Activity EFH-PS-3 (merged with EFH-PS-2)

Provide technical assistance for addressing industrial pollution and supporting environmental inspection and inventory for the Olive Oil and the Tanning industries of Palestine

Task 2 deliverable: Environmental management guidelines for the Olive Oil and Tanning industries

Version	Document Title	Author	Review and Clearance
V1- Draft	Environmental management guidelines for the Olive Oil and Tanning industries	Mr. Tiberio Taddi Mr. Stavros Vlachos	Prof. Michael Scoullos

THE SWIM AND H2020 SUPPORT MECHANISM PROJECT (2016-2019)

The SWIM-H2020 SM is a Regional Technical Support Program that includes the following Partner Countries (PCs): Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine, [Syria] and Tunisia. However, in order to ensure the coherence and effectiveness of Union financing or to foster regional co-operation, eligibility of specific actions will be extended to the Western Balkan countries (Albania, Bosnia Herzegovina and Montenegro), Turkey and Mauritania. The Program is funded by the European Neighbourhood Instrument (ENI) South/Environment. It ensures the continuation of EU's regional support to ENP South countries in the fields of water management, marine pollution prevention and adds value to other important EU-funded regional programs in related fields, in particular the SWITCH-Med program, and the Clima South program, as well as to projects under the EU bilateral programming, where environment and water are identified as priority sectors for the EU co-operation. It complements and provides operational partnerships and links with the projects labelled by the Union for the Mediterranean, project preparation facilities in particular MESHIP phase II and with the next phase of the ENPI-SEIS project on environmental information systems, whereas its work plan will be coherent with, and supportive of, the Barcelona Convention and its Mediterranean Action Plan.

The overall objective of the Program is to contribute to reduced marine pollution and a more sustainable use of scarce water resources. The Technical Assistance services are grouped in 6 work packages: WP1. Expert facility, WP2. Peer-to-peer experience sharing and dialogue, WP3. Training activities, WP4. Communication and visibility, WP5. Capitalizing the lessons learnt, good practices and success stories and WP6. Support activities.

This document is a deliverable of Task 2 of the activity EFH-PS-2&3 “Provide technical assistance for addressing industrial pollution and supporting environmental inspection and inventory for the Olive Oil and the Tanning industries of Palestine”. It was developed taking into account the information exchange that occurred during a relevant training that took place in Ramallah on 28-29 January 2019 under SWIM-H2020 SM.

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PREAMBLE

The 2017-2022 National Policy Agenda of Palestine includes provisions for industrial waste in terms of reduction, pollution control and solid waste management and recycling. Leather tanning wastewater in Palestine is highly polluted with Cr (III). Additionally, Olive Mill wastewater is considered as one of the most polluting waste waters from the food sector and causes great problems in biota and cultivations untreated in soil or aquatic systems.

To this end, Palestine requested from the SWIM-Horizon 2020 SM Expert Facility, support on Hazardous Waste Management which constitutes Activity EFH-PS-3 of the Environmental/Horizon 2020 Component. This document is a deliverable of Task 2 of the activity EFH-PS-2&3 “Provide technical assistance for addressing industrial pollution and supporting environmental inspection and inventory for the Olive Oil and the Tanning industries of Palestine”. It was developed taking into account the information exchange that occurred during a relevant training that took place in Ramallah on 28-29 January 2019 under SWIM-H2020 SM.

There was extensive discussion among the various stakeholders that participated and the outcomes have been considered by the authors in the development of this guidance document

1 ENVIRONMENTAL MANAGEMENT SYSTEMS

An Environmental Management System (EMS) is a framework that more and more **organizations (group, firm, company, business, body, institution, etc.)** adopt in order to address environmental issues and achieve environmental goals.

An organization can use an EMS for various purposes, such as to demonstrate to stakeholders to comply with legal requirements in a cost-effective manner or to go beyond regulatory compliance and improve its corporate image vis-à-vis competition which may lag behind. This is possible, as an EMS does not dictate a specific target of environmental performance to be achieved. As organizations differ from one another, each is set free to set its own individual objectives and targets in a transparent and coherent fashion. However, it is mandatory to achieve continuous improvement by means of consistent reviewing and monitoring, which will help identify opportunities to improve the environmental performance of the organization.

An EMS is a set of practices and procedures to systematically manage the environmental impacts of organizations. This system is based on the *Deming cycle* which is composed of four main steps:

- Plan: identifying aspects and impacts by implementing goals and objectives to be met;
- Do: implementing the selected course of action, including training and operational control measures;
- Check: assessing the measurements and reporting results to decision-makers;
- Act: deciding what changes need to be undertaken in order to improve organizational processes.

When an organization decides to implement an EMS, it needs to explicitly commit and aim for continuous improvement of its environmental performance. In fact, it can set its own targets, but they need to be disclosed and embraced by everyone, as employee participation is a fundamental aspect of EMSs. For this reason, EMSs are effective in improving an organization's environmental performance, and in doing so they provide a sense of direction and engagement at all levels, which contribute to its success.

The most commonly used frameworks for an EMS are ISO14001, established in 1996 by the International Organization for Standardization, and the Eco-Management and Audit Scheme, EMAS, developed by the European Commission in 1993. The ISO 14001 standard exceeds 358,900 certified sites worldwide (The ISO Survey[1]), and EMAS Regulation has more than 3,800 registered organizations covering over thirteen thousand sites in 2018 (EMAS Register[2]).

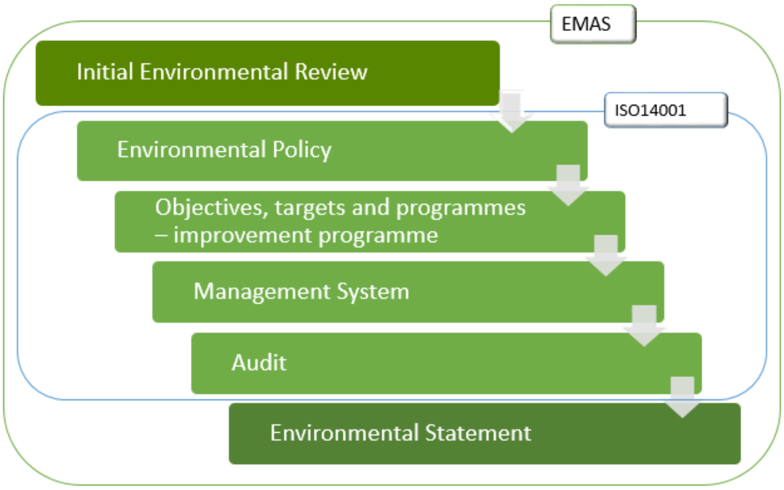
ISO 14001 and EMAS have many aspects in common, as they are both based on the Deming cycle of Plan-Do-Check-Act and aim for continuous improvement. Furthermore, they both place the “organization” as a field of common application of the standard. The term “organization” is broad in meaning and is the subject of a specific, fundamental definition: “group, firm, company, business, body or institution or, part or combination thereof whether incorporated or not, public or private which has its own functional and administrative structure”. This is a very broad definition and includes not only industrial organizations, but also service companies, public bodies, institutions and even individuals all of which cover specific functions (not just EMAS). Everything that falls under this definition is considered a “certifiable entity” and so, the “field of application” can be determined therein.

The delimitation of the activities and processes of the organization to which the “requirements” envisaged will be applied, is intended when talking about the “field of application” of a standard. A crucial aspect in defining these boundaries concerns the so-called risk of “cherry picking” which can compromise the importance and credibility of the certification. This practice, which is explicitly prohibited by the guidelines from the main parties involved in standardization and endorsement in the different schemes (for example ISO and various national training institutions), means that the boundaries which are defined only encompass the “good” part of the organization, so that it can meet the requirements of the scheme in question and therefore, exclude any “problematic” activities and processes from the field of application.

The two standards have also some differences. The EMAS Regulation[3] is a voluntary tool available to any organization operating in any economic sector within or outside the European Union that wants to assume environmental and economic responsibility; improve its environmental performance; and communicate its environmental results to society and stakeholders in general. Instead, the ISO 14001 Standard[4] is a private standard, set up by industry, that countries can adapt into their legislation; it is aimed to improve processes not performance itself. While EMAS is well known in the European context and valid at international level only since 2010, ISO 14001 has been recognized worldwide since its inception in 1996.

EMAS requirements exceed ISO 14001. It demands the publication of an environmental statement publicly available; employee involvement is recommended on top of their participation; any improvement in terms of environmental performance is double-checked by environmental verifiers; public reporting must be done according to the EMAS environmental statement; and the final registration is done by public authorities. The main actors for both standards are competent accreditation bodies, environmental verifiers, and inspection authorities (for EMAS only).

[1] The ISO Survey can be downloaded online at: https://www.iso.org/the-iso-survey.html [last accessed in January 2019]
[2] EMAS Register can be consulted online at: http://ec.europa.eu/environment/emas/emas_registrations/statistics_graphs_en.htm [last accessed in January 2019]
[3] Also referred to as ‘The Regulation’.
[4] Also Referred to as ‘The Standard’.



1.1 Initial Environmental Review (EMAS only)

The initial environmental analysis represents one of the crucial phases in the implementation process of EMAS and ISO 14001. First, it requires the organization to carry out a detailed study and complex self-evaluation. Then, the organization sets its preliminary objectives for improvement that it intends to pursue, which will greatly determine the structure and characteristics of the EMS. The term Initial Environmental Analysis actually means an "exhaustive initial analysis of the problems, impact and environmental performances connected to the activity of an organization".

The main objectives of an initial environmental analysis are to:

- Identify, assess and document the most important environmental aspects connected with the activities carried out;
- Study the interaction between these aspects and the technical and management activities carried out by the organization within its operations;
- Verify compliance with the legislative and regulatory requirements;
- Draft an initial appraisal of the environmental performances in view of the environmental policy (if the organization has already formulated one);
- Provide the necessary information and indications to establish priorities, objectives and the environmental program on the basis of the previous points;

The initial analysis takes into account all the environmental aspects that are connected to the activity and to the goods and services provided by an organization in order to highlight the most important ones to use as a foundation on which to "build" the different components required (the environmental policy, program, management system, audit and statement of activities).

The basic activities making up the initial analysis must, above all, be able to:

1. Identify the legal or regulatory requirements needed to fulfill and assess compliance with them;
2. Identify and analyze all the environmental aspects connected to the activity carried out and to the products and services provided;

3. Assess these aspects and select the most significant ones;
4. Keep a record of the environmental aspects;
5. Analyze the processes and procedures for existing environmental management and assess the lessons learnt from the analysis of any environmental accidents that have occurred.

In order to set up this activity correctly, the organization should conduct an initial detailed review of the:

- Production processes and/or the services it carries out,
- Raw and semi-finished materials, and the services it uses,
- Products and services it provides,

with the aim of identifying their effects (actual or potential) on the environment.

In order to get an overall picture as a reference point to use in the subsequent phase of assessing environmental aspects, the organization should gather data and information about:

- The current organizational layout of the company (including relations, where present, with the parent company) and its development;
- The layout of the production facilities and the infrastructure in which it operates (e.g. production plants for industry, network structure for energy distributors, transport for couriers and haulers, etc.);
- The environment, by showing, where possible, the relevant territorial, urban, housing, landscape, economic, social and environmental (geology, hydrography…) context.

In short, the initial analysis can be equated to a “snapshot” which depicts the environmental conditions of the organization at the time it was taken, forming the “starting point” from which the organization will be able to assess the progress of its environmental performance over time. At this point, the elements allowing the snapshot to be “developed” need to be looked at in more detail.

1.1.1 Identifying legal or regulatory requirements for compliance

EMAS and the ISO 14001 standard view compliance with legislation to be among the most important elements for obtaining registration. The initial analysis must verify that the organization knows all the pertinent regulations and complies with them. The basic requirements with which the organization must comply can be quite different and stem from different regulations, such as environmental laws, existing internal regulations, corporate directives concerning the environment, and its commitments arising from voluntary agreements or participation in initiatives promoted by external parties (environmental groups, local associations, etc.).

EMAS requires the organization to assess its status with regard to legal conformity by intervening in a timely manner to correct any shortcomings, and to verify and ensure that legal conformity is continually maintained. This requirement can be fulfilled by pursuing efficiency in technology, plant design and production and by defining the managerial and organizational methods required to continually monitor the legislative provisions and requirements concerning the organization’s activities.

The execution of the environmental analysis is, therefore, a very important phase in pinpointing, completing and updating the applicable regulation and in defining the appropriate ways to "handle" it correctly.

The box shown below indicates several possible ways of carrying out a check on legal conformity by an organization which can be applied to its different environmental aspects. The last question in the list could represent a starting point from which the organization could initiate an additional process to check and examine in detail the way legislative provisions are managed and compliance is approved.

Box 1.1. Guidelines for checking legislative conformity with all environmental aspects

- Is the organization aware of all the laws and regulations connected to the production activities concerning the aspect under examination?
- Has the organization identified the relevant legislative provisions, fulfilled all the administrative and authorization requirements?
- Has the organization initiated and completed the authorization procedures correctly?
- Has the organization obtained the relevant authorizations and received certifications?
- Has the organization respected all the methods and timeframes to renew the authorizations?
- Is the organization in compliance with the provisions and any regulatory limitations? Are there any disputes or ongoing cases affecting relations with the competent authorities?
- Has the organization initiated ways and means of collecting, updating, recording and archiving references to legislation and relevant regulations?

