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Expert Evaluation Report

on training material of the project:

Solid Waste Facilities Managers Qualification Framework:

Towards a European qualification for Solid Waste Facilities Managers

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Table of Contents

1. Introduction.....	1
2. Evaluation process	1
3. Evaluation results.....	2
<u>3.1</u> Comments on the entire Qualification Framework.....	3
4. Evaluation results of the Qualification Framework sections	4
<u>4.1</u> Environmental Management (ULO EM)	4
<u>4.2</u> Financial and Contractual Management (ULO FCM)	7
<u>4.3</u> Health and Safety Management (ULO HS)	9
<u>4.4</u> Human Resources Management (ULO HRM).....	10
<u>4.5</u> New Projects Management (ULO NP)	11
<u>4.6</u> Operational Management (ULO OM).....	12
5. Evaluation of the Technical Qualification Framework	14
<u>5.1</u> Anaerobic digestion and Mechanical Biological Treatment Module (ULO AD/MTB).....	14
<u>5.2</u> Composting module (ULO COM)	15
<u>5.3</u> Landfill sites module (ULO LF)	16
<u>5.4</u> Recycling module (ULO REC).....	19
<u>5.5</u> Thermal Treatment Module (ULO INC)	19
<u>5.6</u> Transfer Stations Module (ULO TS)	21
6. Evaluation of the Info Training toolkit	22
<u>6.1</u> Environmental Module	23
<u>6.2</u> Financial and Contractual Module	23
<u>6.3</u> Health and Safety Module.....	23
<u>6.4</u> Human Resources Module	23
<u>6.5</u> New Projects Module.....	24
<u>6.6</u> Operational Module	24
<u>6.7</u> Technical Module	24
7. Conclusions.....	26

1. Introduction

The SWFM-QF project “**Towards a European qualification for Solid Waste Facilities’ Managers**” has been funded in the framework of Lifelong Learning Programme under the action of LEONARDO DA VINCI Multilateral Projects for Development of innovation and aims at developing a European qualification and training framework to address the needs of Facilities Managers in the waste management industry. This evaluation report was prepared by the order of the project coordinator, SIGMA Consultants Ltd.

The report has been structured according the following sections:

- Presentation of the evaluation team and the evaluation process;
- General comments on the training material;
- Detailed analysis of the review;

2. Evaluation process

The evaluation team consisted in a group of two experts: P. Samaras and A. Deligiannis.

P. Samaras, Dr Chemical Engineer, is Professor at the Laboratory of Water Technology and Environmental Protection, at the Department of Food Technology, Alexander Technological Education Institute of Thessaloniki, Thessaloniki, Greece. Dr Samaras has more than 20 years of expertise on water and solid waste management issues. He has participated in more than 40 national and international research and demonstration projects, funded by E.U. and from local sources (ministries, industries, companies etc.). He has over than 60 publications in journals; more than 100 presentations in international conferences; 6 chapters in books; 1 EU patent holder. He is member of the Organizing Committee of 10 International Conferences; member of the Scientific Committee of 15 International Conferences; reviewer of research project proposals in EU and Greece; reviewer of papers submitted for publication to international scientific journals; instructor for continuing education courses on Environmental Technologies for various private and public organizations; consulting engineer in private enterprises related to the examination of water-wastewater quality and the preparation of environmental impact assessment reports.

A. Deligiannis, Dr. Chemical Engineer, has more than 35 years on water, wastewater and solid waste management processes. He was working at the Thessaloniki Water and Sewage Authority (EYATH) and he was responsible for the design, construction and operation of several installations of EYATH, such as the Thessaloniki Municipal Wastewater Treatment Plant, the Wastewater Treatment Plant of the Thessaloniki Industrial Area etc. He was involved in works related to the treatment of landfill

leachates, while in the early years of his professional activity he was employed in the construction and operation of sanitary landfill sites. He is teaching as adjunct professor at the Department of Civil Engineering, at the Alexander Technological Education Institute of Thessaloniki, a course related to Wastewater Engineering.

The evaluation process includes the evaluation of all the particular sessions of the info-training toolkit and the qualifications frame of the programme using the following criteria:

- Adequacy and relevance of the proposed qualifications according to the project's objectives;
- Consistency and effectiveness of the training approach;
- Expected relevance impact at EU and national impact.

The evaluation carried out by reviewing the documents and deliverables, as shown in the project site (www.swfm-qi.eu/main). Review took place by line-by-line critical reading, based on evaluators experience.

3. Evaluation results

During the project a Qualification Framework for Solid Waste Facilities Managers has been developed, to fulfill the needs of for managers occupied in different types of solid waste management facilities. The identified qualifications are presented in the form of a matrix according to EQF level 6 knowledge, skills and competences descriptors, supporting to their recognition and adoption across the European Union countries.

The Qualification Framework consisted in seven sections, according to the following:

1. Environmental Management
2. Financial & Contractual Management
3. Health and Safety Management
4. Human Resources Management
5. New Projects Management
6. Operational Management
7. Technical issues

Technical issues are related to technical management of specific waste treatment plants, including:

1. Anaerobic Digestion
2. Mechanical biological treatment

3. Composting
4. Landfills
5. Recycling
6. Thermal Treatment
7. MSW Sorting Facilities (Transfer Stations)

Review comments are presented in the following sections: comments on the overall process are included in the next paragraph, while detailed comments on each section are following.

3.1 Comments on the entire Qualification Framework

A number of specific comments have been noted in specific sessions; however, a general comment is related to the overall concept: the required information and the corresponding training schedules are based on modules that have been (successfully) applied in Central European countries, without taking into account potential national conditions, i.e. assumptions, prerequisites etc that are valid at local/regional level. For example, in Greece, national solid waste management plans are published (and currently are under revision) by the Ministry of Environment, identifying solid waste production rates, potential management and treatment schemes etc. However, the final decision about potential regional solid waste management plans are taken by regional authorities (the so called solid waste management institutions) and are carried out usually as a result of complex procedures including mainly political decisions. The Management Board of the institutions is usually consisting in persons (mayors) not exactly related to solid waste management specific problems and processes. Therefore, the level of contribution of solid waste related scientists in decision making process is rather limited!

