EC-Brazil mission on NanoSafety
22-26 September 2014

Report

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1 Summary

During a five day mission, representatives of the EC, the NANoREG project and a great number of other EU nanosafety projects, explored and elaborated the possibilities for (further) transatlantic cooperation. Two strategic federal laboratories and a number of Universities were visited. The visits, in general, consisted of short presentations from both the Brazilian and the European side, a visit to laboratory facilities and a discussion on the potential collaboration with –in special- the NANoREG project.
The delegation actively contributed in a two day workshop in Curitiba where over 150 representative of Brazilian Laboratories and industries exchanged their ideas regarding nanosafety and innovations in nanotechnology. During this workshop EU delegates gave an overview of the state of the art in the EU regarding nanosafety.

Brazilian parties showed strong interest for the regulatory issues and for collaboration with the NANoREG project. All institutes visited, showed excellent capacity in performing the tasks planned, in terms of equipment available, human resources and work in the field. The outline of the NANoREG-Brazil collaboration agreement has been established; agreements have been made regarding the establishment of a Brazilian NANoREG workplan.

The organisation of the mission was excellent.

2 Background and aim of the mission

In 2004 Brasilia and the European Community signed the Agreement for scientific and technological cooperation between the European Community and the Federative Republic of Brazil. The aim of the Agreement is to encourage, develop and facilitate cooperative activities in areas of common interest by carrying out and supporting scientific and technological research and development activities.

As a corollary of this Agreement the EC and the Brazilian Ministry of Science, Technology and Innovation organised the EU-Brazil mission on nanosafety. In line with the Agreement mentioned before, the aim of the EU-Brazil Mission on nanosafety is to intensify and coordinate the cooperation between Brazil and the European Union on the field of Environmental, Health and

Safety (EHS) aspects of nanomaterials. This also includes the development of instruments for "safe by design" aimed at a more upfront incorporation of EHS aspects in the design, production and application of these materials. Both topics can be considered as non-competitive issues. Collaboration in addressing these topics will be beneficial for Brazil as well as for the European Union.

More specific the aim of the mission is:

- to elaborate the agreement made in May 2014 in Paris between EU, Brazil and the NANoREG coordinator on the involvement of Brazilian parties in the NANoREG project; more specific:
  - to define and elaborate potential Brazilian contributions to the NANoREG project,
  - to establish what Brazilian laboratories will take the main responsibility over the Brazilian participation in NANoREG,
  - to establishing contacts with the representatives of potential collaborating parties,
  - to elaborating the formal aspects of the collaboration, and
  - to explore and select possible collaborations between Brazilian parties and other Nano-SafetyCluster (NSC) projects.

3 Participants

The participants of the meeting have been selected because of their expertise on the field of nanosafety and their active role in running FP7 projects on Nanosafety. George Katalagarianakis (EC) was head of the delegation.

EC delegation

Name	Organisation
George Katalagarianakis	European Commission DG Research
Lang Tran	Institute of Occupational Medicine (UK)
Steffi Friedrichs	Nanotechnology Industries Association (BE)
Aart Dijkzeul	Ministry of Infrastructure and the Environment (NL)
Wim de Jong	National Institute for Public Health and the Environment (NL)
Danail Hristozov	Venice Research Consortium, Universty Ca'Foscari Venice (IT)
Sergio Moya	CICbiomaGUNE; Centre for cooperative research in biomate-rials (ES)
Hermann Stamm	Joint Research Centre; EC (IT)
Marco Monopoli	Centre for BioNano Interactions; University College Dublin (IE)

"Core" Brazilian delegation

Name	Organisation
Flavio Plentz	Ministry of Science, Technology and Innovation; Brazilian Nanotechnology Initiative
Anna Tempesta	Ministry of Science, Technology and Innovation
Helena Gressler	Ministry of Foreign Affairs
Nelson Durán	UNICAMP; SisNANO/Cigenanotox Network
Oswaldo Luiz Alves	UNICAMP; SisNANO/Nanobioss SisNANO Lab.
José Mauro Grajeiro	INMETRO; Nanovalid/Brazilian Nanotox Networks
André Galembeck	CETENE; SisNANO
Luiz Mattoso	SisNANO; EMPRABA Instrumentação/LNNA SisNANO Lab.
Cauê Ribeiro	SisNANO; EMPRABA Instrumentação/LNNA SisNANO Lab.