The ability of the organization to guarantee continuity in conforming to laws and regulations and the extent to which it fulfills its commitments is an initial indication of the significance and difficulties connected to a particular environmental aspect. The organization may decide to initiate corrective actions or improvements with different levels of priority depending on how critical the different situations concerning legislative compliance are (based on the results of the analysis) and its ability to maintain conformity.

The ISO 14001 standard and EMAS Regulation stipulate that the organization shall "establish and maintain a procedure which allows legal or other provisions regarding the environmental aspects of its activities, products and services to be identified and accessed". The organization may set up a registration system of legal and regulatory provisions to fulfill this requirement which is regulated by a procedure defining the responsibilities and the methods to manage, update and archive the registrations in question.

The organization is allowed to choose the structure of the system based on its requirements and features provided that it fulfills the following objectives to:

- Ensure that all the applicable regulations and relevant provisions are known (in short: the organization must know what to do to comply with current legislation);

- Guarantee control of all the activities dealing with administrative and authorization conformities (what it has to do).

The organization can make use of resources which facilitate the identification of the relevant regulations (the Competent Body, local environmental protection agencies, trade associations or magazines, or specialized internet sites, databases, consultancy firms, conventions, etc.) to maintain and revise legal requirements.

1.1.2 The identification phase and analysis of environmental aspects

EMAS stipulates that "an organization must consider all aspects of its activities, products and services and decide which aspects have a greater impact on the environment on the basis of the criteria it has set itself". Furthermore, the organization must initially look at all the environmental aspects connected with its activity and, after careful evaluation, concentrate on the ones it considers to be most significant.

Box 1.2 – Environmental aspect and environmental impact

- Environmental aspect is an "element of an organization's activities, products and services that has or can have an impact on the environment";
- Environmental impact is any "change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, product and services"

EMAS makes a distinction between direct and indirect environmental aspects to enable organizations in any sector to better articulate and complete the picture of environmental impacts that may result from their activities. It uses the concept of management control as a means of distinguishing between direct and indirect environmental aspects. Direct environmental aspects are defined as those aspects "under (full) management control of the organization" and indirect environmental aspects as those over which the organization "may only have partial management control".

A more detailed analysis concludes that the indirect aspects (that is, those aspects over which, according to the definition, the organization has only partial control) occur also because of the contribution (whether conscious or not) of at least one other party external to the organization – hereinafter referred to as the intermediate party – with which the organization shares management control. EMAS suggests that the identification and assessment process should be instigated by a review of the organization's ability to influence the aspect under analysis. In other words, it is necessary to assess the level of control or influence the organization may exert (or effectively exert) on the individual aspect; this assessment, in conjunction with the one for relevant environmental impacts, may make it possible to establish the significance of the indirect aspect.

During the identification and assessment process of the environmental aspects, the analysis must be carried out in consideration of the:

a. routine operating conditions (with regard to normal business operations including, for example, ordinary and extraordinary maintenance planned for the production plant);

b. non-routine operating conditions (including, for example, start-up conditions and shutdown of operations or of the production plant);
c. accidents, unforeseen situations or foreseeable emergencies (in this case the initial analysis should assess the possible consequences and measures adopted to prevent them in conjunction with the probability that the event will take place);
d. past, present and planned activities.

1.1.3 Assessment of environmental aspects and identification of the significant ones

Having identified and analyzed all the environmental aspects related to the activity carried out, the organization must assess them in order to select the ones which are considered significant and merit special attention in structuring the EMS. The definition of the criteria for attributing significance to the environmental aspects is, therefore, left to the organization and represents an essential phase in the initial review. However, these criteria must be ‘comprehensive, capable of independent checking, reproducible and made publicly available’.

1.2 Environmental Policy of an ‘organization’

The Environmental Policy defines an organization’s commitment to protect the environment, by stating objectives and principles for action, which will guide all its actions. Given its strategic importance in the general operation of the organization, the environmental policy must be viewed as an asset at the highest management level, be coherent and integrated into the existing organizational values, routines, and practices. Furthermore, it must be clearly stated in writing; signed by the highest echelons of corporate management; and implemented, maintained and updated over time.

The environmental policy is communicated to all personnel and made available to the public to guarantee the organization’s commitment to its employees and external stakeholders.

Among the mandatory contents, there is compliance with the law and standards of the organization; commitment to continual improvement; participation and involvement of personnel; commitment to dialogue with external parties.

1.3 Objectives, targets, and the environmental program

The organization must then define specific objectives for improvement and plan appropriate actions accordingly. It is essential that there is coherence between the organization’s environmental policy, the significant environmental aspects and the objectives for improvement. The transition from the general objectives to specific objectives allows the commitments undertaken by management to be translated into performance objectives tailored to the organization’s actual operational, organizational, technological and financial situation regarding the significance of the environmental aspects.

Having defined the improvement objectives and identified the actions required to pursue them, the organization then develops the environmental program. The involvement of the organization’s top management is an essential component of any environmental program to achieve the objectives and initiate the operational plans defined. Another fundamental aspect is the involvement of personnel in the environmental improvement program.

The organization should set up and maintain documented objectives and targets. *Environmental objectives* are broad environmental goals, arising from the environmental policy, that an organization sets itself to achieve, and which are quantified where practicable. *Environmental targets* are detailed performance requirements, arising from the environmental objectives, applicable to an organization or parts thereof, and need to be set and met in order to achieve those objectives.

1.4 Environmental Management System

The next step is to create an organizational and management structure, consistent with the identification and assessment of the environmental aspects, the commitments outlined in the Environmental Policy, the objectives and goals set by the improvement program as well as with the regulations which apply to the organization identified during the initial environmental analysis.

The organization needs to define, within its own general management system, a specific management, organizational and technical structure, the environmental management system (EMS) which is the driving force behind the organization's activities and processes aimed at executing the improvement strategy. Once the organizational structure has been defined, it is necessary to understand the training needs for each figure within the environmental management system and define the operational methods to manage the significant environmental aspects properly as well as ensure the system functions correctly.

The design and implementation of an EMS do not always entail an organizational revolution, but merely a rationalization and classification of some of the processes that are already in place before it is introduced into the organization.

Without jeopardizing the organization's complete autonomy in adapting its structure to ISO 14001 or EMAS requirements in accordance with its own technical and management requirements, it is important to consider some of the elements which need to be reviewed in the definition process of the system. In particular, an organization must:

- Adapt its organizational layout by defining (and giving an adequate description of) the "structure" of the environmental management system and the business functions involved by indicating the relevant tasks;
- Involve personnel by finding suitable ways to raise awareness, train and increase competence in managing environmental aspects;
- Define and implement effective work methods for the correct management of environmental aspects and a suitable response to emergencies;
- Monitor its environmental performance, the functioning of the system and find effective ways to solve any discrepancies;
- Define communication processes, both top-down and bottom-up, among the different company departments and towards interested external parties;
- Document the system and record its performance.

1.4.1 Definition of roles and responsibilities within the field of environmental management

In order to give all the functions and human resources, all the references and coordinates to correctly carry out the activities in the field of environmental management, a precise and detailed definition must be given for the:

- Roles of each figure in the organization must cover in the environmental management;
- Responsibilities attributed to those figures concerning environmental aspects;
- Duties and tasks assigned for the environmental management system;
- Work methods each person must employ to complete these tasks and duties.

1.4.2 Raising awareness, training and participation

An effective EMS can be achieved only if all the personnel, irrespective of the duties they perform and their function, are adequately informed and trained. These three areas of learning and personal development are complementary:

- *Education* is essential for creating the organizational conditions needed to assimilate the culture of prevention and is aimed at transferring skills that are not tied to one specific field of activity (know who you are).
- *Information* is a simplified form of classroom training: it transfers contents which can be assimilated even if it does not develop advanced forms of interaction (know-how).
- *Practical training* is a specific educational activity fulfilling the need to learn the correct practical use of tools and procedures (how to do).

1.4.3 Defining and implementing the correct work methods for managing environmental aspects and emergency situations

It is one of the most important requirements of the environmental management system. As a result, the environmental review results must be used as a starting point for identifying the operational activities with which the most significant aspects (direct and indirect) are associated and defining the most suitable actions and behavior in order to ensure that these operations are carried out with minimum impact on the environment.

1.4.4 Performance, monitoring and improvement measurement

The ISO 14001 standard and the EMAS Regulation indicate that the organization should establish and maintain documented procedures for regularly monitoring and measuring the key characteristics of its activities and operations that may have a significant impact on the environment. We can, therefore, pinpoint two elements of the monitoring system, in addition to the audit, which the organization must implement:

- Management monitoring, including periodic monitoring of the implementation status of the objectives and the monitoring of the effectiveness of the controls;

- Performance monitoring, measurement of the organization's environmental performance to verify that the goals set in the program have been reached by using the performance indicators identified.

1.4.5 Documenting the system and recording its performance: maintaining and controlling documentation

The ISO 14001 standard and the EMAS Regulation indicate that the organization should establish and maintain all information on paper or electronic systems needed to:

- Describe the fundamental elements of the management system and how they interact and provide directives on related documentation;
- Record activities regarding environmental management and the control and monitoring of significant aspects;

Box 1-3 Example of maintaining and controlling documentation (CAMBIARE imagine)

Elements of the EMS management system	Examples of management documents	Examples of registration documents
4.1 General requirements		
4.2 Environmental policy	Environmental Policy	
4.3 Planning	P01 Identification and assessment of direct and indirect environmental aspects	
	AAI Initial environmental analysis document	
	P02 Management of legal requirements	REG01 Register of legal requirements and relevant compliances
	Programme for environmental improvement	
4.4 Implementation and activities	P03 Management of human resources, information and training	REG02 Information, classroom training and practical training plan
	P04 Management of communications	REG03 Communications registration form
	P05 Management of system documentation	REG04 List of system documentation
	P06 Management and qualification of contractors	REG05 Questionnaire for environmental qualification of suppliers/contractors
	P07 Management of emergencies	
	IO01 Management of environmental documents for waste	
	IO02 Control of air emissions	REG06 Register of control results

	IO03 Control of transport of goods/waste in ADR	REG07 Check-list of controls on carriers
	IO04 Management of dangerous substances	REG08 Register of dangerous substances
4.5 Controls and corrective actions	P08 Management of performance and monitoring measurements	REG09 Register of monitoring and measurements
	P09 Analysis of NC e consequent CA and PA	REG10 Register of NC, CA and PA
	P10 Internal audit	REG11 Audit report
4.6 Management review	P10 Management review and planning	REG12 Review minutes

1.5 The Environmental Audit

One of the fundamental activities of the "Check" phase of the Deming cycle is the internal audit. After the implementation of the EMS, it will be necessary to assess its efficiency and effectiveness in guaranteeing the expected performance (both management and environmental) and its ability to achieve the objectives laid down in the environmental program by applying what is defined in the system. The operational scheme set out by ISO 14001 and the EMAS Regulation place considerable importance on the role of both the management and control of auditing activities of a correct and complete implementation of adequate environmental management systems. An internal environmental audit is defined as a systematic, documented, periodic and objective evaluation of the environmental performance of an organization, management system and processes designed to protect the environment.

The systematic auditing activity has been instrumental in creating a trend in performance improvement enabling all organizations to exploit the benefits resulting from this activity in terms of the:

- Identification of possible areas for improvement and necessary corrective actions;
- Availability of a complete, adequate, updated information source useful to Management in the decisional process and assessment of the organization's performance;
- Facilitating the comparison and distribution of information within the company;
- Increase in the level of involvement, participation and cultural growth of all personnel;
- Availability of a support tool for managing relations with external contacts (controlling authorities, shareholders, financers, insurers, customers, suppliers, public opinion, etc.).

The standard has three main chapters which deal with the methods for planning audits, conducting auditing activities and indicate the requirements of competence of the auditors.

In particular, key auditor principles according to the ISO 19011 standard are:

- Ethical conduct: is the basis of the competences of anyone conducting an audit characterized by such qualities as *trust, integrity, confidentiality and discretion*.
- Impartial presentation: obligation to report the audit results *faithfully and accurately.*

- Adequate Professionalism: to ensure that the audit is effective and provides indications enabling the organization to pursue continual improvements in its management system, *the auditors must possess the necessary professional competences*.
- Independence: the audit must be conducted by independent parties, that is, must demonstrate that the auditors are independent of the activities they audit and exempt of *conflict of interest*.
- Evidence based approach: the audit results are based on objective and verifiable findings. They can be gathered through document checks, interviews and observations.

From a management point of view, the ISO 14001 standard and EMAS require that the organization establishes and maintains procedures for periodically conducting audits whilst taking into account the results of previous audits and the environmental importance of the activity to be audited.

These procedures should, in particular, define the ways to:

- Train internal auditors and/or select external auditors,
- Set up a team of auditors,
- Plan, program and conduct the audit,
- Report and use the results for the EMS review by Management

The execution phase comprises the following main steps:

1. *Planning and understanding the management systems* → definition of the work calendar, collection and analysis of information about the relevant activity and the necessary documentation (e.g. policy and program, management procedures, applicable legislation, general documentation – organizational charts, process sheets, layout) with particular reference to the results of previous audits. It enables schedules and resources to be well organized.
2. *Collection and assessment of findings* → acquisition of all the elements necessary for the collection of evidence needed to evaluate the EMS. The findings of the audit form the basis of the documents with which the team of auditors establish the conformity of the existing activities *with the applicable laws, regulations, corporate procedures and any management standards*, as well as the degree of fulfillment of the objectives fixed in the policy and improvement program. Three main methods of voluntary evidence can be identified for the collection of evidence:
    1. interviews with personnel,
    2. document analysis, and
    3. direct observations on-site (inspections of working conditions and of the plants)
3. *Preparation of report and follow up* → The audit results are summarized in a final report with an *evaluation of the efficiency and effectiveness* of the management. The report is presented to the Management of the organization, usually during a final meeting. Any adjustment/improvement plans suggested by the team of auditors on the basis of the audit results may be resolved immediately, depending on the type and degree of urgency, through suitable corrective actions.