On the other hand, auditing procedures on the performance of a selected or an existing process are not usually carried out or they are undertaken by Ministerial institutions. Furthermore, public awareness, although significant, is almost always negative to any efforts towards a change in solid waste management techniques (for example see the problems associated with the installation of a solid waste transfer station in Thessaloniki!), due to the fact that landfilling still remains the main (with the lowest cost) solid waste management method in Greece. It seems that the training tool should be adapted to local prevailing conditions, between the EU countries!

It should be mentioned that processes included in the Qualification Framework and methods and practices examined are better targeted to Municipal Solid Wastes rather than Industrial, Hazardous or Infectious wastes requiring a case by case study.. Therefore, a distinct definition should be used of that term in order to avoid any misleading conclusions.

Furthermore, a few of the training modules are dedicated and have to be developed focusing to scientists of specific background: especially modules referring to monitoring equipment or devices for the analysis of the composition of solid waste streams are related only to chemists or related scientists. Simultaneously, target groups for a few of the modules dealing with the mechanisms taken place during a process (i.e. composting; anaerobic digestion) should include only biologists or chemists and related scientists.

Detailed comments on each field of the Qualification Framework are following in the next two sections.

4. Evaluation results of the Qualification Framework sections

This paragraph includes the detailed evaluation results of the 6 first sections of the Qualification Framework, while presentation of the Technical Framework will be given in the next paragraph.

4.1 Environmental Management (ULO EM)

Overall evaluation: The module target is the implementation of environmental protection strategies on site, taking into account the existing environmental policies (national and EU). However, the module covers a broader field, including the development of Environmental Management Systems (EMS), which involves several sustainability principles such as energy, resources and water conservation etc; nevertheless, an EMS does not replace the requirements for issuing an environmental permission. Moreover, the implementation of an EMS is not mandatory right now, and it is usually applied on a voluntary basis.

Learning Outcomes: LO1/2 are quite general-the trainee will be involved in procedures for applying existing environmental policies rather, than ‘constructing’ or ‘reviewing’ them. The main LO of this module should be the ability to prepare and Environmental Impact Assessment Study, required for issuing an Environmental Permission for a particular site or activity. It should be underlined that not all scientists are familiar with environmental permission laws.

Results:

Subunit 1: Knowledge ability refers to ‘keeping up to date with changes in environmental legislation’; basic knowledge on current environmental policies and methods for Environmental Impact Assessment studies is missing!

Subunit 2: This subunit is overlapping with subunit 1.

Subunit 3: Although it refers to the level of understanding the principles of environmental policies in place, foreseen competence involves staff training only in H&S issues.

Subunits 4, 5 and 6: all these subunits are related to the development of an EMS on site and should be merged; the knowledge, skills etc covered by each unit represent the various components of an EMS tool (performance of Environmental Analysis; development of the EMS structure; auditing procedures). The implementation of an EMS is usually carried out by dedicated consultants; in addition, EMS requires the involvement of all personnel, resources etc on a continuous basis; an extended training of personnel is required for a long time aiming to the appropriate implementation of EMS targets. Furthermore, a wider analysis should be given to the preparation of the EMS plan including the identification of parameters, factors, targets etc.

ULO EM-2

Learning Outcomes: LOs are related primarily to preparatory actions for the implementation of environmental policy in a site; however, auditing procedures i.e. the processes for the assessment of the environmental performance of an activity, using targets, countable parameters etc should be included.

Results:

Subunit 1: It is an introductory unit consistent to the module structure.

Subunit 2: This subunit is mainly related to monitoring actions; skills related to social aspects i.e. information of citizens about the environmental performance of the plant are more than welcomed! However, more analysis should be given on control measures of the environmental impacts. In addition, a few of the competences are required by an EMS and potentially there is an overlap by ULO EM-1 (subunits 5-6).

Subunit 3: It has a rather ambitious goal: the title should be replaced to ‘allocation’ of H&F resources than to ‘ensure’ them; efforts for finding the appropriate H&F sources usually depend upon other factors than the ability of personnel to allocate them. In addition, this subunit could be linked to operational management module.

Subunit 4: Target groups for ‘other involved persons’ in training programs should be clearly defined, as training material depends upon the attendants.

Subunit 5: Public awareness is an important option and it is foreseen in this subunit. The adoption of measures for the improvement of the environmental performance of a site is the main target of this subunit; nevertheless, a thorough analysis of improvement measures is usually included in an EMS scheme, where targets are set and the level of confronting to these desired values are evaluated at the end of each period. Therefore, there is partial overlapping with ULO EM-1 (subunits 4-6).

Subunit 6: Risk assessment and management of emergency incidences represents one of the EMS components, while it has to be included in an Environmental Impact

Assessment Study. Nevertheless, other issues could be included, such as those required by IPPC principles.

ULOEM-3

Overall evaluation: The module principles could be covered by the Operational Management or/and Human Resource Management modules as they refer to staff every day actions, duties, training and evaluation of their skills. Moreover, personnel training is already included in ULO EM-2 (subunit 4).

ULOEM-4

Learning Outcomes: LOs are partially included in UL OEM-1 and 2. However, the environmental compliance training module as a single unit is important for performance evaluation/ auditing reasons.

Results:

Subunit 1: Emphasis should be given to policies and guidelines at a national/regional level. Solid waste management plans and facilities are prepared and operated by regional solid waste management institutions, while local authorities (municipalities) are mainly responsible for the collection and transfer of solid wastes rather than treatment and final disposal or utilization. Moreover, according to this comment, the involvement (and therefore the training requirements) of a scientist depends upon his duties as personnel of a regional authority or a local one. In addition, several cases prove that the compliance to environmental legislation requires more efforts than the engagement of the personnel: sometimes it depends upon political decisions, while in other cases it is difficult to be applied, especially when compliance measures are associated to high investment and operation costs.

Subunit 2: It represents a section with confusing goals: the implementation of SEA is beyond the duties of a SWM facility personnel, while application of IPPC or EIA is more than necessary for the operation of such a unit. It could be merged to the previous subunit.

Subunit 3: The target of this subunit could be wider: abilities for identifying trends (at national, EU and worldwide levels) in solid waste management guidelines and treatment systems should be developed.

