



## OPINION

on the materials for participation in a contest for the academic position "professor", field of higher education 4. Natural sciences, mathematics and informatics, PD 4.4. Earth Sciences, scientific specialty "Ecology and Ecosystem Protection", on the discipline "Solid Waste Treatment Technologies", announced by the University of Forestry in SG no. No. 100 of 16.12.2022, procedure code ELA-P-1222-98.

### Candidates for participation in the contest are:

#### 1. Assoc. Prof. Eng. PhD Ekaterina Ivanova Todorova

**Prepared the opinion:** PhD Mariana Genova Doncheva-Boneva, professor of "Ecological Monitoring", PD 4.4. Earth Sciences from University of Forestry (UF)

#### 1. Brief biographical data about the candidate

Assoc. Prof. Ekaterina Todorova was born on December 28, 1961 in Sofia. In 1985, she graduated with a master's degree, chemical engineer at the Institute of Chemical Technology in Sofia. In the period 1985-1987, she studied at the Higher Economic Institute - Sofia and graduated with the qualification "patent specialist". In 1995, she defended her dissertation and obtained the scientific degree "candidate of technical sciences" (Ph.D.). Assoc. Prof. Todorova's work experience is 37 years and includes the following positions: patent specialist at the Patent Office at the University of Chemical Technology and Metallurgy (UCTM) (1983-1986), chemical engineer at the Scientific Research Sector (SRS) of UCTM (1991-1993), project manager at the SRS of the University of Mining and Geology (UMG) and teacher (conducting exercises of "Inorganic Chemistry" and "Electrochemistry") (1993-1999), chief assistant at UF (1999-2006), associate professor of "Solid Waste Treatment Technologies" at UF (2006 – up to now), deputy dean of the Faculty of Ecology and Landscape Architecture (FELA) (2012-2016) and dean of FELA (2016 up to now). In addition, since 1996, she has been working as an expert, consultant, project manager at Ecotech Consult LTD. During the period 2002-2004, she was "Transport and Logistics of Hazardous Substances and Mixtures" coordinator at the Bulgarian Chamber of Chemical Industry.

Assoc. Prof. Todorova has conducted courses to increase the qualification in various areas: project management, training methodology, electronic forms of distance learning, circular economy, management systems audit standard, etc., for which have been presented 10 certificates/official notices.

#### 2. Compliance of the applicant's submitted documents and materials with those required according to the Regulations for the Development of the Academic Staff at UF;

The documents and materials presented by Assoc. Prof. Todorova are in accordance with Art. 65a, paragraph 4 of the Regulations for the Development of the Academic Staff at UF (2019).

#### 3. Evaluation of the candidate's educational and teaching activity

Assoc. Prof. Todorova has over 23 years teaching experience at UF, out of total of 37 years. She conducts lectures and exercises in the following disciplines:

- "Solid Waste Treatment Technologies" - mandatory discipline (MD) for the specialty Ecology and Environmental Protection (EEP), EQD "bachelor" full-time and part-time. Titular of the discipline;
- "Technologies for Fluids Purification" - mandatory discipline for the EEP specialty, EQD "bachelor", full-time and part-time. Titular of the discipline.
- "Preventive Activity for the Environmental Protection" - MD for the specialty EEP, EQD "bachelor", full-time and part-time, module "Complex Permits".
- "Environment Management Systems" - optional discipline for the EEP specialty, EQD "bachelor", full-time and part-time. Titular of the discipline.

- "Chemical Substances and Risk for the Environment" - optional discipline for the EEP specialty, EQD "bachelor", full-time and part-time. Titular of the discipline.
- "Household Waste Management" - mandatory discipline for the EEP specialty, EQD "master", master's program "Urban Ecology". Titular of the discipline.
- "Abiotic Monitoring" - MD for EEP specialty, EQD "master", MP "Environmental Restoration and Ecological Monitoring", module "Waste" and "Water".
- "Application of Remote Methods for Mining Facilities Monitoring" - optional discipline for the specialty "Remote Methods for Monitoring and Modeling in the Environment", EQD "master". Joint program with UMG. Titular of the discipline.
- "Circular and Sustainable Waste Management" - optional discipline for the "Environmental Engineering", EQD "master". Joint program with Technical University - Gabrovo. Titular of the discipline.