The "*Follow up*" phase: findings are taken on board and resolved; it allows the system to bring about improvements with regard to the indications laid out by the auditor during the audit.

The term '**Non-Conformity**' means the failure to fulfil one or more of the requirements defined by the organization through its management system, in accordance with the reference standards (ISO 14001 or EMAS), legislation or applicable regulations which adversely affect its environmental performance. Take, for example, failure by workers to respect a given provision (e.g. incorrect management of a temporary waste deposit), failure to reach an objective, incorrect application of a legal provision (e.g. failure to carry out a periodic check on the quality of emissions) or the failure to meet a specific regulation requirement (e.g. not identifying external documentation).

1.6 Management Review

In line with continual improvement, the Review is aimed at identifying which areas of the management system present margins for improvement. Once the critical points have been narrowed down, the organization's Management can redefine the objectives and/or the components of the EMS in order to pursue any opportunities identified for improvement.

2 PRODUCT LIFE CYCLE ASSESSMENT

Over the last few years, different methods have been developed to study and assess a product's environmental impact. The need to create operational tools and management techniques in this field has developed as a result of growing pressure from external stakeholders in the business who increasingly demand guarantees on the environmental friendliness of products. In order to correctly evaluate the ability of a product to offer better performances from an environmental point of view, it is necessary to consider all the impacts throughout its entire life cycle.

The main instrument available to experts carrying out a study that is consistent with the above-mentioned requirements is the method entitled "Life Cycle Assessment" (LCA), namely an assessment of the life cycle. This tool which was created to prevent these potential problems focuses on the performance of production systems involving raw materials starting from the moment when they are extracted from the ground (when they are "snatched" from the environment) through all the conversion processes which they undergo until they "return to the earth" in the form of waste products. This is why the approach is known as "from cradle to grave".

2.1 Product Environmental Footprint

The proliferation of environmental claims in the market and the increase of misleading claims regarding the environmental performance of products has undermined the level of trust of consumers towards the environmental information that producers communicate about their own products. This situation pushed the European Commission to establish a common harmonized methodological approach to assess the potential environmental impact of products and services over the entire life-cycle to create a green single market.

Its aim was to develop "a common methodology on the quantitative assessment of environmental impacts of products, throughout their life-cycle, in order to support the assessment and labelling of products". The Product Environmental Footprint (PEF) represents this methodology which is principally aimed at providing technical guidelines in as much detail as possible to carry out the LCA, so that studies and results conducted by different analysts on similar products can be compared more easily.

Currently, the PEF methodology is included in Annex A of the European Commission Recommendation of 9 April 2013 (2013/179/EU) regarding the use of common methodologies to measure and communicate environmental performance during the life cycle of products and organizations[5]. It provides both general guidelines for calculating the PEF and specific methodological requirements for the definition of rules per product category (hereinafter PEFCR, Product Environmental Footprint Category Rules). The PEFCRs are a necessary extension of and complement the more general guidance for PEF studies and are aimed at providing more detailed technical guidelines on how to conduct an environmental impact study for specific product categories. In short, the PEFCRs accompany and complete the general guidelines by providing specific indications for each product category.

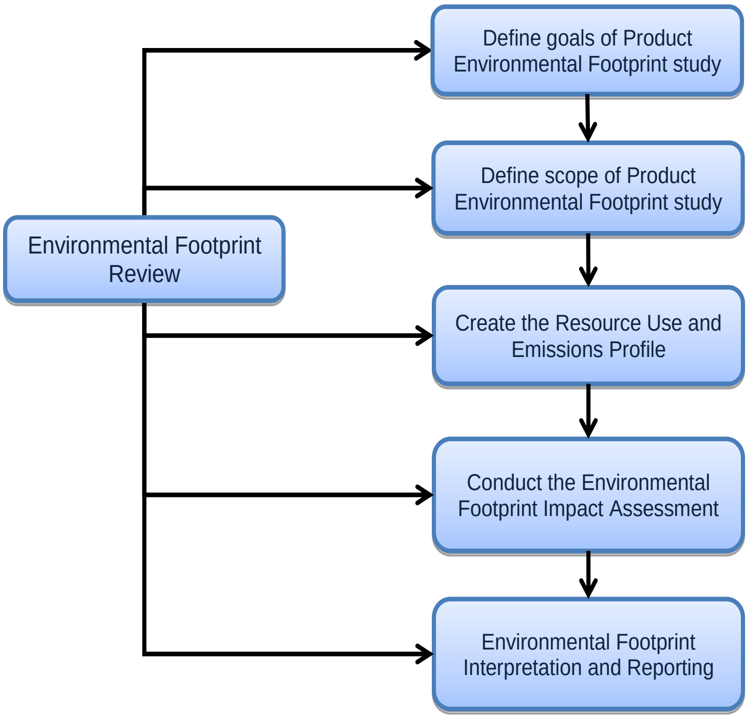
[5] https://publications.europa.eu/en/publication-detail/-/publication/93cb8358-b80d-11e2-ab01-01aa75ed71a1/language-en

Recommendation 179/2013 details the method for calculating PEF in a technical annex and highlights that the PEF:

- Is based on the life cycle approach;
- Defines 15 different categories of environmental impact of the products to be calculated;
- Imposes minimum requirements on data quality;
- Defines precise instructions for allocation of impacts;
- Refers to common rules for conducting the verification and certification of the PEF calculations.

Below, the phases of the PEF are outlined in the following scheme:

Scheme 2-1 Phases of the PEF study



2.1.1 Goal Definition

The first and fundamental step of a PEF study if to define its goal. This sets the overall context for the study. This step includes defining:

- Intended application(s);
- Reasons for carrying out the study and decision context;
- Target audience;
- Whether comparisons and/or comparative assertions are to be disclosed to the public;
- Commissioner of the study;
- Review procedure.

2.1.2 Scope Definition

Defining the scope entails also giving a definition of the system to be evaluated and the associated analytical specifications. Moreover, the scope definition shall be in line with the defined goals of the study and shall include:

- Unit of analysis (functional unit) and reference flow;
- System boundaries;
- Environmental Footprint impact categories;
- Assumptions/Limitations.

The PEF methodology, however, requires the functional unit of the study to be defined more precisely on various aspects, namely:

- Function(s)/service(s) provided: “what”;
- Extent of the function or service: “how much”;
- Expected level of quality: “how well”;
- Duration/life time of the product: “how long”;
- NACE (Nomenclature statistique des activités économiques dans la Communauté européenne) code(s).

The reference flow is a measure of the outputs from processes in a given product system required to fulfil the function expressed by the unit of analysis. All input and output flows in the analysis quantitatively relate to the reference flow.

The system boundaries define which parts of the product life cycle and which associated processes belong to the analyzed system (i.e. are required for carrying out its function as defined by the unit of analysis). The system boundary shall be defined following general supply-chain logic, including all stages from raw material extraction through processing, production, distribution, storage, use stage and end-of-life treatment of the product (i.e. cradle-to-grave), as appropriate to the intended application of the study. Cradle to grave is the approach to be used by default.

2.1.3 Resource Use and Emissions Profile Compilation and Recording

In this phase, an inventory of all the material/energy resource inputs/outputs and emissions into air, water and soil for the product supply chain is compiled (“Life Cycle Inventory” in the ISO standards). In the PEF methodology it is recommended that the following classification of flows is adopted in the study:

- Elementary flows;
- Non-elementary or complex flows.

A two-step procedure is recommended for compiling the resource use and emissions profile. The initial phase is an LCA screening and helps identify which flows (elementary and non-elementary) are the most important for the product in question and determine priorities for data collection and the definition of data quality criteria. In the second phase, the resource use and emissions profile is completed by the best or most up-to-date data collected to ensure that the collected data meet the quality requirements and by the transformation of any remaining non-elementary flows into elementary flows.

2.1.4 Environmental Footprint Impact Assessment

This phase aims to calculate the environmental performance of the product using the environmental footprint impact categories and model. The Environmental Footprint (EF) impact assessment includes two mandatory phases (classification and characterization) and two optional steps (normalization and weighting).

To carry out the impact assessment, the first step is to "assign" a certain EF impact category to every input and output flow of the analyzed system. Every flow must be analyzed to assess whether it has at least one for the pre-defined impact categories by the PEF methodology. A non-exhaustive list of the impact categories is as follows: resource depletion, greenhouse effect, ozone depletion, human toxicity, eco-toxicity, formation of photochemical oxidants, acidification, and eutrophication. Once the input and output flows from the system have been classified, the contribution of each of these flows to their respective impact categories is calculated and the contributions of the different flows are aggregated within the individual impact categories.

The calculation of the magnitude of the contributions is carried out between the characterization factors which are specific for every substance in every impact category. They represent the impact intensity of a single substance relative to a common substance which may vary from category to category. In addition to the two compulsory phases which have been described, a normalization phase (recommended in the PEF studies) and a weighting phase (optional for the PEF studies) can also be performed.

The results are shown in different "formats", that is, each impact category has its own unit of measurement and scale. The spectrum of impact categories gives a complete overview of the potential impacts of the product, but makes it difficult to compare and interpret them. For the reasons given, in some cases it may be advisable to carry out the normalization and weighting phases of the results.

2.1.5 Interpretation and Reporting

This phase mainly serves the purpose of ensuring that the model respects the goals and quality requirements of the study and deriving robust conclusions and recommendations from the analysis. To meet these objectives, the interpretation phase must include the following four steps:

1. Assessment of the robustness of the PEF model – it is advisable to carry out checks on completeness, sensitivity and consistency;
2. Identification of hotspots – the key elements contributing to the PEF results are identified;
3. Estimation of uncertainty – which helps to assess the robustness and applicability of the study results;
4. Conclusions, recommendations and limitations.

A PEF report consists of at least three elements:

- Summary: includes main information specifying the objectives of the study, the purpose, limitations and assumptions adopted, the system under study, the data quality, the main impacts highlighted, the recommendations made and the environmental improvements identified.

- Main report: includes a detailed description of the objectives, the scope, the Resource Use and Emissions Profile, the main impacts highlighted in the phase of impact assessment and the interpretation of the PEF results.
- Annex: includes supporting elements to the main report which are of a more technical nature.

3 ENVIRONMENTAL TECHNOLOGIES AND CHEMICAL SUBSTITUTIONS IN TANNERIES

This section provides an overview on the recommended technological and chemical practices to reduce environmental impacts and at the same time maintain a high quality of the tanned leather. The following does not intend to be an exhaustive list, but can be used as a starting point to green the leather tanning process. In the first part, some of the ***latest available technologies*** are explained. Whereas, the second part concentrates on outlining ***recommended chemical practices*** per tanning phase.

3.1 Technology

3.1.1 Automatic computerized dispensing of chemicals in the drums

Automated dosing systems are used to manage an automatic or a semi-automatic feeding of chemicals to the drums (transfer from storage tanks, weighing, mixing, sending to the waiting tanks, transfer to the drum, automatic washing). The full control over every working parameter ensures the maximum homogeneity of the processes, the reduction of error margins and the consequent improvement of the quality of the products.

3.1.2 Light weight drums

Polypropylene drums are particularly suitable for re-tanning and dyeing processes, specifically designed to significantly reduce the use of resources for processing (electricity, thermal energy, consumption of chemicals and water). These features, together with the possibility of an integrated control, provide reliable, competitive and superior-quality tanning processes.

3.1.3 High precision spraying technology

The spraying machine has at the entrance a bar to scan the size of the leather cut, in order to activate only those spraying guns necessary for the size and type of cut. This avoids over-spraying: reducing VOC emissions and consumption of solvents and dyes. The degree of innovation depends on how close photocells are placed: the closer the photocells are placed to each other, the better the precision. A bar is considered to be innovative if the photocells are placed at least 20 mm away from each other. It is possible to find the most innovative bars with only 6 mm distance.

Another advanced technology involves a controller with laser pointer and HD cameras for spray cabins. Controllers for spray cabins substitute the traditional reading bars placed under the conveyor belt. This reading system uses a laser pointer and HD cameras. It is possible to wash the cabin without damaging the reading systems. Most importantly, the problems linked to the sedimentation of paint on the reading bar are solved. All the parameters and functions can be regulated through a touchscreen panel.

3.1.4 Pressurized spray booth

If the spray booths are not pressurized, the sucked air is taken from the working environment, causing an increase in energy consumption to heat the working area and a deterioration of indoor air quality due to the increase in dust in the workplace. The pressurization of the spray booth avoids this, as it takes air from outside

3.1.5 High precision spraying guns

This type of guns reduces painting costs and gives the possibility to address the ecological aspect of industrial working and its impact on the environment. This is because such a gun is able to work at very low atomization pressures with both savings in painting products and reductions in emissions into the atmosphere. Besides, some of these guns can be built as consisting of three detachable parts, so that only the part that is subject to most wear over time needs to be replaced.

3.1.6 Energy-saving suction plant for drying tunnels

In the drying tunnel there are suction plants with the goal of returning air in the tunnel, especially to reduce the humidity that is created with the drying of the skin. It is possible to equip the drying tunnel of an air exchanger which allows to recover about 50% of the calories present in the extracted air. The recovered thermal energy is generally reused in winter for heating the rooms; in the summer it is fed back into the drying tunnel to reduce its energy consumption.