Subunit 4: It is a rather important subunit, dealing with auditing issues; it should be linked to monitoring and training actions in the corresponding modules (ULO EM-2, subunit 2, UL O EM-3 etc). In addition, public awareness measures could be involved in this subunit, aiming to communicate the auditing (performance evaluation) results to

citizens of the neighbouring areas and the efforts of the personnel for keeping up-to-date to environmental guidelines.

Subunit 5: It is closely connected to previous subunits of this module and should be allocated to the corresponding areas (for example in subunit 1 related to compliance to environmental legislation and subunit 2 related to knowledge on administrative and authorisation processes).

4.2 Financial and Contractual Management (ULO FCM)

Overall comment: This module is related to budget management techniques; however, the implementation of environmental management systems is closely related to the allocation of financial resources and it should be considered as a single module in this section. **Environmental accounting methods** are applied during the establishment of an EMS and are useful for the assessment of the performance, the level of reaching the desired targets, the set-up of new targets etc. The inclusion of such a subunit could greatly enhance the efficiency of the training tool.

Moreover, financial conditions and budget allocation greatly depend on political decisions, subjected to national or local plans of investments and the economic situation (see Greece), without any scientifically rational basis. Therefore, methods for justifying cost breakdown resulting to a prioritized list of potential actions or investments and the corresponding viability, should be useful in this unit (SWAT analysis; LCA analysis etc).

ULO FCM-1

Overall comment: An introduction to fundamental financial terminology and methods could be useful, in order the attendants to be familiar with economic analysis calculation; in several cases, personnel involved in financial breakdown calculations has not the corresponding background.

Subunit 1: the training tool includes the entire solid waste management process; therefore, financial breakdown of processes other than the waste treatment facility should be included, such as those associated to the operation of transfer stations. Nevertheless, potential local conditions about charging policies should be considered, depending upon the trainee target groups: usually municipalities are charged by the solid waste management body for the amount of (collected) solid wastes delivered at the plant, while citizens are charged by the municipalities for the produced wastes. Such a process may affect the estimation of potential incomes.

Subunit 2: Methods for the economic evaluation of a potential investment should be included, such as return of investment, pay-out time, etc, aiming to obtain a ranking list of alternative processes that could be used for decision making.

ULO FCM-2

Overall comment: Although the module title is management of the economic aspects of sustainable business practices, there are not any actions related to sustainability! In addition, the prediction of potential changes and their economic impacts is a rather complicated task: financial crisis in Greece (and worldwide) resulted in the reduction of solid waste production amounts per capita, associated to a decrease of solid waste management revenues and the operation of a solid waste facility at reduced rates, lower than the designed ones, associated to a further burdening of the SWM system.

ULO FCM-3

Overall comment: the preparation of an appropriate contract is usually carried out by dedicated and experienced personnel (either by a notary), using **standard forms** foreseen by the legislation; technical specifications and guidelines are most important and should be carefully described during the contract preparation. The level of involvement of a trainee in contract development issues, and the corresponding freedom parameters are quite limited; nevertheless, significant issues are associated to contract performance and the next sections ULO FCM-4 and 5 are dealing with them. Therefore, these modules and especially ULO FCM-3 and 4 could be merged together, while ULO FCM-5, with practices for monitoring the contract performance and for predicting potential deviations, is very important and should be kept as an independent module. In the latter one, specific emphasis should be paid on measures and actions to counterbalance potential deviations, aiming to the on-time submission of the contract deliverables and outcomes.

ULO FCM-PP-1

This module includes two sections related to actions due to call for tenders and supplies procurement processes; therefore, the contents of the section could be allocated in two modules, i.e. ULO FCM-PP-1 related to call for tenders actions, and ULO FCM-PP-2 related to Supplies Procurements. In addition, national conditions may affect the appropriate realisation of a tender contract: under strong financial crisis conditions, large budget discounts are offered by the tenders, in their efforts to get a work contract; there is a high risk these contractors to fall to deliver the work on time with the appropriate quality. Therefore, specific efforts should be taken for the trainees to establish processes and parameters certifying the safety and the quality of the work; in addition, the evaluation of tenders should be taken place, considering not only the lowest price offer, but using a ranking system considering available sources and personnel, work-load, experience etc. As a result, this subunit should include training methods and information

material on techniques for the evaluation of tenders or suppliers, although in most cases such a process is foreseen by the corresponding legislation.

4.3 Health and Safety Management (ULO HS)

Overall comment: This module is dealing with Health and Safety issues in solid waste management processes. In general, the module is consistent with existing policies; issues related to identification of potential risks, management of threats, training etc are well organized, based on existing practices and following current guidelines. However, two comments which are considered important and should be included as single subunits are:

1. Health and Safety issues are greatly rely on **prevention**; therefore, actions and training material on prevention strategies should be clearly defined and developed.
2. Onsite training or training under real cases is the best practice especially when dealing with H&S matters; as a result, this training module is recommended to include **on site practice and identification of H&S parameters and actions in real cases**. This process will enhance the training target and in addition will offer the trainers the ability to identify potential specific site-related H&S risk factors depending upon a particular process (for example H&S issues in an incineration plant are different than a composting facility).

The module consists in 3 submodules; in a few cases there is an overlapping of each submodule targets, i.e. implementation of H&S policies (in ULO HS-1) requires the establishment, monitoring and maintenance of a H&S plan foreseen in ULO HS-2, and the management of occupational hazards as described in ULO HS-3. In all cases, during the preparation of an H&S plan, the following factors are of importance:

- Workers represent the front line in each facility when dealing with these issues; therefore, all actions should start and end to them. Workers represent valuable sources of information, especially when a detailed analysis of critical hazardous points has to be carried out. In addition, all training tools should be focussed to workers, while every day training should be foreseen, in real (simulated) cases.
- The utilization of experts advices on H&S issues is of importance and should be always asked to, when dealing with such a sensitive area.
- The involvement of a group of scientists with different background is required, especially in actions related to identification of potential hazards (for example in the knowledge abilities of subunit 6, in ULO HS-1: define in detail chemical, physical, biological, ergonomic and organisational hazards). Group work is well documented in ULO HS-2 (subunit 1), although it is missing in a few cases: for example in ULO HS-1, subunit 5, competences foreseen consist in regularly

monitor staff during work (the competence should include the preparation of a H&S group responsible for monitoring staff performance).