César Grisólia	UNB; Aquatic Toxicology Network
José Maria Monserrat	FURG; Enviroment and Ocupational Nanotox Network
Valtencir Zucolotto	USP; Brazilian Nanotox Networks
Ary Correa	UFMG; Nanovalid/ Brazilian Nanotox Networks
Fernando Galembeck	LNNANO/CNPEM; SisNANO
Koiti Araki	USP; NAP-NN SisNANO Lab.
Adalberto Fazzio	USP; NAP-NN SisNANO Lab
Other contacts: see Annex I	

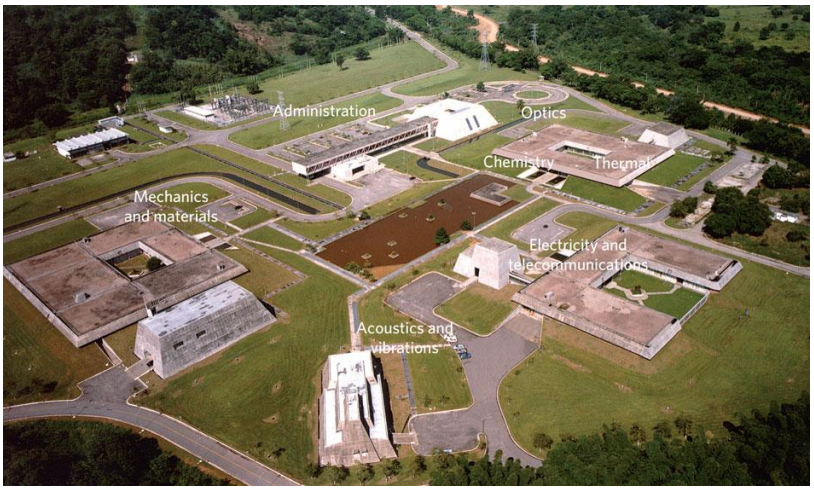
4 Day by day

This paragraph gives summaries of the meetings and visits during the mission. It also gives a brief description of the Curitiba workshop "I workshop de Integracao SisNANO-ISI".". The presentation –as far as available- can be downloaded by following this link. Access to this folder will be possible until 1 November 2014.

4.1 September 22: INMETRO

4.1.1 Meeting

INMETRO is one of the six strategic federal laboratories. Its major task is "to improve the quality of life of the ordinary citizen as well as to seek the competitiveness of the economy through metrology and quality".



After the openings address the director of INMETRO, José Mauro Grajeiro, gave a general presentation titled "INMETRO and nanotoxicology"

INMETRO is one of the laboratories of of SisNano. The National system of Laboratories on Nanotechnology. This network consists of about 30 laboratories; six of them (including INMETRO) are, what is called, strategic laboratories. INMETRO is involved in several transatlantic collaborations on the field of nanosafety and is active in international harmonisation bodies. The INMETRO facilities are (by law) open to other organisations (among other Universities) in order to make an efficient use of facilities, to stimulate collaboration and to support innovation. INMETRO will play a coordinating role in setting up the collaboration between Brazilian partners and the NANoREG project.

In her presentation ("NANoREG, opportunities for transatlantic cooperation") ,Steffi Friedrichs introduced the NANoREG project; the project's aim, approach, involved partners and results so far were explained and discussed. An overview of the possible fields of cooperation from the NANoREG perspective was presented. Emphasise was given to the necessity for Brazilian Partners to accept the provisions laid down in the NANoREG guidance document as a binding frame work for the work to be carried out

During the afternoon discussion, the possible Brazilian contribution to the NANoREG project was further elaborated. Relevant NANoREG tasks were selected as a basis for discussion during the next days. It was concluded that, given the Brazilian expertise and capacity on this field, characterisation and development of SOPs are the most promising fields of collaboration between Brazilian parties and NANoREG.