Assoc. Prof. Todorova has prepared curriculums for the disciplines she leads, some of which were updated in 2012, 2014 and 2017. The last 2 programs were developed in 2022.

During the period 2011-2022, Assoc. Prof. Todorova was the supervisor of 39 successfully defended diploma students, including 30 "masters" and reviewer of 16 graduation theses. She is supervisor of three doctoral students, two of whom have successfully graduated and continue their academic careers at UF. She is a consultant to a doctoral student in department "Engineering Ecology" at UCTM. Assoc. Prof. Todorova is supervisor of four interns on an individual training plan for further qualification in areas such as bio-waste treatment from parks and gardens, chemical substances and environmental risk and environmental management systems.

Assoc. Prof. Todorova has active participation in the updating of the curriculums for EEP specialty, EQD "bachelor" and "master" not only during her term as deputy dean and dean of FELA, but also as a member of the EEP department. In 2008, she is included in a committee for preparing a curriculum for special EEP for the "Union" University - Belgrade. Assoc. Prof. Todorova's contribution, as dean of FELA, in the organization, development and adoption of new joint master's programs (2022) in specialties: "Environmental Engineering" with TU Gabrovo and "Remote Methods for Monitoring and Modeling in the Environment" UMG is significant.

Assoc. Prof. Todorova participated actively in the preparation of documents for three successive accreditations and post-accreditations of PD 4.4. Earth Sciences, for the "Bachelor" and "Master" EEP, as well as doctoral program "Ecology and Ecosystem Protection", as a member and chairman of a committee from the department, and in the last one as deputy dean of FELA.

Assoc. Prof. Todorova annually participates as the head of complex practices of SWTT and TFP. She conducted practical training for Belgian master's students from the University of Liège, Belgium. Assoc. Prof. Todorova was a lecturer in training in a practical environment, organized by the Bulgarian Industrial Association and in the mentoring program "Circular Economy for Sustainable use of Natural Resources".

For 16 years, Assoc. Prof. Todorova has been actively participating in the state examination commissions for the two EQD. She is a chairman of a committee for the planned funds allocation for additional scholarships to full-time PhD students at FELA.

The presented information and the attached evidentiary material (official notes, orders, certificates) are testimony of the high level of educational and teaching activity of Assoc. Prof. Todorova.

#### **4. Evaluation of the candidate's scientific, scientific-applied and publication activities**

General description of presented materials.

The candidate Assoc. Prof. PhD. Ekaterina Todorova participated in the contest with:

- Habilitation work - monograph (B3)
- Articles and reports published in scientific publications, referenced and indexed in world-



- famous databases with scientific information - 9 pcs. (Г7)
- Articles and reports published in non-refereed scientific peer-reviewed journals or published in edited collective volumes – 25 pcs. (Г8)
- Guidance of a successfully defended doctoral student – 2 pcs. (E14)
- Participation in a national scientific or educational project – 18 pcs. (E15)
- Participation in an international scientific or educational project – 3 pcs. (E16)
- Management of a national scientific or educational project – 15 pcs. (E17)
- Funds raised for projects managed by the applicant – 1 pcs.(E19)

*Activities that are not included in the groups of indicators for the minimum requirements for acquisition of AP under PD 4.4. Earth Sciences*

- Implemented development – 1 pc. (No. 105 of the application)
- Issued training materials - 2 pcs., brochures and leaflets related to management of persistent organic pollutants - 7 pcs.
- Unpublished reports, presentations, posters presented at a scientific forum - 3 pcs.
- Prepared reviews - 1 monograph and 4 scientific publications
- Scientific jury – 1 - SS "Doctor of Sciences", 3 - AP "Doctor", 4 - AP "Chief Assistant" and 4 - EQD "Doctor".