- Specific efforts should be given to H&S issues for workers not belonging to the personnel of a specific SWM plant, such as the workers employed in the collection system, which are visiting the management facility during the track emptying process. These workers should follow the guidelines of the site personnel.
- In addition, emphasis on H&S issues should be given especially to visitors, and especially to more sensitive groups such as school students.

4.4 Human Resources Management (ULO HRM)

This particular module is dealing with Human Resources management: it is well organized, covering several issues, as far as possible, including establishment of an efficient human resources strategy, staff allocation depending upon the qualifications, personnel evaluation methods, duties and requirements identification, recruitment of new personnel, communication methods. The following points are of interest and could be taken into account, during the development of an efficient HRM plan:

1. Personnel hierarchy is usually established in existing bodies depending upon a number of factors; especially in public or local authorities structures the duties, of each person of the staff are strictly defined. Therefore, sometimes it is quite difficult to make any changes in the staff or their duties, especially when there changes are associated to a change of roles or salary reduction.
2. Motivation of the personnel aiming to improve the performance and the efficiency of a SWM facility is another factor that has to be taken into account. Personnel, especially in a public body or in a local authority, is used to work based on experience passed to them through older staff, and in most of the cases there is not any challenge for doing this work through a different way or for doing another work. Therefore, an HRM plan should include methods and practices for setting up strong incentives for the workers.
3. The proposed plan, as it has been developed, is mainly targeted to higher level personnel, supervising a department. These persons have the authority to establish an HRM plan, to evaluate the skills and the performance of the workers and to make recommendations of each worker duties according to his qualifications. However, potential training plan could involve lower level personnel, aiming to support them during the everyday work, regarding their role in the SWM facility as a worker, their duties and responses, evaluation practices, their behaviour in the workplace, the communication with the other colleagues, the public or their superiors.

4.5 New Projects Management (ULO NP)

ULO NP-1

Overall comment: This module refers to the establishment of a strategic planning and management process for a SWM facility. The approach used in the specific module is well organized, although it is more adapted to the private sector than to bodies that belong or are operating under public or local authorities stakeholders. The strategic management plan of a SWF includes a rather limited number of freedom parameters; the efforts of the personnel of such a plan are concentrated on the appropriate management of solid wastes produced from a particular area. Therefore, efforts to expand the targets or the objectives of the SWM plant could be associated to technical issues or dissemination activities; these issues are well developed in the next modules (ULO NP-2). Furthermore, strategic planning related to solid waste management is carried out, at least in Greece, at central governmental level by the corresponding Ministry of Environment, responsible for issuing the National Solid Waste Management Plans (currently under update). These plans identify a list of methods for collection, processing and treatment of solid wastes, as recommended by the corresponding EU guidelines, with a limited contribution from a SWF body. Therefore, this section could be removed or merged to the following ones.

ULO NP-2

Overall comment: This is a significant training module, that is related to measures for technical improvement of a SWM facility. The module is well structured following subsequent steps from identifying potential needs, preparation of a cost-benefit analysis, and development of a plan for future investments adapted to the organizations demands. A few of the module subunits could be linked to other modules such as:

1. Cost benefit analysis and preparation of a ranked list of recommended measures for technical improvement could be linked to the Financial Management module (ULO FCM).
2. The analysis for the identification of new technologies should take into account methods for the analysis of new trends in solid waste management processes by reviewing existing techniques, and by identifying models for predicting solid waste management production rates, depending upon consumers behavior: the establishment of consumer behavior profile is a known technique for predicting drinking water demands and could be employed in this section (see the current trend of decreasing solid waste production per capita due to financial crisis).
3. The analysis of potential improvements in a SWM plant should include from the starting point the examination of two factors that may be interrelated: public awareness (social factor) and environmental legislation. Both factors are well developed in the Environmental Management module (ULO EM) and are usually time consuming

parameters that strongly affect the time schedule of a proposed new investment. Fail to rationally assess the effect of these factors may result to significant delays in the implementation of the strategic plans of a SWM facility.

ULO NP-3

Overall comment: It is a training module related to the implementation of improvements during waste management operations. Although this section refers to improvements, same processes developed in ULO FCM-PP-1 could be applied (and should be linked to) when dealing with call for tenders and construction works onsite: implementation of improvements, monitoring of implementation and evaluation of the implementation plan follow the approach used in the contract agreement.

ULO NP-4

Overall comment: the target of this module is quite important: some of the products from a SWM facility require a thorough market analysis (such as recycled materials from sorting facilities, bottom ash fractions from the pollution control equipment of an energy recovery system, compost, etc). The content of the subunits should be linked with the Financial Management module and especially with the methods used for Procurement Processes (ULO FCM-PP-1): market analysis, information on sources, equipment etc and contract development are components discussed in the particular module.

4.6 Operational Management (ULO OM)

Overall comment: It is a significant module related to appropriate and efficient operation of a SWM facility, representing the 'core' of the entire training program. A few of this module Learning Outcomes are linked to the other modules i.e. Human Resources management related to the management of SWM workers, the Health and Safety module, the Environmental Management module etc; however, the integration of these sections in the particular module and the development of OM as a distinct module are more than necessary, ensuring the appropriate share of knowledge in a rational level. A short comment is associated to the need of expanding the contents of this module to include Operational Activities in case of emergency and/or natural disasters.

ULO OM-1

Overall comment: Management of the daily activities of a SWM facility is the objective of this module and it is well structured, taking into account as far as possible the related measures about organization of the normal operation, to plant operators training, safety

etc. Some of the issues have to be handled according to existing best practices or according to the guidelines. For example:

In subunit 6, 'Ensure a system to control the movement of vehicles in the site': specific provisions are taken for the movement of vehicles into the site at low speed limits-usually vehicles are moving in the opposite side of the road than it is normally used, in order the drivers to move at low speed and avoid thus potential accidents. In case of accidents, specific and immediate actions are foreseen aiming to keep the facility under operation for 24 hours per day. Another issue to deal with is the harsh climatic conditions that in some cases may affect the movement of SW transfer trucks into the site, ensuring the appropriate and continuous feeding of the plant.