4.1.2 Laboratory visits

The electron microscopy facilities. INMETRO is equipped with state of the art electron microscopy facilities, for both transmission and scanning. Two SEM microscopies are available with FIB and STEM capabilities. There is a TITAN transmission electron microscope of high resolution with STEM and two additional TEM in house.

The staff of INMETRO showed several examples of the research carried out with electron microscopy within INMETRO. The facility is used to address highly complex problems in material science like the development of single carbon nanowires in electrical junctions. At the same time, work is performed to solve problems specific to Brazil (i.e. characterization of soil from the Amazon area).

The characterization facility is equipped as well with several XRAYs devices, fluorescence XRAY spectroscopy, and several XPS, used for material characterization i.e. catalytic materials. In addition SNOM and Raman are available.

The biological facility addresses problems of molecular biology, enzyme technology and toxicology among others. It has state of the art facilities, including a TEM for biological samples, a low vacuum SEM for biological samples, a confocal laser scanning microscope, FACS, mass spectroscopy for protein analysis, several PCRs, and cell culture laboratories.

4.2 September 23-24: Workshop Curitiba

The EU delegation participated in the two day “I workshop de Integracao SisNANO-ISI”. This workshop, held at the Federal University of Paraná in Curitiba, was organized by SisNANO (collaborative network of laboratories) and Instituto de Inovacao SENAI (collaborative network of industries). The workshop was aimed at fostering the collaboration between industry and research organizations as well as cooperation between Brazilian parties and the NANoREG project.

4.2.1 Morning 23 September:

Flavio Plentz, Georgios Katalagarianakis and representatives of industry associations, the university of Parana and the ministry of Foreign Affairs, gave a short opening- and welcome address.

In a number of presentations, the need for collaboration between industry, universities and governmental bodies was emphasised. The nanotechnology market applications in Brazil involving local companies is mainly focussed on cosmetics, textile, agriculture and food packaging. There is a strong need to create a regulation infrastructure to develop regulation in parallel with the technology in order to stimulate innovation and to support market introduction of new products.

Jose Molinari’s talk focused on the link between academia and industries. Knowledge generated in the university must be transferred to industry as well as to governmental bodies so it also can be used for regulation purpose.

SENAI Innovation Institutes were presented. The mission of this network is "to promote vocational and technological education, the innovation and transfer of industrial technologies, contributing to increase the competitiveness of Brazilian industry."

4.2.2 Afternoon 23 September

In the afternoon the development and market introduction of several nanotechnology products was presented.

Prof. Jefferson Oliviera Gomes addressed the possibilities of finding partners in the nanotechnology area for developing a product. Nanotechnology companies are widely scattered around the whole of Brazil. Finding each other and cooperate in product development, is much more difficult in Brazil than in e.g. south Germany. The establishment of a nano-network could be helpful for companies to find each other.

Three cases of successful nanotechnology products were presented.

- Case I describes the development of the application of nanomaterials in ceramics to add functionality (company Ekozinha). The most striking example is the use of nanosilver in bathroom tiles to prevent bacterial and fungal growth. These may be especially useful in hospital settings. The project was approved and funded by the Brazilian SENAI innovation program.
- Case II described the development of furniture for hotels and restaurants (company Molevaria Paranista). The link with nanotechnology was not clear. So, this might just be an example of cooperation in the development of a new product. The need for cooperation (it was a small company) was emphasized and the introduction of trainees in the company. The latter really gave a boost to the product development.
- Case III was presented by Leonardo Simon of the University of Waterloo, Canada. He presented the development of an environmental friendly production of biodegradable plastic based on wheat straw. The product was developed within a value chain of several companies. Currently the University of Waterloo was involved in the development of thermoplastic starch made from cassava. The cassava will be sourced in Brazil. Another project is the use of nanocrystalline cellulose as reinforcement for polyamide (4% nanocellulose in polyamide polymer).

