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**ORNL  
FOREIGN TRIP REPORT  
TA 416 401**

**DATE:** December 4, 2017

**SUBJECT:** Report of Foreign Travel to Paris and Fontenay aux Roses, France – Vladimir Sobes, Reactor and Nuclear Systems Division

**TO:** Angela Chambers, Nuclear Criticality Safety Program Manager, National Nuclear Security Administration / NA-511/GTN, Pantex Plant, PO Box 30020, Amarillo, TX 79120-0020

**FROM:** Vladimir Sobes

**MEETING:  
TITLE** NEA Nuclear Data Week and Working Party on Nuclear Data Evaluation Cooperation (WPEC) Parallel Meeting and NCSP Nuclear Data Collaboration Meeting with IRSN

**MEETING:  
LOCATION** NEA Headquarters, Paris, France; Institute of Radiological protection and Nuclear Safety (IRSN), Fontenay Aux Roses, France

**MEETING:  
DATES** 11/20/2017 – 12/01/2017

**ATTENDEES:  
ON BEHALF  
OF NCSP** Vladimir Sobes

**MEETING:  
BENEFIT TO  
NCSP** The benefit of this travel is that it supports the Mission and Vision of the Nuclear Criticality Safety Program in a number of ways. Foremost, this travel supports the Mission of the Nuclear Data technical program element through the coordination of nuclear data activities and fostering a strong collaborative effort among international resources via active participation in the OECD/NEA Working Party Evaluation Cooperation (WPEC) expert working groups. Furthermore, this travel supports two Nuclear Data Milestones (ORNL-ND1 and ORNL-ND8) as detailed in the NCSP Five Year Execution Plan. The main purpose of the trip is for nuclear data research collaboration between ORNL and IRSN in support of timely completion of the nuclear data evaluations listed in the Appendix B of the Five Year Execution Plan. Further details are provided in the Trip Purpose section below.

**MEETING  
PURPOSE:** The purpose of the first week of this trip is for Dr. Sobes to lead the meeting of the WPEC Subgroup 44 on the Investigation of Covariance Data in General Purpose Nuclear Data Libraries during the NEA Nuclear Data Week. Dr. Sobes has been selected as the coordinator of this international subgroup. In this faculty, Dr. Sobes supports the Mission of the Nuclear Data technical program element of the NCSP by facilitating coordination of nuclear data activities by fostering a strong collaborative effort among international resources in this highly technical area. Active participation in the OECD/NEA Working Party Evaluation Cooperation (WPEC) expert working groups is explicitly called out in the NCSP Mission and Vision document. The mandate of Subgroup 44 sets out to improve nuclear data covariance evaluations in

general purpose nuclear data libraries, such as the ENDF/B library used by practitioners of nuclear criticality safety in the US. Quality nuclear data covariance information is essential to establishing safety margins in criticality calculations. In particular, the purpose of this trip is to exchange information with international NCS community to improve NCSP nuclear data work and cultivate new collaborations to support future NCSP nuclear data tasks which is in accordance with the specific milestone ORNL-ND1 set out in the NCSP Five Year Execution Plan FY2018-2022.

The purpose of the collaboration visit during the second week is for Dr. Sobes (ORNL) to collaborate with Dr. Luiz Leal (IRSN) on several nuclear data evaluation tasks listed in the NCSP Five Year Execution Plan FY2018-2022. Dr. Sobes is the PI at ORNL for the resonance region evaluation of  $^{156}\text{Gd}$ ,  $^{158}\text{Gd}$ , and  $^{160}\text{Gd}$  as indicated in Appendix B of the NCSP Five Year Plan and implied under the Milestone ORNL-ND1. Dr. Leal has been working in parallel on the resonance evaluation of  $^{155}\text{Gd}$  and  $^{157}\text{Gd}$  at IRSN. One of the objectives of this visit is for the two researchers to come together and synchronize their work, such that each can benefit from further working with the latest resonance parameters for the other isotopes of Gadolinium. The technical significance of this synchronization is that in the resonance analysis, experimental data are measured using natural samples and the analysis impacted by the resonances of all five isotopes. Therefore, it is natural, that changes to one or several of the isotopes will have an impact on the resonance parameters of the other isotopes. Thus, periodic synchronization is essential.