In subunit 7, 'Maintain a system to ensure contractors and visitors received appropriate site induction and instructions': it is an important option especially when visitors are sensitive groups such as school students. Usually, watching a 5 min video about site constrictions, and signing an official form represent common practices prior to entering into the site.

In subunit 9, 'Apply techniques for the identification of training needs': personnel training, especially on H&S issues represent a requirement by the corresponding legislation and should be linked to ULO HS module.

Subunit 12 is related to public awareness activities and could be moved to ULO OM-4 module related to social aspects of sustainable business practices. In addition, the proposed approach should include activities related to social responsibility methods, communication of the everyday performance data to public, contribution or encouragement for the establishment of citizens bodies contributing to auditing schemes and aiming to favor public trust to the operation of a SWM facility in the neighboring area.

ULO OM-2

Subunit 1: the skills described in this subunit are related to a limited number of scientists. The 'demonstration of advanced skills on how to check the proper functioning of laboratory equipment' is an action requiring personnel of a particular scientific background.

Subunit 2: The skills foreseen by this subunit, including the organization of internal auditing processes, is very important for the successful and efficient operation of a SWM facility: scheduled and non-scheduled internal exercises are often organized for this reason and should be included in this section.

ULO OM-3

Overall comment: Although the Learning Outcomes include the development of a strategy according to sustainability issues and aiming to reduce the environmental impact from the operation of a SWM facility, the corresponding measures are limited only to collection of recyclables. Moreover, utilization of several materials or resources is a great option in such facilities, including energy recovery, materials recovery, utilization of byproducts in various applications etc. Therefore, the content of subunits 1 and 2 could be extended to include all potential alternatives and could be linked to Environmental Management module (ULO EM).

ULO OM-4

Overall comment: As already mentioned, the content of subunit 12 of module ULO OM-1 could be moved to this specific one. Social factors are of great importance in the entire life of a SWM facility and the corresponding section is well developed.

5. Evaluation of the Technical Qualification Framework

The evaluation of the technical section of the Qualification Framework is presented in this paragraph, with comments and recommendations for each of the corresponding training modules.

5.1 Anaerobic digestion and Mechanical Biological Treatment Module (ULO AD/MTB)

Overall comment: This module is related to solid wastes mechanical and biological treatment including anaerobic digestion. These processes are quite different, presenting distinctive characteristics, byproducts, assumptions etc. Therefore, it is recommended the module to be replaced by two modules: one related to Mechanical Biological Treatment and a second one related to Anaerobic Digestion processes. Under these conditions, potential overlapping in few subunits will be avoided (for example ULO AD/MTB-5 and ULO AD/MTB-9 are similar but refer to different processes).

Furthermore, the two modules could be organized according to the structure followed in the other modules (ULO INC; ULO COM etc) with the following sections: issues on planning and construction phase, management of every day operation and performance, monitoring, etc.

Mechanical-Biological Treatment: It is recommended to replace the acronym MTB by **MBT** corresponding to the initials of the process. Specific subunits could be added related to:

- Plan, design and construction of the MBT facility, including the required licensing;
- Environmental impact of the operation;
- Specific facilities for the treatment of off-gases;
- Provisions for the quality of the products (SRF; RDF) including procedures for the analysis of their quality and potential certification, and marketability analysis.

It is recommended to apply in this module the approach, principles and methods used in the Composting module (ULO COM).

Anaerobic Digestion module: The structure of this module could follow the structure used for the other modules (such as the Incineration one, ULO INC). Issues that are required in order to deduce an integrated approach, include:

- Plan, design and construction of the anaerobic digestion facility, including the required licensing;
- Environmental impact of the plant;
- **Safety issues** that are of specific importance for biogas management;
- Biogas utilization for power/heat production, following the principles applied in the corresponding section of ULO INC;
- Provisions for the utilization/management of residues i.e. the solid residue remaining after the digestion and the liquid residue (digestate).

5.2 Composting module (ULO COM)

Overall comment: This module is related to solid waste composting stations; it is well developed giving a thorough analysis of all related issues in an adequate way. A few comments related to the module development are:

1. In addition to quantity, the quality (characteristics) of the produced compost play a significant role and special provisions should be paid to this issue. In several countries, standardized guidelines have been adopted regarding the composition of the compost, depending upon foreseen uses. Quality issues should be included in more details, aiming to enhance the marketability of the produced materials (for example in ULO COM-1 subunit 2; ULO COM-2 subunits 1 and 3; ULO COM-3 subunit 3).
2. Training should provide an analysis of required environmental permissions for composting facilities; environmental management processes should be clearly identified in ULO COM-1, subunits 2 to 4, related to the planning and construction phase of a composting facility.

5.3 Landfill sites module (ULO LF)

Overall comment: This module is dedicated to the management of a landfill site and the related processes. It is well organized, and includes most of the primary issues associated to sanitary landfills. Main components that are recommended to be included in the module are:

1. Public awareness and dissemination of operation data to the citizens represent an important component for the acceptance of a landfill site in an area. Such actions should start from the early period of landfill site planning and continue for a long time after the closure of the site (see the following comment about remediation). In addition, activities open to the public should be foreseen, such as organization of visits from citizens, schools etc.
2. Remediation processes and after landfill closure activities should be included as a single module in this section. The life of a landfill could be extended to a long time after closure (20 to 40 years), during which several processes are taken place resulting to a (decreased) leachate and biogas production etc. Nevertheless, remediated landfills are open for recreational activities and therefore a specific unit is recommended to include these options.
3. Specific efforts are given to the closure and remediation of **uncontrolled landfills**, according to the EU legislation. As the number of these sites is quite large, a module could be prepared related to these issues.

Comments on the specific components of this module are:

ULO LF-1

This module is related to the processes during the planning and construction phase of a landfill; it is assumed that a survey of alternative places for the construction of the landfill site has been already carried out, but a short subunit could be added, regarding the selection criteria of the most appropriate area for the construction site. This process is quite important and it seems that it is the most difficult and time consuming stage in the entire process (taking into account the necessary actions for public acceptance).