Flavio Plentz (Brazilian government) gave an overview on SISnano as part of the Brazilian nanotechnology initiative. This initiative encompasses ‘a set of actions that aims to create, integrate and strengthen governmental activities and the agents anchored in nanoscience and nanotechnology, in order to promote scientific and technological development of the sector` SisNANO, a system formed by laboratories specialized in nanotechnology, is one of those actions. A number of governmental laboratories has been identified as “strategic labs”, while other laboratories function as “associated labs”. Together they form a conglomerate of laboratories that should bring further development of nanotechnology in Brazil. Investments must be focused on innovation potential.

4.2.3 Morning 24 September

In a series of presentations, the EU delegates gave an overview of the state of the art regarding nanosafety research and regulation.

- George Katalagarianakis presented the EU strategy to stimulate innovation on the field of nanotechnology and to tackle the related Environmental, Health and Safety aspects.
- Wim de Jong further elaborated the “nanosafety theme” by presenting three EU projects: NanoMile, SUN and GUIDEnano. He explained the different approaches of nanosafety by these projects.
- In a presentation titled “Long range challenges in nanosafety” Marco Monopoli emphasized the necessity to make difference between “chemicals” and “nanoparticles” regarding their influence on biological systems. There is a strong need to indentify and classify new nano-biological mechanisms and paradigms not presented by chemicals. Furthermore he gave an overview of the activities of the NanoSafety Cluster and in special the QualityNano Research Infrastructure.

- Hermann Stamm gave an overview of the activities of JRC. He explained that JRC provides the (present and future) NANoREG with well characterized representative nanomaterials. He also presented the current EU regulatory framework; the horizontal legislation as well as product oriented legislation.
- Steffi Friedrichs presented the NANoREG project (see paragraph 4.1.1); she put emphasize on the important role industry plays in the project and the importance of a good regulation from an industrial perspective.

Prof. Nelson Duran from UNICAMP presented a report of the initiatives and actions aimed at regulating nanotechnology in Brazil and the European Union that have been identified/developed under the NanoDialogues Programme.
He stressed the fact that Brazil is currently seeking cooperation and collaboration with international research initiatives in order to develop regulation for nanomaterials. The development of regulation applicable to nanomaterials is fast advancing in the EU. A Sector Dialogue with the European Union on the Regulation of Nano-based products has been established. It is intended to support (underpin) the process leading to the development of a nanotechnology regulatory framework(s) in Brazil. Expected results and specific actions were mentioned.

4.2.4 Afternoon 24 September

Breakout sessions were organised to identify priorities for Brazil collaboration with EU, mainly through NANoREG. The discussion was structured around a number of "Questions and Needs" that form the basis (the demand side) of the NANoREG project in a way to provide answers to specific questions.

The discussions identified priority questions as defined as demand side for the NANoREG project (see public version of the NANoREG deliverable on Questions and Needs)

4.3 September 25: Campinas

4.3.1 UNICAMP

Prof. Oswaldo Luiz Alves gave a presentation on ongoing work in his laboratory. This presentation was followed by a general presentation on the NanoSafetyCluster activities by Sergio Moya.

Following the presentations the group paid a visit to the laboratories of Prof. Alves, where we were shown their facilities for synthesis of nanomaterials.

4.3.2 CNPEM

In the afternoon the National Laboratory of Nanotechnology, LNNano (Laboratorio Nacional de Nanotecnologia) was visited. It is part of the National Center for research in Energy and Materials(*CNPEM*). Prof. Galembeck, the director of the Laboratory welcomed the delegation. He gave a general overview of the research in the center and its structure, followed by short presentation of researchers of the institution working on nanosafety. Steffi Friedrichs gave a presentation on the NANoREG project and Sergio Moya presented the NanoSafetyCluster. Af-

ter the presentations the delegation visited the facilities for biological research (mass spectroscopy, NMR, etc).

4.4 September 26:

4.4.1 UFSCar, USP São Carlos and EMBRAPA

At the São Carlos Institute of Physics, which belongs to the University of São Paolo, Jose Bonagamba, the director of the institute gave a general introduction on the institute. Sergio Moya presented the NanoSafetyCluster and Steffi Friedrichs presented the NANoREG project. Both presentation were given to an audience of students and faculty. A post doc from the group of Prof. Zuccolotto gave a short presentation of their research with a focus on nanosafety.