Further, Sobes (ORNL) and Leal (IRSN) are scheduled to collaborate on a new resonance evaluation of lead as indicated in Appendix B. This visit will allow the two researchers to review the existing body of experimental knowledge on resonance cross sections of lead and establish a roadmap for future collaboration on the evaluation.

Lastly, Milestone ORNL-ND8 requires a detailed comprehensive assessment of the status of  $^{233}\text{U}$  nuclear data with input from ORNL and IRSN amongst others. During this visit,  $^{233}\text{U}$  nuclear data gaps identified by IRSN and ORNL will be discussed.

**SITES  
VISITED:**

NEA Headquarters, Paris, France  
IRSN, Fontenay aux Roses, France

**ABSTRACT:**

The traveler made a trip to the Institute of Radiological protection and Nuclear Safety (IRSN) to work collaboratively with the IRSN nuclear data team on the cross section evaluations in the resolved resonance region for isotopes of interest to NCSP and IRSN. In particular, gadolinium, lead and uranium-233 were discussed. The traveler also was responsible for leading the meeting of WPEC Subgroup 44 on the “Investigation of Covariance Data in General Purpose Nuclear Data Libraries” during the NEA Nuclear Data Week.

**Access to the information in this report is limited to those indicated  
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## **REPORT OF FOREIGN TRAVEL**

**Vladimir Sobes**

**Fontenay aux Roses, France**

**November 20, 2017 – December 1, 2017**

### **PURPOSE OF TRAVEL**

The benefit of this travel is that it supports the Mission and Vision of the Nuclear Criticality Safety Program in a number of ways. Foremost, this travel supports the Mission of the Nuclear Data technical program element through the coordination of nuclear data activities and fostering a strong collaborative effort among international resources via active participation in the OECD/NEA Working Party Evaluation Cooperation (WPEC) expert working groups. Furthermore, this travel supports two Nuclear Data Milestones (ORNL-ND1 and ORNL-ND8) as detailed in the NCSP Five Year Execution Plan. The main purpose of the trip was for nuclear data research collaboration between ORNL and IRSN in support of timely completion of the nuclear data evaluations listed in the Appendix B of the Five Year Execution Plan.

The purpose of the first week of this trip was for Dr. Sobes to lead the meeting of the WPEC Subgroup 44 on the Investigation of Covariance Data in General Purpose Nuclear Data Libraries during the NEA Nuclear Data Week. Dr. Sobes has been selected as the coordinator of this international subgroup. In this faculty, Dr. Sobes supports the Mission of the Nuclear Data technical program element of the NCSP by facilitating coordination of nuclear data activities by fostering a strong collaborative effort among international resources in this highly technical area. Active participation in the OECD/NEA Working Party Evaluation Cooperation (WPEC) expert working groups is explicitly called out in the NCSP Mission and Vision document. The mandate of Subgroup 44 sets out to improve nuclear data covariance evaluations in general purpose nuclear data libraries, such as the ENDF/B library used by practitioners of nuclear criticality safety in the US. Quality nuclear data covariance information is essential to establishing safety margins in criticality calculations. In particular, the purpose of this trip was to exchange information with international NCS community to improve NCSP nuclear data work and cultivate new collaborations to support future NCSP nuclear data tasks which is in accordance with the specific milestone ORNL-ND1 set out in the NCSP Five Year Execution Plan FY2018-2022.