Assoc. Prof. Ekaterina Todorova is very active as an expert in the field of waste in preparation of strategic documents, plans, in development of projects, environmental assessments, etc. to various institutions and organizations - Ministry of Environment and Water, Ministry of Agriculture, Food and Forestry, Sofia Municipality, Energy Institute, Balkan Scientific and Educational Center of Ecology and Environment, "KRESS 2013" LTD, "Himkomplekt" LTD, etc., for which 13 orders/references/office notes are presented.

#### **4.1. Participation in scientific, scientific-applied and educational projects**

Assoc. Prof. Todorova has submitted documents for participation in 37 scientific-applied and educational projects, including 3 international, 1 infrastructural, 3 educational. She is manager to 15 of the projects, and to 2 of them – manager by UF. The total number of points for indicators from group "E" is 764, incl. 80 points for supervision of doctoral students (E14), 180 points for participation in national projects (E15), 60 points for participation in international projects (E16), 300 points for project management (E17) and 144 points for attracted funds for projects (E19). With minimum requirements for AP "professor" 150 points, Assoc. Prof. Todorova significantly exceeds the minimum requirements for this indicator.

#### **4.2. Characteristics of published scientific results**

The monograph submitted for the competition "Industrial symbiosis of biodegradable waste - a key element for its prevention" is written on 168 pages and fully meets the requirement for a monograph according to DASRBA, as the topic is directly related to the announced contest in the discipline "Solid Waste Treatment Technologies".

For participation in the contest for the academic position of "professor", Assoc. Prof. Todorova submitted 34 scientific publications, which were not included in her participation in the contest for the academic position of "associate professor". Publications are in scientific journals and collections of international scientific conferences, as follows:

- Publications in scientific editions referenced in global databases - 9 pcs. (26.5%), including 4 in editions abroad and 5 in editions in Bulgaria.
  - Publications in journals with impact factor (IF) WoS and Elsevier – 4 pcs. (11.8%), total IF = 1.743;
  - Publications in journals refereed in WoS – 5 pcs. (14,7%)
- Publications in non-refereed peer-reviewed or edited journals – 25 pcs. (73,5%)

- Publications in journals – 15 pcs. (44,1%)
- Publications in collections of scientific forums – 7 pcs. (20,6%)
- Edited collective volumes – 3 pcs. (8,8%)

Journals in which the scientific papers are published - International Journal on the Science and Technology of Desalting and Water Purification (1pc.), Journal of Environmental Protection and Ecology (3pcs.), Journal of Balkan Ecology (5pcs.), Journal of the University of Chemical Technology and Metallurgy (1pc.), Forestry Ideas (5 pcs.), Web of Scholar (2 pcs.), Journal of Management and Sustainable Development (2pcs.), Journal of Chemical, Biological and Physical Sciences (1pc.), etc.

- ✓ Language – English 21 pcs, Bulgarian – 13 pcs.
- ✓ Number of co-authors: independently - monograph; with one co-author – 14 pcs; with two co-authors – 10 pcs; with three or more - 10 pcs.

The scientific papers presented by Assoc. Prof. Todorova form the following number of points:

- from group "B" - 100 points for a published monograph (B3), which fulfills the requirements for this group indicators.
- from group "Г" - publications in refereed and indexed editions (Г7) – 137,9 p. and publications in non-refereed, peer-reviewed (Г8) – 170,2 p. The total number of points from group "Г" indicators is 308,1 points, with a required minimum of 200 points.

**The minimum national requirements for the acquisition of AP "Professor" PD 4.4. Earth Sciences are not only fulfilled, but exceeded by 108 points.**

#### **4.3. Reflection of the candidate's scientific activity in the literature (citability)**

In the documents presented by Assoc. Prof. Ekaterina Todorova, a list with a total of 188 citations of 24 scientific papers is attached. Excerpts from the citations are presented as evidentiary material.