After the presentation we visited the laboratories of Prof. Zuccolotto The laboratories are well equipped for basic research on the interaction of nanomaterials with membranes and model lipid monolayers, for studying cell nanoparticle interactions and nanomaterial characterization.

The visit to the Institute of Physics was followed by a visit to Embrapa Instrumentation (Embrapa Instrumentação). Embrapa stands for Brasilian Enterprise for Agropecuary Research (Empresa Brasileira de Pesquisa Agropecuaria). Embrapa's main goal is to support the agriculture and animal industry sector in Brazil and to improve the sustainability of the sector. There is a focus on applied research with a close relation with the producers. The Embrapa division at São Carlos is primarily focused on the development of analytical tools to be applied on agriculture research and the use of nanotechnology in agriculture. Embrapa researchers gave us a general presentation on the institution and on their research.

Embrapa has excellent facilities for exposure and for animal research, in São Carlos and through the whole research network, which is located all over the country. Steffi Friedrichs presented the NANoREG project. Several laboratories at the institute were visited.

Afterwards, we visited the electron microscopy facilities at the Faculty of Material Science of the Federal University of São Carlos. This university is equipped with several scanning electron and transmission electron microscopies and is more focused towards chemical and composition analysis at the micro- and nanoscale We also toured new laboratories sponsored by Petrobras, the Brazilian oil company.

4.4.2 USP

The visit to São Paulo University was the last leg of our mission to Brazil. The large part of the morning was for the EU mission to present:

- the NanoREG project
- achievements from EU projects and
- the infrastructure for EU research: the NSC, JRC and the QNano project.

The Brazilian audience were material scientists, bio scientists, representatives from Brazilian cosmetics industry and students.

The Brazilians were surprisingly well aware of EU issues. They emphasised the need for adequate and evidence based regulation of nanomaterials in Brazil. It was stated that, at this moment regulation in Brazil hampers the further capitalisation of the benefits of nanotechnology in specific sectors.

We had a very short visit at the Radionuclear Laboratory, in which they prepared radiochemicals for diagnostics and therapy for Brazil including the shipment to hospitals in Brazil. It was not clear whether they also actually manufcatured the radiochemicals locally.

5 Evaluation and follow up

5.1 Organisation:

Excellent organisation in both scientific and organisational terms. The visits and the workshop helped the EU delegation to formulate a very positive opinion regarding the determination of government and industry to achieve fast progress.

5.2 NANoREG:

Genuine interest in launching and ensuring success of the Brazilian contribution was demonstrated. All institutes that were visited, showed excellent capacity in performing the tasks planned in terms of equipment available, human resources and work in the field. The coordinating institute has good international contacts in metrology and standardisation. The government was very positive in creating and maintaining momentum. The ministry of external affairs was present at the workshop and expressed their support. Industry also showed very good understanding and provided their support. Very good access and knowledge of the regulatory processes and, in some cases, very good links with the nano-medicine research were noticed.

5.3 Research:

Capacities are impressive though it must be taken into account that this big country benefits from concentration of resources to few institutes. However there seems to be some fragmentation across institutes financed by the central government, institutes financed by the federal states and private ones. As the domain and the market expands, more of the institutes will come into the scene necessitating inter-laboratory streamlining and benchmarking. The SisNANO network launched in Brazil a year ago may solve some of the problems.

5.4 Regulatory- and market scene:

Strong interest was shown for the regulatory issues and the progress achieved in the EU. The recent absence of Brazil from the OECD-WPMN was mentioned and this issue will most likely be resolved. There is no competence centre for nano-risk management established similar to those in some EU member states.

5.5 Follow up

Nanoreg:

Based on the results of the mission, an collaboration agreement between Brazilian organisations and the NANoREG project will be established. The ministry of Science, Technology and Innovation will appoint a national coordinator for the NANoREG project. INMETRO will act as the scientific coordinator.