The purpose of the collaboration visit during the second week was for Dr. Sobes (ORNL) to collaborate with Dr. Luiz Leal (IRSN) on several nuclear data evaluation tasks listed in the NCSP Five Year Execution Plan FY2018-2022. Dr. Sobes is the PI at ORNL for the resonance region evaluation of  $^{156}\text{Gd}$ ,  $^{158}\text{Gd}$ , and  $^{160}\text{Gd}$  as indicated in Appendix B of the NCSP Five Year Plan and implied under the Milestone ORNL-ND1. Dr. Leal has been working in parallel on the resonance evaluation of  $^{155}\text{Gd}$  and  $^{157}\text{Gd}$  at IRSN. One of the objectives of this visit was for the two researchers to come together and synchronize their work, such that each can benefit from further working with the latest resonance parameters for the other isotopes of Gadolinium. The technical significance of this synchronization is that in the resonance analysis, experimental data are measured using natural samples and the analysis impacted by the resonances of all five isotopes. Therefore, it is natural, that changes to one or several of the isotopes will have an impact on the resonance parameters of the other isotopes. Thus, periodic synchronization is essential.

Further, Sobes (ORNL) and Leal (IRSN) are scheduled to collaborate on a new resonance evaluation of lead as indicated in Appendix B. This visit allowed the two researchers to review the existing body of

experimental knowledge on resonance cross sections of lead and establish a roadmap for future collaboration on the evaluation.

Lastly, Milestone ORNL-ND8 requires a detailed comprehensive assessment of the status of  $^{233}\text{U}$  nuclear data with input from ORNL and IRSN amongst others. During this visit,  $^{233}\text{U}$  nuclear data gaps identified by IRSN and ORNL were discussed.

Overall, Dr. Sobes' foreign travel to IRSN was successful and essential to enable ORNL to make progress on the planned NCSP nuclear data evaluation tasks (ORNL ND1) and contribute to (ORNL ND8) as defined in the NCSP Five-Year Plan Execution Plan FY2017-2021. The complete resonance region evaluations of the isotopes of  $^{155}\text{Gd}$ ,  $^{156}\text{Gd}$ ,  $^{157}\text{Gd}$ ,  $^{158}\text{Gd}$  and  $^{160}\text{Gd}$  are currently estimated to be delivered at the end of Q2 of FY2019.

### **Persons Contacted at IRSN**

Luiz Leal, Host  
Raphaelle Ichou  
Stephan Ivo

### **Itinerary**

11/19/17	Travel from Munich, Germany (personal vacation) to Paris, France
11/20/17 – 11/24/17	NEA Headquarters, Paris, France (conference agenda attached)
11/27/17 – 12/01/17	IRSN, Fontenay aux Roses, France (detailed agenda follows)
12/02/17	Travel from Paris, France to Knoxville, USA

IRSN, Fontenay aux Roses, France (day-by-day agenda)

11/24/17	Evaluation work on the isotopes of $^{156}\text{Gd}$ , $^{158}\text{Gd}$ and $^{160}\text{Gd}$ . Review of historical experimental data for lead. Review of current lead evaluations.
11/27/17	Synchronization of evaluated resonance parameters between $^{156}\text{Gd}$ , $^{158}\text{Gd}$ , and $^{160}\text{Gd}$ (ORNL) and $^{155}\text{Gd}$ and $^{157}\text{Gd}$ (IRSN). Review of performance improvements and differences.
11/28/17	Evaluation work on the isotopes of $^{156}\text{Gd}$ , $^{158}\text{Gd}$ and $^{160}\text{Gd}$ . Review of experimental data for lead.
11/29/17	Discussion of U-233 nuclear data needs. Review of experimental data for lead. Review of current lead evaluations.
11/30/17	Benchmarking studies using the latest joint resonance parameters for all isotopes of gadolinium, $^{156}\text{Gd}$ , $^{158}\text{Gd}$ and $^{160}\text{Gd}$ (ORNL) and $^{155}\text{Gd}$ , and $^{157}\text{Gd}$ (IRSN).
12/01/17	Evaluation of the benchmarking results. Discussion of the experimental data needs for a new evaluation for lead.

## DISTRIBUTION

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