In addition, risk management studies should take place during the planning phase, aiming to identify the operation life of the landfill, the environmental impacts, remediation studies etc. Risk management studies could be linked to the last subunit of this module about management of landfill security system (No 6). Risk management studies should be developed on a 'what-if' scenarios, and should include the understanding and training on real cases scenarios i.e. measures and activities during emergency: fire (it is analyzed in ULO LF-7), collapse of a cell wall, release of biogas at long distance from the landfill site by passing through porous soil (partially covered by ULO LF-4 and LF-8), change of leachate quality by the time (requiring thus alternative treatment methods), failure or

breakage of bottom liner resulting to the release of leachates on surface water or underground water aquifers, etc.

Furthermore, a subunit should be included related to the expected environmental impacts and the preparation of an Environmental Impact Assessment Study, required to obtain the Environmental Permission for the operation of the site. Such a process could be linked as a case study to the Environmental Management module (ULOEM).

Moreover, specific provisions should be taken for leachate management and treatment, during the planning phase, according to the following:

1. Leachate quality is changing as the landfill becomes older; therefore a different treatment system is required in order to produce an effluent of acceptable quality.
2. In some cases, co-treatment of leachates and municipal or industrial wastewater is carried out with various advantages. Therefore, one of the knowledge targets of this subunit (No. 3) should be alternative treatment processes of the leachates.
3. Reclamation of leachates and reuse of recycled water on site or for other applications are some of the sustainability options of a landfill site (especially when using dedicated treatment equipment such as membranes, producing an effluent of high quality).
4. The final water body for the discharge of treated effluent is an additional option that has to be developed in subunit 3, and could be linked to the corresponding activities related to the required Environmental Permission processes.
5. Nevertheless, sludge is produced during leachate treatment and specific efforts should be given to the appropriate handling of this waste; potentially, sludge could be disposed in the landfill site itself, but such a process required a specific permission, and it should be foreseen from the planning phase.

The title of subunit 6 could be changed to ‘Develop a landfill security system’ as this unit is included in the module related to planning and construction phase.

ULO LF-2

Subunits 1 and 2: The types of the wastes that can be delivered to a site are identified during the planning phase; any other type of waste not foreseen in the Environmental Permission is not accepted and has to be diverted in another site or treated by a different process.

Subunit 3: The examination of the composition of solid wastes is time consuming, requiring long term studies and it is not taken place on an every day routine analysis; in addition, as soon as a landfill site is constructed and operated, the knowledge of qualitative data of solid wastes have a low impact on the operation process.

Subunit 7: This subunit is mainly related to gas collection system. However, landfill gas may be utilized for power production or should be subjected to onsite treatment for

removal of specific substances (e.g. sulfur compounds) prior to its combustion in a flare. It is recommended these issues to be included in the corresponding section.

Subunit 8: Communication of the performance data should include citizens, aiming to increase the public acceptance of the landfill site.

ULO LF-3

Subunit 5: The quantities of leachates produced by a landfill are not easily estimated as there are several factors that affect the formation of wastewaters. Usually, flowmeters are installed at the entrance of the leachate treatment facility, accounting for variations of leachate flowrates. More important is the training on the varying leachate quality and the appropriate treatment methods, to obtain an effluent that can be reused or discharged, according to the guidelines.

ULO LF-4

Subunit 3: This section is organized in a general way, that does not reflect actions taken in a landfill site. The appropriate environmental and H&S parameters that are proposed to be monitored should identified, in order the trainee to understand which equipment is used and for what reason.

ULO LF-6

Subunit 2: The subunit is related to procedures for the management of unauthorized wastes. However, as already mentioned, the types of wastes accepted in a site are pre-defined during the planning phase; any other wastes should not be accepted onsite. Therefore, there is not any alternative process for the management of non-permitted wastes. In addition, there is not any time available to consult an expert about the management of a specific waste, as soon as the truck is in front of the landfill entrance gate.

Subunit 3 is missing.

ULO LF-7

Subunit 1: It has to rephrased there is a continuous repetition of the word ‘cause’.

Subunit 3: Training on the development of a plan for the prediction of short- and long term impacts (environmental, financial and social) due to landfill fire.

ULO LF-8

Overall comment: This subunit could be linked to an Environmental Permission subunit.

Subunit 6: It is strange that this section is related to bird control measures! What about other species of the ecosystem?

5.4 Recycling module (ULO REC)

Overall comment: This module is related to solid waste recycling stations. Usually the operation of these stations is associated to mechanical sorting of recycled materials and partially, this module could be merged to ULO TS module. In general, the module is well organized, with a structure adequate to cover all relative issues. Potentially, the module could be linked to other modules on the following issues:

1. ULO FCM related to Financial Management issues: market analysis of recycled materials should be carried out aiming to determine potential revenues or alternative markets for the produced materials. In addition, market analysis will allow the prediction of future trends in the variation of recycled material prices and the prediction of recycling plant viability.
2. ULO NP related to New Projects: the trainees should be able to identify alternative recycled materials buyers or new/alternative sorting equipment of recyclables.
3. ULO HS related to Health and Safety issues: H&S is important in these facilities, due to both the operation of the mechanical equipment and the composition of the wastes. Therefore, a specific subunit could be added dealing with H&S matters.
4. Public awareness can greatly affect the amounts and the composition of recycled materials; therefore, specific efforts should be given to the organization of public campaigns and a particular subunit could be added to this module.
5. A field visit should be organized during this course, in a solid waste recycling plant, and the trainees should work in groups on several issues presented during the course, such as types of materials recycled, recycling equipment, handling of recyclables etc.

ULO REC-1, subunit 3: There is an incomplete sentence in *Competences!*

5.5 Thermal Treatment Module (ULO INC)

Overall comment: The term Incineration was used for combustion processes in recent years; however, currently the adoption of sustainability principles in solid waste management resulted to strong efforts for materials and energy recovery from every available source. Therefore, combustion processes are associated to measures for energy and material recovery; **Waste to Energy (WtE)** or **energy recovery** processes of solid wastes are the terms used and it is recommended to replace the term incineration by them in this module.

ULO INC-1

Learning Outcome 3 is related to Recognize systems and procedures to implement, in order to deal with waste that require specific handling and the rejection of unauthorised waste; quality control measures at the entrance of a WtE facility includes a few measurements (for the determination of chemical composition such as moisture etc); the origin of the wastes is reported by the owner himself and there is not applied any other control measure to justify the hazardous properties of a waste delivered to the plant.

