gel electrophoresis units
Culture processing labs
CO2 incubators with indigenously developed automated culture maintenance system
Culture handling & processing facilities, refrigerated centrifuges and cold storages
Various gamma, X ray, neutron and light ion irradiation facilities optimized for irradiation for biological samples. The dosimetry of these irradiators is treaceable to national standards.

10. PROPOSED COMMENCEMENT DATE: April 01, 2017

11. SIGNATURES

CHIEF SCIENTIFIC INVESTIGATOR

Name (in capitals) DR NAGESH N BHAT Signature Nagesh N Bhat 21/02/2017 Date

HEAD OF INSTITUTE

Name (in capitals) Signature 24 FEB 2017 Date

के. एन. व्यास / K. N. Vyas
निदेशक, भा.प.अ. केंद्र
Director, B.A.R.C.