Other projects

A great number of contacts has been established that will be beneficial to expand the already existing collaboration between Brazil and the EU on the field of nanosafety modelling,

Name	Organisation	email address	Remarks
Fernando Galembeck	CNPEM	Fernando.galembeck@innano.cnpem.br	Brazilian Nanotechnology National Laboratory
Diego Stefani Teodoro Martinez	CNPEM	diego.martinez@innani.cnpem.br	
Pedro Amores da Silva	ABIHPEC	amores.silva@abiihpec.org.br	Technical and Regulatory Affairs Consultor, representative of the Brazilian Association of the Cosmetic, Toiletry and Fragrance Industry, São Paolo
Dra.Neola Invernizzi	UFPR	noela@ufpr.br	Researcher
Prof. Adalberto Fazzio	Institute of Physics	fazzio@if.usp.br	Sergio: Common interest is in Modelling. Interested in developing models of nanoparticle flow in turbulent fluid. The plan is to invite him over to EU, using our COST Action fund, early next year to give a talk and join the existing EU network on modelling.
Veola Invernizzi			A useful contact for risk perception/communication.
Dr. Valtencir Zucolotto	IFC USP SÃO CARLOS	zuco@ifsc.usp.com.br	
Prof. Koiti Araki	Institute of Chemistry	Koiaraki@iq.usp.br	
Elisa Yoko Hirooka Dr	Parana	hirooka@uel.br	
Jose Mauro Granjeiro,DSc	Inmetro	jmgranjeiro@inmetro.gov.br	Coordinator Program of Bio-engineering Sergio: we are already planning 2 collaborations: one on cardiovascular disease and one on Alzheimer. There will be a Brazilian call next year and I will help him with the proposal. Jose's group is vibrant and has experience in lipid analysis which is very much in line with our interest.
Prof. Dr. Oswaldo Luiz Alves	Unicamp	oalves@iqm.unicamp.br	Laboratory of Solid State Chemistry; Institute of Chemsitry, State University of Campinas
Luiz Henrique Catalani	USP	catalane@USP.br	Instituto de Quimica
Ary Correa Jr.	UFMG	acorrea@ufmg.br	Sergio: his interest is in ecotoxicology, I have ar-

			ranged for him to be in touch with Janeck Scott Fordsmand. We will have a telconf with Ary on 02/10/14
William Waissmann, MD, MSc, PhD.	FIOCRUZ	Waissman@ensp.fiocruz.br William.waissmann@gmail.com	Senior Researcher, President Advisor Nanotechnology, Toxicology, Endocrinology, Metabolism and Nutrition. Might be interesting for contacts regarding Toxicology. Dr Waissmann is the vice-coordinator of a Brazilian nanotoxicology network.
Prof Koiti Araki,.	USP Chemistry, Department of Fundamental Chemistry	koiaraki@iq.usp.br	Development of the supramolecular coordination chemistry approach to nanotechnology, based on supramolecular hybrid organic/inorganic nanomaterials
Prof Adalberto Fazzio,	Univ São Paolo	fazzio@if.usp.br	Vice Director, Institute of Physics,
Prof Luiz Henrique Catalani,	USP	catalini@usp.br	Institute of chemistry. Laboratory for Polymeric Biomaterials.
Prof Leonardo Simon	University of Waterloo	Lsimon@uwaterloo.ca	Faculty of Engineering
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Dr Valtencir Zucolotto	IFSC-USP		Nanomedicine and Nanotoxicology Lab
Tito Jose Bonagamba	IFSC-USP	tito@ifsc.usp.br	Tito is the Director of IFSC-USP.
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Daniel Souza Correa	Embrapa	Daniel.correa@embrapa.br	
Caue Ribeiro de Oliveira	Embrapa	Caue.ribeiro@embrapa.br	
Dra Amanda Luizetto dos Santos	NanoMed	amanda@nanomed.ind.br	NanoMed is one of Dr Zucolotto's spin-out companies at USP; Amanda is in charge of NanoMed.