3.1.7 Energy-saving infrared drying tunnel and energy recovery system

A high efficiency drying tunnel can be built with heating by infra-red radiation. The tunnel heats using medium wave infrared lamps that reach the emission levels required in a very short space of time, thereby reducing waiting times for starting work, to a minimum. Power is adjusted by an electronic control system (PLC) that guarantees regulation of the radiating power. The control system monitors constantly the temperature of the leather coming out of the tunnel, by an optical pyrometer. Considerable energy saving is achieved by the power system sent to the lamps that automatically modulates to a minimum power. This tunnel works even without the internal fan. This reduces the possibility of contaminating leather surfaces with dust.

3.2 Chemical practices per phase

3.2.1 Leather arrives as raw material

The meatparts can be removed from the skins immediately when received or in the slaughterhouse. Skinning and trimming (legs, tails, etc.) can become inputs for other production uses (e.g. jelly), as at this stage they are free of pollutants. This practice is in line with the Circular Economy principles, as byproducts, which once where considered as waste, form now inputs for other sectors.

3.2.2 Beamhouse: pre-tanning of hides

In the *liming* phase, it is advisable to use an anti-bacterial with the replacement of dithiocarbonates with other substances such as for example with peroxides or iodine derivatives. Then, it is important to avoid the use of NPEO (Nonyl phenol ethoxylates), e.g. substitution of ethoxylated fatty alcohols with the use of enzymes. Also, when choosing a low impact anti-wrinkle, give preference to enzymes and probiotics (biotechnology) and avoid the use of mercaptoethanol. Ethanolamines perform better than the latter, but they still have a negative impact. Finally, detachment of hair and epidermis should be done by enzymes and with limited use of sulphide or hydrogen sulphide.

In the phase of *deliming and pickling*, it is recommended to avoid the use of boric acid, and replace it with other less harmful substances. *Deliming* is preferable with organic acids to obtain Ammonium reduction or elimination. Finally, avoid using salt during pickling, if possible.

3.2.3 Tanning

There are three types of tanning considered: chrome tanning, other metal tannings, and vegetable tanning. Chrome tanning is the **most used** tanning method, due to its **fast** and **efficient** process. Leather tanned with chromium salts results in **soft hides**, suitable for **clothing and footwear**. Due to its use of heavy metals, this method is considered to be the least environmentally-friendly.

If a tannery uses chrome for its tanning processes, then it should use a mix of techniques to reduce the environmental impact of chrome tanning. These involve for example practices to exhaust chromium, checking the level of free chrome in the tanned leather, and using recovered chromium if possible.

Other tanning methods should be considered, as chrome tanning is under attack due to its negative impact on the environment. Some tanneries adopt chrome-free tanning, still using metals, but avoiding chrome. Some of the other tanning methods include tanning with titanium salts, aluminum salts, glutaraldehyde, and other inorganic tanning agents. Among these, the only recommended use is tanning with titanium salts, while the others have a negative impact on the environment and on leather quality.

In vegetable tanning, the **tannins** used are derived from tree bark or other natural resources, which result in natural looking leather. This process is suitable for **suitcases**, **accessories** and **furniture**. Vegetable tanning takes more time than chrome tanning and may require more energy.

Regardless of the tanning methods, it is highly recommended to limit the use of biocides on the skin. While the recommended value is under 200 mg / kg, between 200 and 500 mg / kg may be reasonable.

During *dying*, try and avoid, or reduce, the use of resins made from formaldehyde or sodium sulphate. Complex metal dyes allow to obtain excellent resistance to light, washing, and hydrolysis. Complex iron dyes have no particular contraindications, while chromium dyes do not significantly alter the total content of metal on wet blue. The least impactful complex metal dye is iron-based, while the worst performing ones are nickel and cobalt.

In the *finishing* phase, water based solvents are to be preferred and low-phthalate products are to be chosen.

3.2.4 General considerations

Finally, splitting in wet, wet blue or crust allows to reduce the environmental impact in a preventive manner. Besides, split leather whose crust has been reused can be used as a by-product or to make other leather items. Hydrolyzed collagen, deriving from scraps of the tanning process, is used in a thermoplastic matrix in the production of transparent films, or plastic for industrial use in packaging. It is also advisable to anticipate the scraps / cut-outs from the raw phase with respect to the finished product phase.

4 ENVIRONMENTAL MANAGEMENT GUIDELINES FOR THE OLIVE OIL INDUSTRY

4.1 Liquid waste treatment methods

Disposal and management of highly contaminated wastewater constitute a serious environmental problem due to the biorecalcitrant nature of these types of effluents, in most cases.

Generally, biological treatment (mainly aerobic) is the preferred option for dealing with urban and industrial effluents because of its relative cost-effectiveness and applicability for treating a wide variety of hazardous substances. Nevertheless, some drawbacks may be found when applying this technology. For instance, some chemical structures, when present in high concentrations, are difficult to biodegrade because of their refractory nature or even toxicity toward microorganisms. Thus, several substances have been found to present inhibitory effects when undergoing biological oxidation. Among them, phenolic compounds constitute one of the most important groups of pollutants present in numerous industrial effluents. Owing to the increasing restrictions in quality control of public river courses, development of suitable technologies and procedures are needed to reduce the pollutant load of discharges, increase the biodegradability of the effluent, and minimize the environmental impact to the biota.

Industries that generate nonbiodegradable wastewater showing high concentrations of refractory substances (chiefly phenol-type compounds) include the pharmaceutical industry, refineries, coal-processing plants, and food-stuff manufacturing. The olive oil industry (a common activity in Mediterranean countries), in particular, generates highly contaminated effluents during different stages of mill olive oil production (washing and vegetation waters).

Therefore, most treatment processes used for high-strength industrial wastewaters have been applied to olive oil mill effluents (OME). Yet, OME treatment difficulties are mainly associated with: (a) high organic load (OME are among the strongest industrial effluents, with COD up to 220 g/L and sometimes reaching 400 g/L); (b) seasonal operation, which requires storage (often impossible in small mills); (c) high territorial scattering; and (d) presence of organic compounds that are difficult to degrade by microorganisms (long-chain fatty acids and phenolic compounds of the C-7 and C-9 phenylpropanoic family).

Furthermore, a great variety of components found in liquid waste (alpachin) and solid waste (orujo and alpeorujo) require different technologies to eliminate those with harmful effects on the environment. Most used methods for the treatment of liquid waste from olive oil are economically feasible. These methods are designed to eliminate organic components and to reduce the mass. In some cases, substances belonging to other categories are also partly removed. In practice, these processes are often combined since their effects differ widely. Therefore, methods should be used in combination with each other.

The following key treatment methods are mainly applied to liquid waste. Some of these methods can also be used in the treatment of liquid–solid waste (alpeorujo), for example, treatment by fungi, evaporation/drying, composting, and livestock feeding. Regarding the olive oil industry, it should always be considered that complicated treatment methods that lack profitable use of the final product are not useful, and all methods should have a control system for the material flows.

Low-Cost Methods

Of these methods, the most important ones are:

- Drainage of olive oil mill liquid waste in some types of soils, with rates up to 50 m^3/ ha-year (in the case of traditional mills) and up to 80 m^3/ha-year (in the case of decanting-based methods), or to apply the olive oil mill liquid wastes into the irrigation water at a rate of less than 3%. These processes are risky because they decrease the fertility of the soil. This calls for great care and scientific research into these methods prior to agronomic application.

- Simple disposal and retention in evaporation ponds (large surface and small depth ponds), to be dried by solar radiation and other climatic factors. This method does not require energy or highly trained personnel. Drawbacks are associated with the evaporation process, which generates odors and additional risks for the aquatic system of the area (filtration phenomena, surface water contamination, etc.). In addition, the disadvantages include: the need of large areas for drying, in selected regions with impermeable (clay) soil, far from populated areas; the requirement, in most cases, for taking necessary precautions to prevent pollutants reaching the groundwater through placement of impermeable layers in the ground and walls of ponds; ineffective in higher rainfall regions; emergence of air pollutants caused by decomposition of organic substances (ammonia-hydrocarbon volatile compounds). This method is being applied in many countries of the Mediterranean area. In Spain alone, there are about 1000 evaporation ponds, which improve the water quality, but the ponds themselves cause serious negative environmental impacts. Dried sludge from the ponds can be used as fertilizer, either directly or composted with other agricultural byproducts (e.g. grape seed residues, cotton wastes, bean straw).

- Mixing the olive oil mill liquid wastes with municipal solid wastes in sanitary landfills leads to increased organic load on site. Consideration should be made regarding the pollutants that may reach the groundwater, in addition to the risks of combustion due to generation of combustible hydrocarbon gases. These factors should be taken into account in designing and establishing landfills, not forgetting the necessity to collect and treat the drainage wastewater resulted from applying this method. This method is cost-effective and is suitable for final disposal of the wastes, with the property of obtaining energy from the generated gases. Nevertheless, there are drawbacks such as the air pollution caused by the decomposition, the need for advanced treatment for the highly polluted collected drainage wastewater, and the need for using large areas of land and particular specifications.

Aerobic Treatment

When biodegradable organic pollutants in olive oil mill wastewater (alpechin) are eliminated by oxygen-consuming microorganisms in water to produce energy, the oxygen concentration decreases and the natural balance in the water body is disturbed. To counteract an overloading of the oxygen balance, the largest part of these oxygen-consuming substances (defined as BOD5) must be removed before being discharged into the water body. Wastewater treatment processes have, therefore, been developed with the aim of reducing the BOD5 concentration as well as eliminating eutrophying inorganic salts, that is, phosphorus and nitrogen compounds, ammonium compounds, nonbiodegradable compounds that are analyzed as part of the COD, and organic and inorganic suspended solids.

In aerobic biological wastewater treatment plants, the natural purification processes taking place in rivers are simulated under optimized technical conditions. Bacteria and monocellular organisms (microorganisms) degrade the organic substances dissolved in water and transform them into carbonic acid, water, and cell mass. The microorganisms that are best suited for the purification of a certain wastewater develop in the wastewater independently of external influences and adapt to the respective substrate composition (enzymatic adaptation). Owing to the oxidative degradation processes, oxygen is required for wastewater treatment. The oxygen demand corresponds to the load of the wastewater.

Two types of microorganisms live in waters: suspended organisms, floating in the water, and sessile organisms, which often settle on the surface of stones and form biofilms. Biofilm processes such as fixed-bed or trickling filter processes are examples of the technical application of these natural processes.

Treatment of Olive Oil Mill Wastewaters in Municipal Plants

Municipal wastewater is unique in that a major portion of the organics are present in suspended or colloidal form. Typically, the BOD in municipal sewage consists of 50% suspended, 10% colloidal, and 40% soluble parts. By contrast, most industrial wastewaters are almost 100% soluble. In an activated sludge plant-treating municipal wastewater, the suspended organics are rapidly enmeshed in the flocs, the colloids are adsorbed on the flocs, and a portion of the soluble organics are absorbed. These reactions occur in the first few minutes of aeration contact. By contrast, for readily degradable wastewaters, that is, food processing, a portion of the BOD is rapidly sorbed and the remainder removed as a function of time and biological solids concentration. Very little sorption occurs in refractory wastewaters. The kinetics of the activated sludge process will, therefore, vary depending on the percentage and type of industrial wastewater discharged to the municipal plant and must be considered in the design calculations.

The percentage of biological solids in the aeration basin will also vary with the amount and nature of the industrial wastewater. Increasing the sludge age increases the biomass percentage as volatile suspended solids undergo degradation and synthesis. Soluble industrial wastewater will increase the biomass percentage in the activated sludge. A number of factors should be considered when discharging industrial wastewaters, including olive oil mill effluents, into municipal plants:

- Effect on effluent quality. Soluble industrial wastewaters will affect the reaction rate K. Refractory wastewaters such as from olive oil mills, tannery, and chemical will reduce K, while readily degradable wastewaters such as food processing and brewery will increase K.
- Effect on sludge quality. Readily degradable wastewaters will stimulate filamentous bulking, depending on basin configuration, while refractory wastewaters will suppress filamentous bulking.

- Effect of temperature. An increased industrial wastewater input, that is, soluble organics, will increase the temperature coefficient u, thereby decreasing efficiency at reduced operating temperatures.
- Sludge handling. An increase in soluble organics will increase the percentage of biological sludge in the waste sludge mixture. This will generally decrease dewaterability, decrease cake solids, and increase conditioning chemical requirements.

One exception is pulp and paper-mill wastewaters in which pulp and fiber serve as a sludge conditioner and enhances dewatering rates. It is worth pointing out that certain threshold concentrations for inhibiting agent and toxic substances must not be exceeded. Moreover, it should be noted that most industrial wastewaters are nutrient deficient, that is, they lack nitrogen and phosphorus. Municipal wastewater with a surplus of these nutrients will provide the required nutrient balance.

The objective of the activated sludge process is to remove soluble and insoluble organics from a wastewater stream and to convert this material into a flocculent microbial suspension that is readily settleable and permits the use of gravitational solids liquid separation techniques. A number of different modifications or variants of the activated sludge process have been developed since the original experiments. These variants, to a large extent, have been developed out of necessity or to suit particular circumstances that have arisen. The activated sludge process is a biological wastewater treatment technique in which a mixture of wastewater and biological sludge (microorganisms) is agitated and aerated. The biological solids are subsequently separated from the treated wastewater and returned to the aeration process as needed. The activated sludge process derives its name from the biological mass formed when air is continuously injected into the wastewater. Under such conditions, microorganisms are mixed thoroughly with the organics under conditions that stimulate their growth through use of the organics as food. As the microorganisms grow and are mixed by the agitation of the air, the individual organisms clump together (flocculate) to form an active mass of microbes (biologic floc) called activated sludge.