ULO INC-2

Overall comment: A similar comment as in ULO INC-1: no specific measures are taken for waste identification at the entrance; waste origin is reported by the owner by filling a questionnaire. It is very difficult to identify the composition and the properties of a waste sample, requiring expensive equipment, trained personnel and long period of times.

Subunit 3: this section is related to a technical issue, i.e. size reduction of solid wastes. However, the specific module is related to waste management and does not include any technical parts. Therefore, it is recommended to move this subunit to a section dealing with technical parts such as subunit 5.

ULO INC-5

Overall comment: The content of this module is very broad, involving all the actions and measures for the operation of a high temperature facility. Therefore, a more thorough analysis should be undertaken with a detailed analysis of waste quality justification, monitoring equipment, safety measures etc.

In addition, bottom and fly ash handling should be moved in a distinct subunit; usually in existing WtE facilities, specific efforts are paid for the treatment of combustion residues. Especially for fly ash, dedicated landfills are constructed for its appropriate disposal; nevertheless, bottom ash may be utilized in various applications such as road construction, pavements etc. In these cases, trained staff is required for operating the quality control and delivery stations of bottom ash.

In addition to ash residues, other residues (e.g. metals) may be recovered during the operation of a WtE facility and specific provisions should be taken for their appropriate handling on site.

ULO INC-7

Overall comment: Air Pollution Control facilities in WtE plants represent a significant component of the entire system, with a large share of operation costs. Training of scientists on these issues is a rather difficult task including several options such as operation and maintenance, operation under optimum conditions, monitoring etc, and it is well developed in this subunit. More emphasis should be given to the communication of the operation results to the public by developing methods of dissemination (for example organization of public workshops; on line publication of the results; encouragement for the establishment of citizens-bodies allowed to freely check the operation data, etc).

In addition, the operation of Air Pollution Control facilities is associated to a number of materials-consumables (for example lime for sulfur control, filters for the baghouse, activated carbon, etc). Training actions related to delivery, storage, and handling of the raw and used materials should be included in this subunit.

5.6 Transfer Stations Module (ULO TS)

Overall comment: This module is related to solid waste transfer stations where the main process is compression/compaction of solid wastes and loading on large trucks for transfer to the final treatment plant; however, the approach used is quite general and it better corresponds to sorting stations. Sorting stations are used to separate the various fractions of commingled wastes streams producing streams for recyclable and energy recovery materials. Usually, sorting stations represent a part of a solid waste recycling station; therefore, it is recommended to merge this module with the Recycling module (ULO REC).

ULO TS-2

Subunit 2: This module is related to the identification of options for the management, treatment and disposal of waste types. Sorting stations represent a component of a specific solid waste treatment facility, where the treatment process has been already identified, constructed and operated; nevertheless, the installed treatment processes determine the types of waste streams that will be delivered in the site. Therefore, the development of a training module in this subunit related to outline the various waste treatment and disposal options is questionable, as delivered wastes will be subjected to already specified treatment.

ULO TS-3

Overall comment: Sorting stations (and all solid waste management facilities) are designed and constructed to receive a specific type of a waste stream; other types of wastes are not allowed to be treated in a particular facility and should be diverted to a

different plant. The type of the waste stream is identified usually by the owner; if non-permitted waste is delivered on site, it should be directly returned to the owner. Therefore, the objective of this module is not justified.

6. Evaluation of the Info Training toolkit

The Info Training Toolkits were evaluated by a thorough examination of the information given in the corresponding sections. As a general comment, it has been noticed that training toolkits were developed in accordance to the learning outcomes, the knowledge, skill and competence of the corresponding sections of the Qualification Framework. Therefore, the comments made for the Qualification Framework are valid for the Training Toolkits. Furthermore:

- The adaptation of the training toolkits in conditions prevailing in each country is considered important; therefore, course content and training material should include information about national policies, practices and methods, in order to enhance the knowledge transfer process and to favor the gained knowledge and experience of the trainees by a specific course, that will be utilized then in their work life.
- Requirements for trainers could be given in more details, in order to make easier the selection of the most appropriate one for each course, by the introduction of specific qualifications: for example, a few of the qualifications required by the trainers could be experience of more than 5 years on a particular training course, teaching experience of at least 2 years, number of projects involved etc.
- Requirements for trainees could be set up to include scientists of specific background: for example field studies on waste management could be replaced by a background on civil, mechanical or chemical engineering. In addition, similar to trainers qualification, criteria for the selection of trainees could be employed for example current work in similar field, post graduate studies, previous experience etc, using appropriate weighting factors.
- For both trainers and trainees, a comprehensive, balanced, rational and transparent framework of evaluation should be developed and presented to the candidates, before the call for tenders process.
- It is important to include as much as possible case studies or field visits in each training course that will enhance the training potential of the participants and it will bring them in front of 'real life' problems.

Additional comments about each section are following.

6.1 Environmental Module

Courses structure and training material have been developed in accordance to the Environmental module Qualification Framework. However, it has been noticed that a few of the links are not working (for example check: http://www.zerowastescotland.org.uk/sites/files/wrap/EN979_EMS%20Building%20Blocks.pdf or <http://www.zerowastescotland.org.uk/content/how-do-i-write-environmental-policy>) while other links are connected to a site with limited access (for example: <http://accessengineeringlibrary.com/browse/environmental-monitoring-handbook>).

Trainers requirements could be focused on their employment in environmental policies and environmental management systems rather, than on sampling, monitoring, waste management etc; these issues will be covered in the Technical Info-Training Toolkit.

6.2 Financial and Contractual Module

Course description of units 2 to 5 is quite poor and needs to be developed in more details in order to highlight the primary content of each session. Furthermore, additional course materials have to be introduced, as in 4 out of the totally 5 units, only one link is mentioned!

Requirements of trainers and trainees are very general without giving guidelines on specific qualifications that will allow the selection of the most appropriate candidates for each course (see general comments in paragraph 6).

6.3 Health and Safety Module

This module has been very well developed in almost all sessions!

Course structure is well organized including 8 sub-units; selection criteria have been set for both trainers and trainees, with the corresponding weighting factors for the evaluation. There is only one comment for this session: only one link for all units is offered as course material and it should be enriched.