The presented citations are distributed among the groups of indicators as follows:

- Citations in scientific publications referenced and indexed in world-famous databases with scientific information or in monographs and collective volumes - Д10 - 156 citations (17 in publications with IF) on 13 scientific works - 780 points.
- Citations in monographs and collective volumes with scientific review - Д11 – 6 citations of 2 scientific papers – 18 points.
- Citations in non-refereed journals with scientific review – Д12 – 26 citations of 9 scientific papers – 52 points.

**The total number of points for indicators from group Д is 850, with a minimum requirement of 100 points for AP "Professor" for PD 4.4 Earth Sciences.**

*The large number of citations, as well as the fact that 3 of the publications have over 130 citations, a large part of which are in refereed and indexed editions, shows the great interest of the scientific community abroad and in our country to the papers of Assoc. Prof. Ek. Todorova.*

#### **4.4. Contributions at the candidate/s papers (scientific, scientific-applied, applied)**

The scientific works of Assoc. Prof. Ekaterina Todorova cover various areas of waste management, such as research on the quantity, quality and composition of domestic, construction, mining, hazardous, biodegradable waste and sewage sludge, as well as the impact of some of them on the environment, treatment methods, eco-efficiency assessment, etc. and can be united in 3 directions, and in summary the scientific and scientific-applied contributions are the following:

**Direction 1. Minimization and utilization of waste as a raw material and energy resource, including through industrial symbiosis**

*Scientific contributions:*

- Opportunities for the realization of industrial symbiosis for biodegradable waste in Bulgaria are scientifically, technically and technologically justified (B1).



- For the first time, was made a connection between the possibilities for waste minimizing and utilizing as a raw material and energy resource in settlement systems, different in size, number of population and represented industrial sectors, enabling the development of new industrial activity.(B1, Γ8-14)
- It has been established that industrial symbiosis is realized in different ways depending on the classification of sewage sludge from treatment plants as hazardous or non-hazardous waste. (B1)
- It has been confirmed that industrial symbiosis can bring benefits to the environment, in case of successful implementation and functioning of the symbiotic relationships between the participants (B1).

#### *Scientific-applied contributions*

- Specific technological solutions are proposed based on the biodegradable waste quantitative and qualitative composition and its life cycle, in the context of industrial symbiosis.(B1)
- A scheme for minimization and utilization of non-hazardous sludge from sewage treatment plants by obtaining compost and lubricompost, has been developed.(B1)
- It has been confirmed the need for sludge to go to an anaerobic biotechnological treatment process in order to use the energy capacity for energy production, after which the resulting fermentation product to be applied in agriculture.(B1)
- A quantitative assessment of the generated waste from treatment plants is made and it was established that their classification as hazardous and non-hazardous predetermines their treatment. A scheme of industrial symbiosis of hazardous sewage sludge from treatment plants has been developed based on thermal methods for obtaining various chemical products that are an alternative to natural gas and oil (Γ8.17, Γ8.18).
- The possibilities and conditions for achieving the ecological standards in waste water treatment from the pulp and paper industry, as well as in the waste water treatment of some heavy metals and metalloids in the copper production, have been established (Γ7.1; Γ8.7).
- Hazardous waste at the national level has been identified quantitatively and by location, as well as the quantities of composite packaging waste by municipalities, the problems with construction waste. It has been proven that hazardous waste quantities are decreasing, but through eco-efficiency, the appropriate methods of their treatment and conversion into energy and raw material resources can be identified (Γ7.9, Γ8.3, Γ8.5, Γ8.8, Γ8.12, Γ8.19, Γ8.20).
- An advanced household waste management system has been developed, which can ensure its transformation into a raw material and energy resource. It has been experimentally proven that the location of municipalities at the national level does not affect the household waste morphological composition. It has been proposed a scheme for treatment and utilization of solid household waste generated in Sofia. (Γ7.2; Γ8.2; Γ8.6; Γ8.10, Γ8.14)
- The quantities for initiating the primary C/N ratio (30:1) of green and brown waste, their preliminary preparation, the sequence of loading into the compost pile, including its aeration, ensuring an optimal composting regime are determined.(Γ8.23)

## **Direction 2. Environmentally friendly management of mining waste**

#### *Scientific-applied contributions*

- It has been established that mining waste from processing of copper and polymetallic ores, containing gold and silver, do not contain hazardous to the environment and human health substances, in concentrations, leading to their classification as hazardous waste. (Γ7.6, Γ7.7, Γ8.1, Γ8.9, Γ8.11)
- It has been confirmed that mine waste from cyanide gold mining meet the regulatory requirements and concentration of weak acid dissociable cyanide at discharge points meets best available techniques (Γ8-4).