In practice, wastewater flows continuously into an aeration tank where air is injected to mix the activated sludge with the wastewater and to supply the oxygen needed for the organisms to break down the organics. The mixture of activated sludge and wastewater in the aeration tank is called mixed liquor. The mixed liquor flows from the aeration tank to a secondary clarifier where the activated sludge is settled out. Most of the settled sludge is returned to the aeration tank (return sludge) to maintain a high population of microbes to permit rapid breakdown of the organics. Because more activated sludge is produced than is desirable in the process, some of the return sludge is diverted or wasted to the sludge handling system for treatment and disposal. Biofilm processes are used when the goal is very far-reaching retention and concentration of the biomass in a system. This is especially the case with slowly reproducing microorganisms in aerobic or anaerobic environments. The growth of sessile microorganisms on a carrier is called biofilm. The filling material (e.g., in a trickling filter stones, lava slag, or plastic bodies) or the filter material (e.g., in a biofilter) serve as carrier. The diffusion processes in biofilm plants are more important than in activated sludge plants because unlike activated sludge flocs the biofilms are shaped approximately two-dimensionally. On the one hand, diffusion is necessary to supply the biofilm with substrate and oxygen; on the other hand, the final metabolic products (e.g., CO2 and nitrate) must be removed from the biofilm.

For treatment of industrial wastewater, trickling filters are often used. A trickling filter is a container filled completely with filling material, such as stones, slats, or plastic materials (media), over which wastewater is applied. Trickling filters are a popular biological treatment process. The most widely used design for many years was simply a bed of stones, 1–3 m deep, through which the wastewater passed. The wastewater is typically distributed over the surface of the rocks by a rotating arm. Rock filter diameters may range up to 60 m. As wastewater trickles through the bed, a microbial growth establishes itself on the surface of the stone or packing in a fixed film. The wastewater passes over the stationary microbial population, providing contact between the microorganisms and the organics. The biomass is supplied with oxygen using outside air, most of the time without additional technical measures. If the wastewater is not free of solid matter (as in the case of alpechin), it should be pre-screened to reduce the risk of obstructions.

Excess growths of microorganisms wash from the rock media and would cause undesirably high levels of suspended solids in the plant effluent if not removed. Thus, the flow from the filter is passed through a sedimentation basin to allow these solids to settle out. This sedimentation basin is referred to as a secondary clarifier, or final clarifier, to differentiate it from the sedimentation basin used for primary settling. An important element in trickling filter design is the provision for return of a portion of the effluent (recirculation) to flow through the filter. Owing to seasonal production of wastewater and to the rather slow growth rates of the microorganisms, these processes are less suited for the treatment of alpechin, compared to the activated sludge process.

Another worthwhile aerobic treatment method developed is the bioremediation process, based on the intrinsic property of an Azotobacter vinelandii strain to proliferate on limed olive oil mill wastewater. More specifically, the olive mill wastewater is pre-treated with lime to pH 7–8 and then is fed into an aerobic bioreactor equipped with a rotating wheel-type air conductor. The reactor is operated in a repeated fed batch culture fashion with a cycle time of 3 days. During each cycle, the Azotobacter population proliferates and fixes molecular nitrogen. It concomitantly produces copious amounts of slime and plant growth promoting substances. The endproduct is a thick, yellow-brown liquid. It has a pH of about 7.5–8.0, it is nonphytotoxic, soluble in water, and can be used as liquid fertilizer over a wide range of cultivated plants (olives, grapes, citrus, vegetables, and ornamentals). Moreover, there is good evidence that the biofertilizer induces soil suppressiveness against root pathogenic fungi, and improves soil structure. A medium-scale pilot plant of 25 m^3 capacity has been constructed in Greece by the Olive Cooperative of Peta near Arta with the financial support of the General Secretariat of Science and Technology of Greece. The plant has been operating since 1997. The local farmers use the liquid biofertilizer that is produced to treat their olive and citrus groves.

Anaerobic Treatment

Anaerobic processes are increasingly used for the treatment of industrial wastewaters. They have distinct advantages including energy and chemical efficiency and low biological sludge yield, in addition to the possibility of treating organically high-loaded wastewater (COD . 1500 mg/L), with the requirement of only a small reactor volume.

Anaerobic processes can break down a variety of aromatic compounds. It is known that anaerobic breakdown of the benzene nucleus can occur by two different pathways, namely, photometabolism and methanogenic fermentation. It has been shown that benzoate, phenylacetate, phenylpropionate, and annamate were completely degraded to CO_2 and CH_4. While long acclimation periods were required to initiate gas production, the time required could be reduced by adapting the bacteria to an acetic acid and substrate before adapting them to the aromatic. It is showed that phenol, p-cresol, and resorcinol yielded complete conversion to CH_4 and CO_2.

Principle of Anaerobic Fermentation

In anaerobic fermentation, roughly four groups of microorganisms sequentially degrade organic matter. Hydrolytic microorganisms degrade polymer-type material such as polysaccharides and proteins to monomers. This reduction results in no reduction of COD. The monomers are then converted into fatty acids (VFA) with a small amount of H_2. The principal organic acids are acetic, propionic, and butyric with small quantities of valeric. In the acidification stage, there is minimal reduction of COD. Should a large amount of H_2 occur, some COD reduction will result, seldom exceeding 10%. All formed acids are converted into acetate and H_2 by acetogenic microorganisms. Acetic acid and H_2 are converted to CH_4 by methanogenic organisms. The specific biomass loading of typical anaerobic processes treating soluble industrial wastewaters is approximately 1 kg COD utilized/(kg biomass-day). There are two classes of methanogenes that convert acetate to methane, namely, Methanothrix and Methanosarcina. Methanothrix has a low specific activity that allows it to predominate in systems with a low steady-state acetate concentration. In highly loaded systems, Methanosarcina will predominate with a higher specific activity (3 to 5 times as high as Methanothrix) if trace nutrients are available. At standard temperature and pressure, 1 kg of COD or ultimate BOD removed in the process will yield 0.35 m^3 of methane.

The quantity of cells produced during methane fermentation will depend on the strength and character of the waste, and the retention of the cells in the system. In comparing anaerobic processes and aerobic processes, which require high energy and high capital cost and produce large amounts of secondary biological sludge, the quantity of excess sludge produced is 20 times lower in anaerobic processes. This can be explained by the fact that with the same organic load under oxygen exchange about 20 times less metabolic energy is available for the microorganisms. Anaerobic wastewater treatment methods are mainly used for rather high-loaded wastewaters with a COD of 5000 up to 40,000 mg/L from the food and chemical industry. Unfortunately, these methods are normally employed strictly as pre-treatment measures. Aerobic follow-up treatment, for example, in a downstream-arranged activated sludge plant, is possible and recommended.

Factors Affecting Anaerobic Process Operation

The anaerobic process functions effectively over two temperature ranges: the mesophilic range of 85–100°F (29–38°C) and the thermophilic range of 120–135°F (49–57°C). Although the rates of reaction are much greater in the thermophilic range, the maintenance of higher temperatures is usually not economically justifiable. Methane organisms function over a pH range of 6.6–7.6 with an optimum near pH 7.0. When the rate of acid formation exceeds the rate of breakdown to methane, a process imbalance results in which the pH decreases, gas production falls off, and the CO_2 content increases. pH control is therefore essential to ensure a high rate of methane production. According to German literature, the tolerable pH range for anaerobic microorganisms is between 6.8 and 7.5.

This means that the anaerobic biocenosis is very pH-specific. With regard to the influence of initial concentration on anaerobic degradation, preliminary laboratory and pilot-scale experimentation on diluted olive oil mill effluents (OME) showed that the anaerobic contact process was able to provide high organic removal efficiency (80–85%) at 35°C and at an organic load lower than 4 kg COD/m^3/day; however, in particular at high feed concentration, the process proved unstable due to the inhibitory effects of substances such as polyphenols. Moreover, additions of alkalinity to neutralize acidity and ammonia to furnish nitrogen for cellular biosynthesis were required.

To overcome these difficulties and improve process efficiency and stability, there are basically two methods that may be adopted: (a) the treatment of combined OME and sewage sludge in contact bioreactors; and (b) operation with more diluted OME in high-rate bioreactors (such as UASB reactors and fixed-bed filters).

In the first method, conventional digesters can be overloaded with concentrated soluble wastes such as OME, and still operate satisfactorily. Moreover, nutrients such as ammonia and buffers are provided by degradation of proteineous substances from sludge. On this basis, laboratory-scale experimentation has shown that removal efficiencies of 65 and 37% in terms of COD and VSS, respectively, were obtained at 35°C and at an organic load of 4.2 kg COD/m^3/day (66% from sewage sludge, 34% from OME). Higher OME additions led to process imbalance due to the inhibitory effects of polyphenols. This method, based on anaerobic contact digestion of combined OME and sewage sludge, seems to be suitable only for those locations where the polluting load due to the OME is lower than the domestic wastewater load.

In this regard it is worth considering that during the olive oil milling season, OME pollution largely exceeds that from domestic wastewater.

With regard to the second method, based on the use of high-rate bioreactors, experimentation on UASB reactors showed that COD removal efficiencies of about 70–75% were obtained at 37°C and at an organic load in the range 12–18 kg COD/m^3/day by adopting a dilution ratio in the range of 1 : 8 to 1 : 5 (OME: tap water; diluted OME initial concentration in the range 11–19 g COD/L). Slightly less satisfactory results were obtained by using anaerobic filters filled with macroreticulated polyurethane foam.

It is important to note that immobilization of methanogenic bacteria may decrease the toxicity of phenolic compounds. Another pilot-scale anaerobic–aerobic treatment of OME mixed with settled domestic wastewater [48] produced a final COD concentration of about 160 mg/L, provided that a dilution ratio of 1 : 60 to 1 : 100 was adopted, corresponding to a COD load ratio equal to 3 : 1 for OME and domestic wastewater, respectively. This ratio is typical for those locations with a high density of olive oil mills. However, in addition to the high value required for the dilution ratio, the final effluent did not comply with legal requirements in terms of color and nitrogen.

The aforementioned data clearly show that in the treatment of OME, even when carried out with the use of most appropriate technology, that is, anaerobic digestion, it was difficult to reach the treatment efficiencies required by national regulations throughout the Mediterranean area. In particular, methanogenesis, which represents the limiting step in the anaerobic digestion of soluble compounds, is severely hindered by the inhibition caused by the buildup of volatile fatty acids (VFAs) and/or the presence of a high concentration of phenolic compounds and/or oleic acid in the OME. As for phenol, 1.25 g/L leads to 50% activity reduction of acetateutilizing methanogens. As for oleic acid, it is reported that 5 mM is toxic to methanogenic bacteria.

Anaerobic Treatment Systems of Wastewater

Seasonal operation of olive oil mills is not a disadvantage for anaerobic treatment systems because anaerobic digesters can be easily restarted after several months of mill shutdown. At present there are no large-scale plants. However, the anaerobic contact reactors and upflow sludge-blanket reactors have been mainly studied using several pilot tests, besides other tested reactors such as anaerobic filters and fluidized-bed reactors.

Sludge retention is decisive for the load capacity and, thus, the field of application of an anaerobic reactor. In the UASB reactor, favorable sludge retention is realized in a simple way.

Wastewater flows into the active space of the reactor, passing from the bottom to the top of the reactor. Owing to the favorable flocculation characteristics of the anaerobic-activated sludge, which in higher-loaded reactors normally leads to the development of activated sludge grains and to its favorable sedimentation capacity, a sludge bed is formed at the reactor bottom with a sludge blanket developing above it. To avoid sludge removal from the reactor and to collect the biogas, a gas-sludge separator (also called a three-phase separator) is fitted into the upper part of the reactor. Through openings in the bottom of this sedimentation unit, the separated sludge returns into the active space of the reactor. Because of this special construction, the UASB reactor has a very high load capacity. In contrast to the contact sludge process, no additional sedimentation tank is necessary, which would require return sludge flow for the anaerobic activated sludge, resulting in a reduction of the effective reactor volume.

Evaporation/Drying

Evaporation is a method used to concentrate non-steam-volatile wastewater components. The evaporation plant contains a vapor condenser by which vapor and steam-volatile compounds are separated from the concentrate. While the concentrate is then recycled into the evaporator, the exhaust steam can be used for indirect heating of other evaporator stages.

The degree of concentration of the wastewater components depends on different factors, for example:

- reuse of the concentrate (e.g., reuse in production, use as fodder, recovery of recyclable material)
- type of disposal of the concentrate (e.g., incineration, landfill)
- properties of the concentrate (e.g., viscosity, propensity to form incrustation, chemical stability)

Advantages of this method include:

- the residue (dried oil wastes) can be reused as fodder and fertilizer
- only a small area is needed
- exhaust steam can be reused as energy
- considered state of the art in the food industry

Disadvantages are:

- the exhaust steam from evaporation is organically polluted and needs treatment
- rather high operation and maintenance costs

- requires high energy
- requires trained personnel.

4.2 Evaporation ponds: low cost wastewater treatment

The most popular method for wastewater treatment around the world is also one of the simplest and least expensive. Lagoon systems use natural and energy-efficient processes to provide low-cost wastewater treatment. They are one of the most cost-effective wastewater treatment options. Lagoons are especially well suited to small enterprises because they can cost less to construct, operate, and maintain than other systems. They require more land than other wastewater treatment methods, and land is more likely to be available and inexpensive in rural areas.