6.4 Human Resources Module

Human Resources Module has been developed in accordance to the corresponding session foreseen in the Common Qualification Framework: courses have been structured in 4 sub-units and a wide range of links is included for course materials.

Comments on the requirements for trainers and trainees follow the corresponding general comments in the beginning of paragraph 6, i.e. guidelines and measurable parameters should be set for the evaluation and the selection between the candidates.

6.5 New Projects Module

This module has been structured in 4 sub-courses; each sub-unit description could be given in more details (especially for unit 4) in order to reflect the main targets of the course. Several links are included for course material; however, two of them are not linked to a specific site (in unit 1, Project Management Professional Study Guide and in unit 2, Technology roadmapping), while there is one link that is not working (http://www.uni-oldenburg.de/fileadmin/user_upload/forschung/download/guideline_project-management.pdf).

Requirements for trainers and trainees should follow the general comments and the specific comments presented in 6.1 Environmental Module: identification of specific qualification and evaluation guidelines should take place, adapted to the corresponding issues of the particular module.

6.6 Operational Module

This module has been developed following the principles set in the Qualification Framework; the module is structured in 5 sub-units while 3 more sub-units are recommended as an alternative option, depending on the background and the experience of the trainees. Each sub-unit targets are well organized, according the corresponding learning outcomes; however, course description and content for all units is missing, although a broad list of skills and competences has been included at the end of the Structure and Contents section. It is required that course description will be completed for each unit, in accordance to the previous sessions. There are two links in unit 2 connected to the same web-page (<http://www.gdrc.org/uem/waste/swm-fogawa1.htm> and http://www.legrand.com/EN/sustainable-development-description_12847.html).

Additional qualifications for trainers and trainees should be included in case of the optional courses.

6.7 Technical Module

Technical Module has been developed according to the Technical Qualification Framework. Comments for each specific sub-module are following:

ANAEROBIC DIGESTION

The course on anaerobic digestion follows the structure of a common book on Fundamentals of Anaerobic Digestion rather, than it is adapted to the principles given by the Qualification Framework; the course contains the sub-units on Introduction, Types of Anaerobic Digesters, Start-up, Operation and Control, and Regulation and economical

aspects. It is recommended to follow the learning outcomes, the skills and competences foreseen by the corresponding Qualification Framework (as soon as it is prepared as a separate module from the mechanical treatment one).

Proposed course material is rather poor and in some cases does not correspond to the content of the unit: unit 2 is related to types of anaerobic digesters and has a three page document with photos from anaerobic digesters; unit 3 on anaerobic digester start-up, operation and control is linked to a document on biogas upgrade and utilization.

Trainees requirements are quite broad covering a background from chemistry and microbiology to laws and economic/scientific(what does it mean) field.

COMPOSTING

This sub-module has been developed in a conceptual and well organized method, consisting in 4 sub-units, with an extended description of the learning targets, the content and the support material for each one. Few links in training material do not work and should be checked.

Requirements for trainers and trainees are well presented, although a number of measurable factors should be included to facilitate the selection of the most appropriate applicants.

LANDFILL SITES

Landfilling course is developed in 7 sub-units with a detailed description of each unit targets and content. Emphasis should be given to broad the number of recommended training material, as there is only one reference for all units.

Qualification framework for trainers and trainees is thoroughly developed and there are no comments.

MECHANICAL BIOLOGICAL TREATMENT

The course concept has to be updated as anaerobic digestion is included together with mechanical biological (MBT) treatment, although:

- Anaerobic Digestion has been developed as a separate module in the Technical Training ToolKit
- In this module, no other information is included about anaerobic digestion.

The module is structured in 3 sub-units related to MBT; although the course description and contents are rather interesting, support material is missing. There is one document in Italian language in unit 1, while two documents in English are foreseen in total.

Trainers requirements have to be considered again as they are related to experience on anaerobic digestion and not to mechanical biological processes.

RECYCLING

Although the title of this module is recycling it is a module with quite general targets and content, that it is not focused directly on recycling and recovery of resources. There are several issues from energy management to plant management, although much work has been done at EU and national levels on recycling practices. Sub-unit description and content is missing; however, a list of contents and skills has been included at the end of the webpage and could be reallocated to each sub-unit. Support material is rather poor and it is not directly related to recycling (there are only 2 references associated to recycling), while a few links are not working. In addition, this course could be developed by merging with the Sorting Processes module.

Requirements of trainers could be identified in more details (for example 5 years experience in training at which field? 5 years of consulting experience in which field?).

THERMAL TREATMENT

The Thermal Treatment module is well developed, and it includes a broad field of issues on Waste to Energy facilities. Support material could be found in the following site www.wtert.eu. Requirements for trainers and trainees are rationally determined.

MSW SORTING FACILITIES

It is a module prepared in adequate method, covering as more as possible the corresponding issues about targets, outcomes, content, support material etc. It could be merged to the rather poor Recycling module, as already described in details in the corresponding Qualification Framework section (paragraphs 5.4 and 5.6).

Trainers and trainees qualifications are adequately foreseen, as well as the required training facilities and infrastructure.

7. Conclusions

The Qualification Framework developed under the SWFM-QF project “Towards a European qualification for Solid Waste Facilities’ Managers” is well structures including several issues related to solid waste management facilities.

A few issues have been identified by the line-by-line review of the project documents, related to each section. In general, the partners should primarily take care of the following:

The various processes and practices in the framework refer mainly to Municipal Solid Waste management techniques;

The modules should have the flexibility to be adapted to national guidelines, prevailing conditions and current practices;

A few of the modules are targeted to trainees with dedicated scientific background;

A few of the modules/subunits is recommended to be merged or extended according to the detailed analysis;

Furthermore, a continuous update of practices, techniques and processes is required in order the Qualification Framework to follow modern trends in solid waste management options.

Info Training Toolkits have been developed according to the principles, learning outcomes, skills and competences of the corresponding sections of the Qualification Framework. In general, trainers and trainees qualifications should be developed in a countable method, while in some courses an update of the support material is required. Anaerobic digestion Module has been developed separated from Mechanical-Biological Treatment Module, while Recycling Module could be merged to MSW Sorting Module.