- It has been proven that mining waste can be used in various sectors of industry and construction. They contain valuable substances that can be used as an alternative to natural materials. It has been proven that mining waste utilization for backfilling of mining developments does not lead to additional leaching of the impurity elements contained in it. (Г8.13, Г8.15, Г8.16)
- A database has been created for the mineral substrate (mining waste), hydrological and hydrogeological profile of the area of the village of Chelopech, surface and underground water quality, soil and sediment analysis. It has been found that mine waste from the embankments has no potential to neutralize acidic waters, which leads to the deterioration of plant nutrition conditions, suppressing their growth and inhibiting the metabolic processes of some microorganisms. (Г8.22, Г8.21)

#### *Methodical contributions*

- It has been developed a methodological approach for mining waste classification and its behavior in the environment by applying a static and kinetic leaching test. A leading criterion in the mining waste classification is its origin and chemical composition, with complex application of legislation on mining waste and waste management (Г7.4, Г7.3).

### **Direction 3. Eco-efficiency of waste treatment technologies**

#### *Scientific-applied contributions*

- By eco-efficiency assessment of various operating installations for bio-waste composting and thermal treatment, it is confirmed that higher eco-efficiency has methods in which the energy and raw material potential of waste is utilized (Г7.5, Г7.8).
- By determining eco-efficiency for different thermal methods for waste treatment, it is found that the installation for obtaining electrical energy has the highest efficiency, followed by the installations for the production of ammonia and diesel (Г8.18).
- It has been proven that collecting and recycling of one ton recyclable materials is much more economical than landfilling one ton of waste. It has been found that as disposal costs increase, thermal methods will become more eco-efficient (Г8.20).

#### *Methodical contributions*

- A unified system for detailed eco-efficiency assessment through thirteen groups of indicators is proposed, each of which includes a different number of specific indicators for environmental protection, human health protection and sustainable development (Г7.5).

### **5. Assessment of the candidate's personal contribution**

From the submitted materials for the "Professor" contest, the monograph is entirely the candidate's personal work. Of the publications co-authored by Assoc. Prof. Todorova, she is the lead author in 9 issues. Since no separation protocols have been presented for the other scientific papers, I assume that contributions and participation in them are distributed equally among the participants.

I believe that the achieved scientific, scientific-applied and methodical contributions in the scientific papers of Assoc. Prof. Todorova are significant in the scientific specialty in which the contest is announced and especially in the field of Waste Management.

### **6. Critical notes and recommendations**

I have no critical notes. The materials for the contest have been prepared very precisely.

### **7. Personal impressions**

I have known Assoc. Prof. Ekaterina Todorova for over 20 years and my impression of her teaching, research and administrative work is excellent. She is a respected and demanding teacher, authoritative, respectful with professionalism and at the same time dedicated in working with students and PhD students. In her scientific activity, she is extremely responsible and precise. Assoc. Prof. Todorova is a very good leader and organizer - active, proactive and precise. As a colleague, she is attentive, loyal, and responsive.



### **8. Conclusion**

From the exhibition presented above, it is visible that over the years Assoc. Prof. Todorova has established herself as an authoritative teacher and scientist in the field of Waste Management.

**In conclusion, I SUGGEST the candidate ASSOC. PROF. PHD EKATERINA IVANOVA TODOROVA to occupy the academic position of "professor" in the discipline "Solid Waste Treatment Technologies" from PD 4.4. Earth Sciences, scientific specialty "Ecology and Ecosystem Protection"**

Prepared the opinion:

The opinion is submitted: 03.04. 2023