There are several different types and names for lagoons and many possible system designs. Lagoon systems include one or more pond-like bodies of water or basins designed to receive, hold, and treat wastewater for a predetermined period of time. Lagoons are constructed and lined with material, such as clay or an artificial liner that will prevent leaks to the groundwater below. While in the lagoon wastewater receives treatment through a combination of physical, biological, and chemical processes. Much of the treatment occurs naturally, but some systems are designed to also use aeration devices that increase the amount of oxygen in the wastewater. Aeration makes treatment more efficient, so that less land area is necessary, and aerators can be used to upgrade some existing systems to treat more wastewater. Every lagoon system must be individually designed to fit its specific site and use. Designs are based on such factors as the type of soil, the amount of land area available, the climate, and the amount of sunlight and wind in an area. Other important design considerations for lagoon systems include the amount and type of wastewater to be treated and the level of treatment required by state and local regulations. Depending on local standards and the final method of disposal chosen, wastewater leaving lagoon systems often requires additional treatment, or “polishing,” to remove disease-causing organisms or nutrients from the wastewater before it can be returned to the environment.

Types of lagoons

Lagoons are not all the same. Some employ different biological, chemical, and physical processes to treat the wastewater, while others may play a different role in overall treatment. Some lagoon designs provide adequate treatment for certain methods of discharge, while others should be used in combination with other lagoons or with additional treatment. Complicating matters further, there can be several different names for the same type of lagoon. For example, the terms lagoon and pond are often used interchangeably, and names, such as polishing, stabilization, and maturation, can refer to a lagoon’s particular role in treatment. This can be very confusing for olive mill operators trying to evaluate lagoon systems. The following is a brief overview of some of the more common types of lagoons and some of the terms used for them.

Anaerobic Lagoons

The word anaerobic means without oxygen, which describes the conditions inside this type of lagoon. Anaerobic lagoons are most often used to treat animal wastes from dairies and pig farms, commercial or industrial wastes, or as the first treatment step in systems using two or more lagoons in a series. Typically, anaerobic lagoons are designed to hold and treat wastewater from 20 to 50 days. They are relatively deep (usually 3 to 5 meters) and work much like septic tanks. Inside an anaerobic lagoon, solids in the wastewater separate and settle into layers. The top layer consists of grease, scum, and other floating materials. This layer keeps oxygen out, allowing bacteria and other organisms that thrive in anaerobic conditions to work to treat the wastewater. As with septic tanks and most other lagoon designs, the layer of sludge that settles at the bottom of an anaerobic lagoon eventually accumulates and must be removed periodically. Also similar to a septic tank, the wastewater that leaves an anaerobic lagoon always requires further treatment. Odor can be a problem with anaerobic lagoons. However, in many cases odor can be managed through a variety of methods, such as adding sodium nitrate, recirculating pond effluent, and through regular maintenance.

Aerobic Lagoons

Dissolved oxygen is present throughout much of the depth of aerobic lagoons. They tend to be much shallower than other lagoons, so sunlight and oxygen from air and wind can better penetrate the wastewater. In general, they are better suited for warm, sunny climates, where they are less likely to freeze. Wastewater usually must remain in aerobic lagoons from 3 to 50 days to receive adequate treatment. Wastewater treatment takes place naturally in aerobic lagoons with the aid of aerobic bacteria and algae. Because they are so shallow, their bottoms need to be either paved or lined with materials that will prevent weeds from growing in them. Sometimes, the wastewater in aerobic lagoons needs to be mixed to allow sunlight to reach all of the algae and to keep it from forming a layer that blocks out the air and sun completely.

Aerated Lagoons

These systems use aerators to mix the contents of the pond and add oxygen to the wastewater. They are sometimes referred to as partial-mix or complete-mix lagoons depending on the extent of aeration. Partial-mix aerated lagoons are sometimes facultative lagoons that have been adapted and upgraded to receive more wastewater. With the exception of wind-driven designs, most aerators require energy to operate. However, energy costs are almost always considerably less than those for other mechanical community treatment systems. Aeration makes treatment more efficient, which offsets energy costs in some cases. Aerated lagoons require less land area and shorter detention times for wastewater than other lagoons.

Facultative Lagoons

Both aerobic and anaerobic conditions exist in facultative lagoons, which are also called stabilization ponds, oxidation ponds, photosynthetic ponds, and aerobic-anaerobic ponds. They are the most common type of wastewater treatment lagoon used by olive mill operators. Facultative lagoons can be adapted for use in most climates, require no machinery, and treat wastewater naturally, using both aerobic and anaerobic processes. Like most natural environments, conditions inside facultative lagoons are always changing. Lagoons experience cycles due to variations in the weather, the composition of the wastewater, and other factors. However, in general, the wastewater inside facultative lagoons naturally settles into three fairly distinct layers or zones.

Different conditions exist in each zone, and wastewater treatment takes place in all three. The top layer in a facultative lagoon is called the aerobic zone, because the majority of oxygen is present there. How deep the aerobic zone is, depends on climate, the amount of sunlight and wind, and how much algae is in the water. The wastewater in this part of the lagoon receives oxygen from air, from algae, and from the agitation of the water surface (from wind and rain, for example). Aerobic bacteria and other organisms live in the aerobic zone and contribute to wastewater treatment. This zone also serves as a barrier for the odors from gases produced by the treatment processes occurring in the lower layers. The anaerobic zone is the layer at the very bottom of the lagoon where no oxygen is present. This area includes a layer of sludge, which forms from all the solids that settle out from the wastewater. In the anaerobic zone, wastewater is treated by anaerobic bacteria; microscopic organisms, such as certain protozoa; and sludge worms, all of which thrive in anaerobic conditions. Names for the middle layer include the facultative, intermediate, or aerobic- anaerobic zone. Both aerobic and anaerobic conditions exist in this layer in varying degrees. Depending on the specific conditions in any given part of this zone, different types of bacteria and other organisms are present that contribute to wastewater treatment.

Throughout facultative lagoons, physical, biological, and chemical processes take place that result in wastewater treatment. Many of these processes are interdependent. For example, on the surface, wind and sunlight play important roles. Surface agitation of any kind adds oxygen to the waste-water. For this reason, facultative lagoons are designed to make the best use of wind in the area. The amount of wind the lagoon receives is not only important for the oxygen it contributes, but also because it affects the overall hydraulic flow pattern of the wastewater inside the lagoon, which is another physical factor that contributes to treatment. Time is another important factor in treatment. Facultative lagoons are designed to hold the wastewater long enough for much of the solids in the wastewater to settle and for many disease-causing bacteria, parasites, and viruses to either die off or settle out. Time also allows treatment to reduce the overall organic strength of the wastewater, or its biochemical oxygen demand (BOD). In addition, some of the wastewater eventually evaporates and percolates very slowly through the soil below when site conditions are favorable. Sunlight is also extremely important to facultative lagoons because it contributes to the growth of green algae on the water surface. Because algae are plants, they require sunlight for photosynthesis. Oxygen is a byproduct of photosynthesis, and the presence of green algae contributes significantly to the amount of oxygen in the aerobic zone. The more warmth and light the sun provides, the more green algae and oxygen there is likely to be in the lagoon. The oxygen in the aerobic zone makes conditions favorable for aerobic bacteria. Both aerobic and anaerobic bacteria are very important to the wastewater treatment process and to each other. Bacteria treat wastewater by converting it into other substances. Aerobic bacteria converts wastes into carbon dioxide, ammonia, and phosphates, which, in turn, are used by the algae as food. Anaerobic bacteria convert substances in wastewater to gases, such as hydrogen sulfide, ammonia, and methane. Many of these byproducts are then used as food by both the aerobic bacteria and algae in the layers above. In addition, the sludge layer at the bottom of the lagoon is full of anaerobic bacteria, sludge worms, and other organisms, which provide treatment through digestion and prevent the sludge from quickly accumulating to the point where it needs to be removed. How often sludge must be removed from facultative lagoons varies depending on the climate, the individual lagoon design, and how well it is maintained. Sludge in all lagoons accumulates more quickly in cold than in warm temperatures. However, many facultative lagoons are designed to function well without sludge removal for 5 to 10 years or more. In every lagoon, there are likely to be other plants and organisms that contribute to, and benefit from, the wastewater treatment processes taking place. These types of interdependent relationships are what make the treatment process in lagoons work.

Advantages and Disadvantages of Lagoon Systems

• Lagoon systems can be cost-effective to design and construct in areas where land is inexpensive.

• They use less energy than most wastewater treatment methods.

• They are simple to operate and maintain and generally require only part-time staff.

• They can handle intermittent use and shock loadings better than many systems, making them a good option for campgrounds, resorts, and other seasonal properties.

• They are very effective at removing disease-causing organisms (pathogens) from wastewater.

• The effluent from lagoon systems can be suitable for irrigation (where appropriate), because of its high-nutrient and low-pathogen content.

• Lagoon systems require more land than other treatment methods.

• They are less efficient in cold climates and may require additional land or longer detention times in these areas.

• Odor can become a nuisance during algae blooms, spring thaw in cold climates, or with anaerobic lagoons and lagoons that are inadequately maintained.

• Unless they are properly maintained, lagoons can provide a breeding area for mosquitoes and other insects.

• They are not very effective at removing heavy metals from wastewater.

• Effluent from some types of lagoons contains algae and often requires additional treatment or “polishing” to meet local discharge standards.

5 ANNEX: TRAINING EVALUATION

EFH-PS-2 & 3

Provide technical assistance for addressing industrial pollution and supporting environmental inspection and inventory for the Olive Oil and the Tanning industries of Palestine

Evaluation Report of the training on addressing industrial pollution from the Olive Oil and Tanning industries of Palestine (EFH-PS-2 & 3)

Grand Park Hotel, Ramallah, 28-29 January 2019

April 2019

Version	Document Title	Author	Review and Clearance
1	Report of the training on addressing industrial pollution from the Olive Oil and Tanning industries of Palestine	Stavros Vlachos Tiberio Daddi	Michael Scoullos Anis Ismail

THE SWIM AND H2020 SUPPORT MECHANISM PROJECT (2016-2019)

The SWIM and H2020 SM is a Regional Technical Support Program, funded by the European Commission, Directorate General (DG) NEAR (Neighbourhood and Enlargement Negotiations), that includes the following Partner Countries (PCs): Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine, [Syria] and Tunisia. However, in order to ensure the coherence and effectiveness of Union financing or to foster regional co-operation, eligibility of specific actions will be extended to the Western Balkan countries (Albania, Bosnia Herzegovina and Montenegro), Turkey and Mauritania. The Program is funded by the European Neighbourhood Instrument (ENI) South/Environment. It ensures the continuation of EU's regional support to ENP South countries in the fields of water management, marine pollution prevention and adds value to other important EU-funded regional programs in related fields, in particular the SWITCH-Med program, and the Clima South program, as well as to projects under the EU bilateral programming, where environment and water are identified as priority sectors for the EU co-operation. It complements and provides operational partnerships and links with the projects labelled by the Union for the Mediterranean, project preparation facilities in particular MESHIP phase II and with the next phase of the ENPI-SEIS project on environmental information systems, whereas its work plan will be coherent with, and supportive of, the Barcelona Convention and its Mediterranean Action Plan.

The overall objective of the Program is to contribute to reduced marine pollution and a more sustainable use of scarce water resources. The Technical Assistance services are grouped in 6 work packages: WP1. Expert facility, WP2. Peer-to-peer experience sharing and dialogue, WP3. Training activities, WP4. Communication and visibility, WP5. Capitalizing the lessons learnt, good practices and success stories and WP6. Support activities.

Disclaimer:

This publication was produced with the financial support of the European Union. Its contents are the sole responsibility of the SWIM-H2020 SM Project and do not necessarily reflect the views of the European Union.

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1 GENERAL INTRODUCTION

The 2017-2022 National Policy Agenda of Palestine includes provisions for industrial waste: reduce and effectively control pollution and greenhouse gas emissions; expand solid waste management and recycling. At the same time, institutions in Palestine need support and technical assistance in the inspection, inventory processes and enforcement of environmental legislation.

Leather tanning wastewater in Palestine is highly polluted with Cr(III). International environmental standards require that chromium in wastewater should not exceed 5 mg L^{-1} for Cr(III) and 0.05 mg L^{-1} for Cr(VI). Meanwhile, the olive oil mill waste water is considered as one of the most polluting waste waters from the food sector and causes great problems in biota and cultivations untreated in soil or aquatic systems. It has a very high COD, i.e. 200 000 mg/l, a low pH, i.e. 3–5.9, and a high content of solid matter, i.e. TSS 20 000 mg/l. In addition, the high polyphenol content of olive mill waste water (OMW), up to 80 000 mg/l, make bacterial degradation very difficult and give them phytotoxic characteristics.

Much like in other regions of the world, the tanneries and olive mills in Palestine contribute to the core problem of surface and groundwater pollution. The wastewater from the different olive mills located in and around the different villages in the West Bank is being disposed into the wadies. The olive mill wastewater is then mixed with the flowing untreated municipal wastewater or with rainwater. The high organic polluted wastewater affects the soil, groundwater and water courses downstream. This occurs mainly during the olive season, generally from early October to late December.

Initially the Work Programme of SWIM-H2020 SM had two different activities, one entitled “Provide technical assistance for addressing industrial pollution focusing on the tanning and olive oil industries” and another on “Support in environmental inspection and enforcement of environmental legislation”. However, a joint decision (of the project and National Horizon 2020 Focal Point) was taken to merge the two activities into one: Provide technical assistance for addressing industrial pollution, supporting environmental inspection and enforcing environmental legislation for the Olive Oil and the Tanning industries in Palestine.

This report is about the 2-day training that provided technical assistance for addressing industrial pollution caused by the tanning and olive oil industries (e.g. PRTR, rehabilitation of polluted areas, design and implementation of environmental management plans, inventory, development of guidelines and tools on pollution reduction and prevention). It took place on 28-29 January 2019 in Ramallah.

2. OBJECTIVES AND EXPECTED RESULTS of the workshop

The training aimed to enhance the knowledge of public officials and professionals of tanneries and olive oil mills on how to prevent and reduce pollution from the olive oil and tanning sectors in Palestine. The training’s purpose was the development of guidelines and tools for pollution inspection/control in the mentioned industries in Palestine. To reach its objectives, the approach of the training was practical, included discussions of practical cases and engagement exercises of environmental management experiences adopted in the EU in the olive oil and the tanning industries.

The expected results of this training were:

1. Reinforced and developed capacities
2. Inputs for the experts to finalise the environmental pollution management guidelines/manuals for the Olive Oil and Tanning industries

The experts in charge are convinced that the above results were achieved, and also the positive overall assessment of the training by the trainees shows this. However, for any potential follow-up activities, the suggestions of the trainees (Annex 5.3) will be very useful in the design.

3. PARTICIPANTS PROFILE

In accordance with Terms of Reference of this activity, this workshop targeted competent professionals from the two industrial sectors, and technical staff from the Environmental Quality Authority (EQA), Ministry of National Economy, Joint Services Council for Sloid Waste Management, Ministry of Local Government (Municipalities, Council, etc.), Committees of public health and safety in Governorates, Ministry of Health, Industries Union, Ministry of Agriculture (MoA) and Palestinian olive oil council.

As seen also from the list of participants (see Annex), the event was attended by14 professionals from the 2 industrial sectors, 14 from the EQA, 4 from MoA, 1 from Palestinian Food Industry Union (PFIU), 1 from Palestinian Central Bureau of Statistics (PCBS) and 1 from the Palestine Police Department.

4. EVALUATION OF THE TRAINING BY THE TRAINEES

A. Feedback on organizational, administrative and planning issues of the event

A set of 7 criteria; A1-A7 (see table below) were assessed by the participants, using a qualitative description ranging between “Excellent” to “Poor”, with an opportunity to provide suggestions for improvement. For the sake of comparison, the qualitative descriptions are given series numbers as follows: Excellent = 4; Good = 3; Average = 2; Poor = 1.

Table 1. Training rating results related to organizational, administrative and planning issues

A. ORGANISATIONAL, ADMINISTRATIVE AND PLANNING ISSUES BEFORE AND DURING THE EVENT		EXCELLENT	GOOD	AVERAGE	POOR	Total Replies	Average Score (max = 4)
A1	Efficient logistics: location of venue and interpretation	7	15	2	0	24	3.21
A2	Smooth flow of programme, efficient handling of emerging needs and attentiveness to participants concerns	5	17	2	0	24	3.13
A3	Presentations correspond and contribute to the planned objectives and are conducive to enhanced shared understanding and participation on addressed topics	5	13	5	1	24	2.92

A4	Clarity, coverage and sufficiency of concepts, objectives, anticipated outputs and outcomes	5	10	9	0	24	2.83
A5	The materials distributed were helpful	4	12	8	0	24	2.83
A6	Efficient and effective facilitation	9	12	3	0	24	3.25
A7	Overall rating of the event	7	16	1	0	24	3.25

See also the corresponding graphs for Table 1 in Annex 5.3.

B. Feedback on technical aspects of the event

Figure 1- Coverage of the event

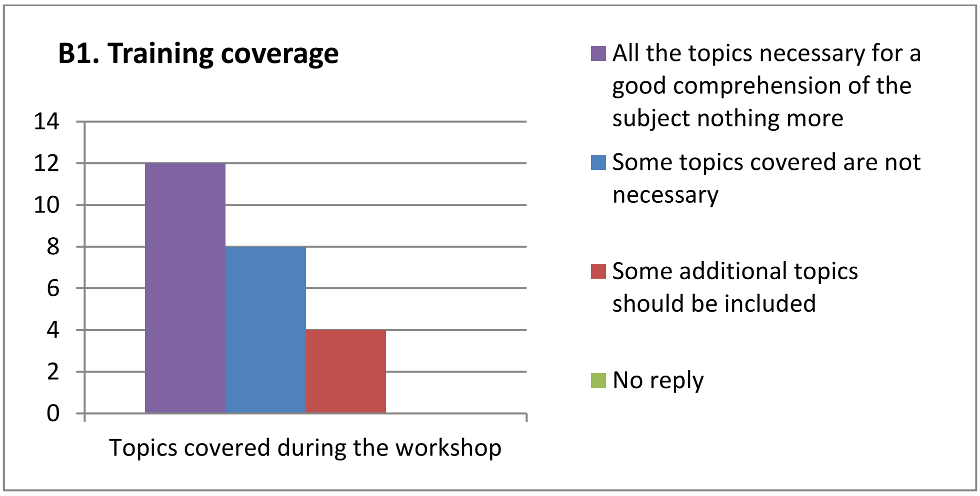


Figure 2 – Level of difficulty

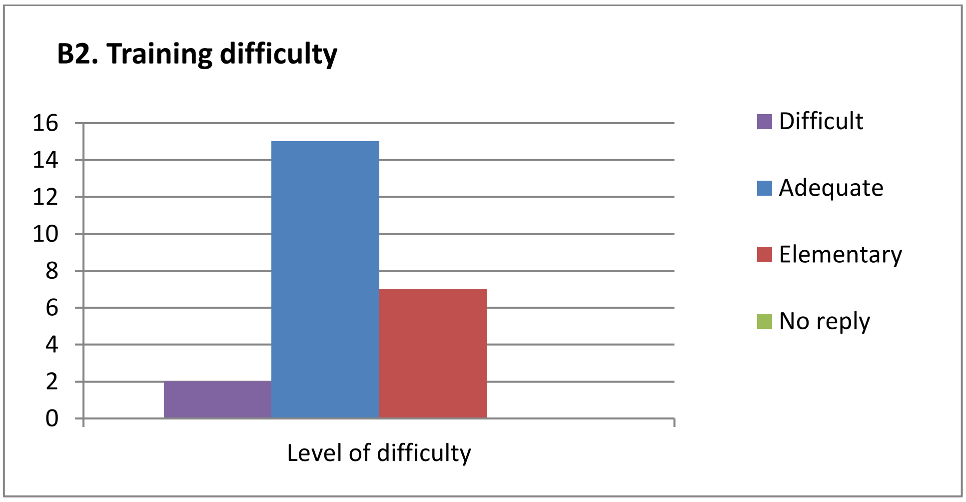
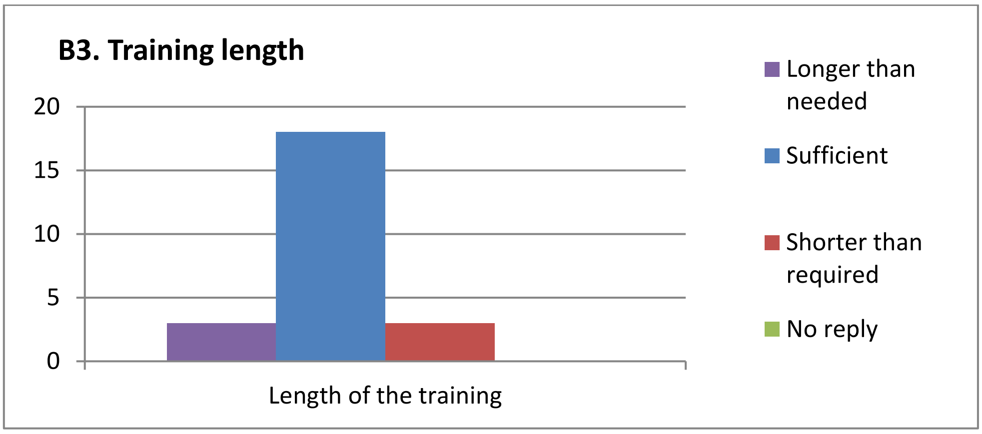


Figure 3- Length of the training



See more details regarding technical aspects in Table 2 in Annex 5.3.

For participants replies to the open-ended questions see Table 3 in Annex 5.3.

5. ANNEXES

5.1 AGENDA OF THE TRAINING

EFH-PS-2&3
Addressing industrial pollution from the Olive Oil and Tanning industries of Palestine
28- 29 January 2019, 09.00-15.00
Venue: Grand Park Hotel, Ramallah, Rafat St. Al-Masyoun Heights

28 January		*Duration*	
Session 1 ***Introduction***	• Welcome addresses, opening remarks • The SWIM-HORIZON 2020 Support Mechanism • Introduction, aims, participants expectations, ice-breaking	09.00 - 10.00	• *SWIM-H2020 Experts* • *EUD* • *EQA*
Session 2 ***Plenary***	The Palestinian framework for the waste management of the two sectors	10.00 - 10.30	Presentation by EQA *Discussion*
Coffee Break			**10.30 -11.00**
Session 3 ***Parallel Sessions***	Environmental management system standards and their application in **olive mills** *Stavros Vlachos, SWIM-H2020 SM Expert*	11.00 - 13.00	Environmental management system standards and their application in **tanneries** *Tiberio Daddi, SWIM-H2020 SM Expert*
Lunch Break			**13.00 - 14.00**

Session 4 ***Parallel Sessions***	Case study: the application of LCA (Life Cycle Assessment) in the **olive mill sector** *Stavros Vlachos, SWIM-H2020 SM Expert*	14.00 - 15.00	Case study: the application of LCA (Life Cycle Assessment) and PEF (Product Environmental Footprint) in **tanneries** *Tiberio Daddi, SWIM-H2020 SM Expert*
			29 January
Session 5 ***Parallel Sessions***	Process description and key environmental aspects in the olive mill sector *Stavros Vlachos, SWIM-H2020 SM Expert*	09.00 - 11.00	• Process and product environmental performance for tanneries of excellence: the requirements imposed to EU tanneries by luxury brands • Environmental technologies and chemical substitutions in tanneries *Tiberio Daddi, SWIM-H2020 SM Expert*
	Coffee Break		**11.00 - 11.30**
Session 6 ***Parallel Sessions***	• Environmental Performance Indicators and monitoring of olive mills- International Legislation • Best available techniques application in olive mills • DMF technology- Decanter Multiple Function *Stavros Vlachos, SWIM-H2020 SM Expert* *Taher Omair, Pieralisi S.p.A.*	11.30 - 13.00	• Case study: Cooperative approach to manage environmental aspects (chromium, shavings and flashings, common wastewater treatment plant and its sludge) from tanneries located in large industrial areas: the case of tannery industrial cluster of S.Croce sull'Arno (Italy) • Engagement exercise on BAT (Best Available Techniques) in tanneries • Discussion of the exercise among participants *Tiberio Daddi, SWIM-H2020 SM Expert*
	Lunch Break		**13.00 - 14.00**
Session 7 ***Plenary***	• Closing/Wrap up • Course Evaluation • Certificates Award	14.00 - 15.00	

5.2 LIST OF PARTICIPANTS OF THE TRAINING

Addressing industrial pollution from the Olive Oil and Tanning industries of Palestine (EFH-PS-2&3)
28-29 January 2019, Ramallah, Palestine

No.	COUNTRY	TYPE OF INSTITUTION (please use the options provided*)	TITLE (Mr/Ms)	FIRST NAME	LAST NAME	POSITION/ FUNCTION	ORGANISATION/ INSTITUTION	EMAIL
1	GREECE	INTERNATIONAL ORGANISATIONS AND PROGRAMMES	Mr	Stavros	VLACHOS	Project Expert	Envirometrics / SWIM-H2020 SM	svlachos@envirometrics.gr
2	ITALY	INTERNATIONAL ORGANISATIONS AND PROGRAMMES	Mr	Tiberio	DADDI	Project Expert	SWIM-H2020 SM	tiberio.daddi@santannapisa.it
3	PALESTINE	INTERNATIONAL ORGANISATIONS AND PROGRAMMES	Mr	Amer	EL-HAMOUZ	Project Expert	SWIM-H2020 SM	elhamouz@yahoo.com
4	PALESTINE	MINISTRY REPRESENTATIVES	Mr.	Ahmad	ABUTHAHER	Director General For Projects and International Relations & H2020 focal point	Environment Quality Authority (EQA)	ahmadabuthaher@yahoo.com
5	PALESTINE	MINISTRY REPRESENTATIVES	Mr.	Yaser	ABU SHANAB		Environment Quality Authority (EQA)	yaser_shanab@hotmail.com
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7	PALESTINE	MINISTRY REPRESENTATIVES	Mr.	Talib	IHMIED	Director of monitoring & inspection	Environment Quality Authority (EQA)	ihmied@gmail.com

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9	PALESTINE	MINISTRY REPRESENTATIVES	Mr.	Thabet	YOUSEF	Director of Ramallah Office	Environment Quality Authority (EQA)	thabet63@yahoo.com
10	PALESTINE	MINISTRY REPRESENTATIVES	Ms.	Saeda	SHAEBAT	Director of Environment Teaching	Environment Quality Authority (EQA)	ska_002005@yahoo.com
11	PALESTINE	MINISTRY REPRESENTATIVES	Mr.	Amjad	IBRAHIM	Director of Jericho Office	Environment Quality Authority (EQA)	amjadibrahim69@yahoo.com
12	PALESTINE	NGOs REPRESENTATIVES	Ms.	Sabha	ABDEL-RAHMAN	Technical	Palestinian Food Industry Union (PFIU)	s.ziad@pfiu.org
13	PALESTINE	ACADEMIA AND RESEARCH INSTITUTES	Ms.	Safia	IBRAHIM	Statistician, Head of Solid Waste Division	Palestinian Central Bureau of Statistics (PCBS)	sibrahim@pcbs.gov.ps
14	PALESTINE	MINISTRY REPRESENTATIVES	Ms.	Lames	FAHD	Inspector	Environment Quality Authority (EQA)	lameesfahd@hotmail.com
15	PALESTINE	MINISTRY REPRESENTATIVES	Ms.	Thikra	MUSTAFA	Inspector	Environment Quality Authority (EQA)	thikra.mustafa@yahoo.com
16	PALESTINE	MINISTRY REPRESENTATIVES	Ms.	Doaa	ABDALLAH	Inspector (Chemical Department)	Environment Quality Authority (EQA)	doaabdallah@hotmail.com
17	PALESTINE	MINISTRY REPRESENTATIVES	Ms.	Ruba	ABDEL HADI-ARMAN	Inspector	Environment Quality Authority (EQA)	rubaarman@hotmail.com
18	PALESTINE	MINISTRY REPRESENTATIVES	Ms.	Kahramana	AL-KELANI	Director of International relations	Environment Quality Authority (EQA)	kah_kelani@yahoo.com

19	PALESTINE	MINISTRY REPRESENTATIVES	Mr.	Zeyad	ADELRAHMAN	Director of National product industry	Ministry of National Economy (MoNE)	zeiadf@met.gov.ps
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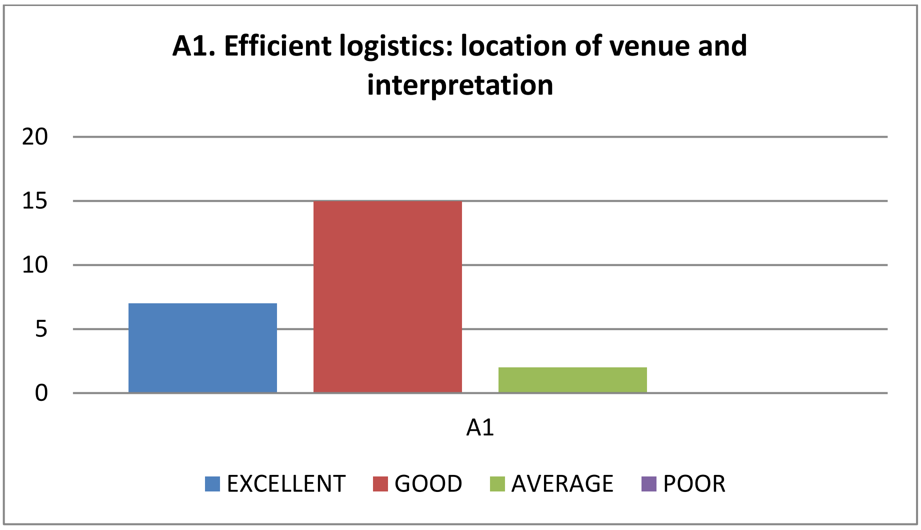
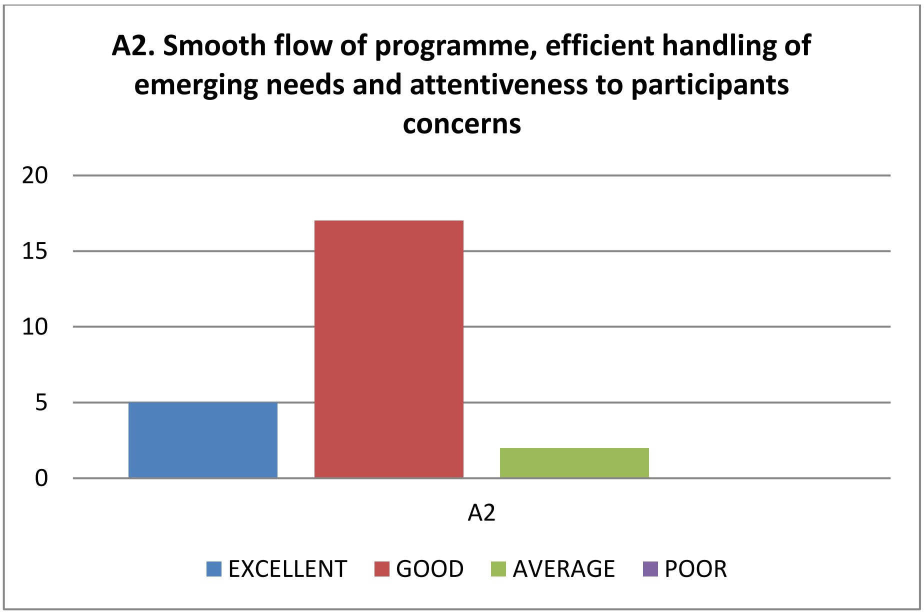
21	PALESTINE	PRIVATE SECTOR	Mr.	Khaled	SHTAYE	Inspector	Al Zaytoun Palestine	
22	PALESTINE	PRIVATE SECTOR	Mr.	Taher	OMAIR	General Manager	Pieralisi S.p.A	taher.omair@gmail.com
23	PALESTINE	PRIVATE SECTOR	Mr.	Khamees	QADI	Operator	Etalaf co-operative	khameesqadi@hotmail.com
24	PALESTINE	PRIVATE SECTOR	Mr.	Odwan	BANJABIR	Owner	Aqraba Olive Oil Mill	
25	PALESTINE	PRIVATE SECTOR	Mr.	Jamal	SALEH	Operator	Aruora electronic olive oil mill	
26	PALESTINE	PRIVATE SECTOR	Mr.	Shaher	RAFEQAH	Owner	Sinjel	shaheraburafeqah1958@gmail.com
27	PALESTINE	MINISTRY REPRESENTATIVES	Mr.	Bashir	ABU HIJLEH		Environment Quality Authority (EQA)	
28	PALESTINE	ACADEMIA AND RESEARCH INSTITUTES	Mr.	Abdallah	ALKHALEK	Director	Institute Abou Hallah	
29	PALESTINE	PRIVATE SECTOR	Mr.	Waleed	ZAHNEN		Olive press	

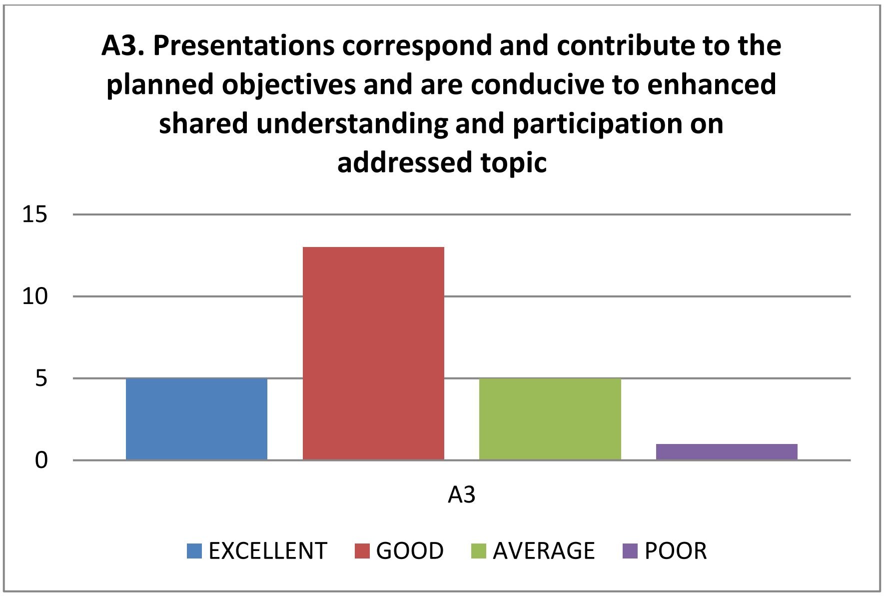
30	PALESTINE	PRIVATE SECTOR	Mr.	Hilal	MALHIS	Legal translator	Translation center Nabillus	hilal.malhis@yahoo.com
31	PALESTINE	PRIVATE SECTOR	Mr.	Reda	ISMAT	Project Director	Deir Ghasana olive oil mill	
32	PALESTINE	PRIVATE SECTOR	Mr.	Ali Ibrahim	ODAI	Director	The modern Beit Mreen oilive oil mill	
33	PALESTINE	PRIVATE SECTOR	Mr.	Abu Lyla	THAER	Director	Qouseen Olive oil mill	
34	PALESTINE	PRIVATE SECTOR	Mr.	Mohammed	NABIL	Director	Modern Sarra Olive oil Mill	
35	ITALY	ACADEMIA AND RESEARCH INSTITUTES	Ms.	Guia	BIANCHI	PhD Researcher	Sant'Anna School of Advanced Studies in Pisa	gu.bianchi@santannapisa.it
36	PALESTINE	MINISTRY REPRESENTATIVES	Mr.	Ramiz	OBAID	Director of Olive department	Ministry of Agriculture (MoA)	ramiz_obaid@yahoo.com
37	PALESTINE	MINISTRY REPRESENTATIVES	Ms.	Ahlam	SADER	Head of Olive Oil department	Ministry of Agriculture (MoA)	a_alsadder04@yahoo.com
38	PALESTINE	MINISTRY REPRESENTATIVES	Ms.	Jumana	ZAID	Head of Olive Oil department	Ministry of Agriculture (MoA)	jumana_z@hotmail.com
39	PALESTINE	PRIVATE SECTOR	Mr.	Islam	ARAR	Director	Janat AlKods modern olive oil mill	islam.arar2010@hotmail.com
40	PALESTINE	LOCAL AUTHORITIES	Mr.	Ribhe	HANAYSHIB	Assistant director	Palestine Police Department	ribhebadad@gmail.com

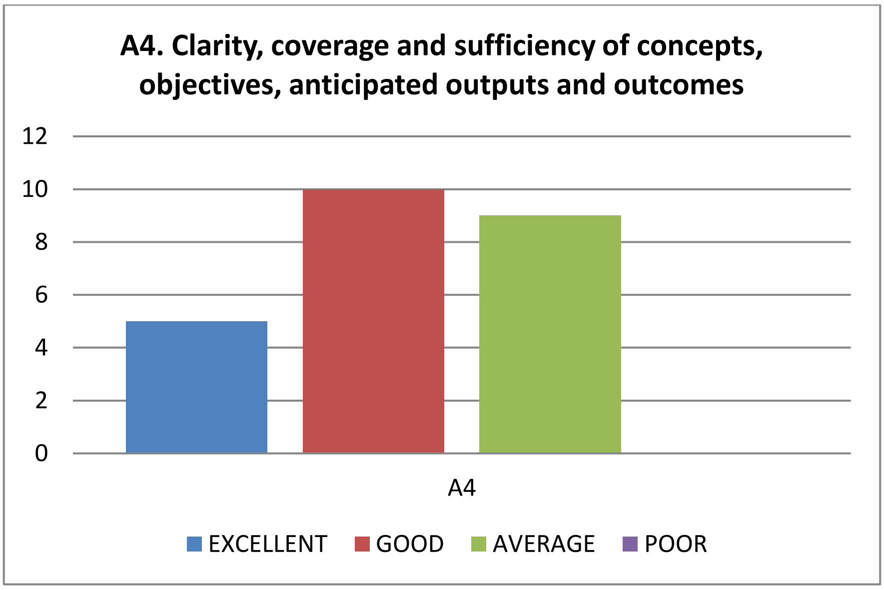
5.3 DETAILS ON THE RESULTS OF THE EVALUATION FORMS

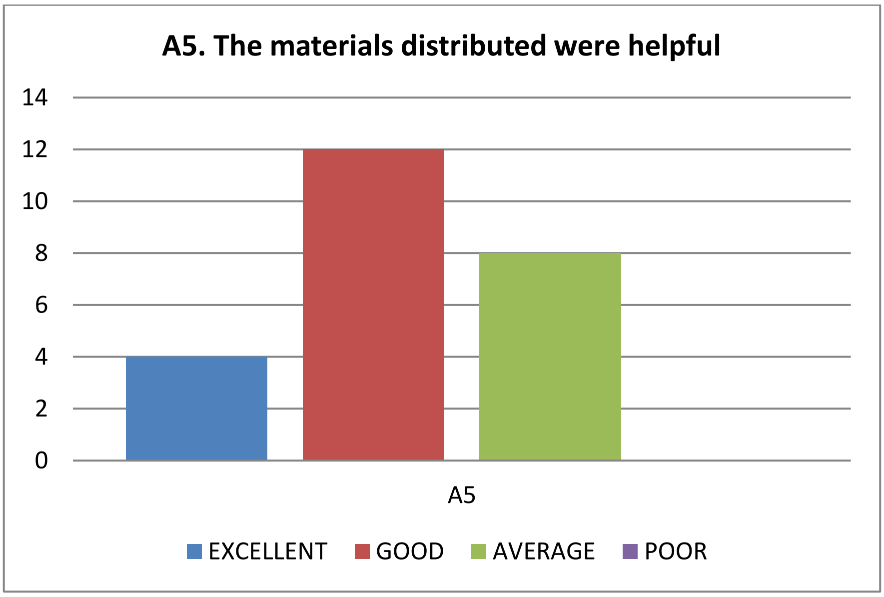
The following graphs illustrate Table 1: Training rating results related to organizational, administrative and planning issues.

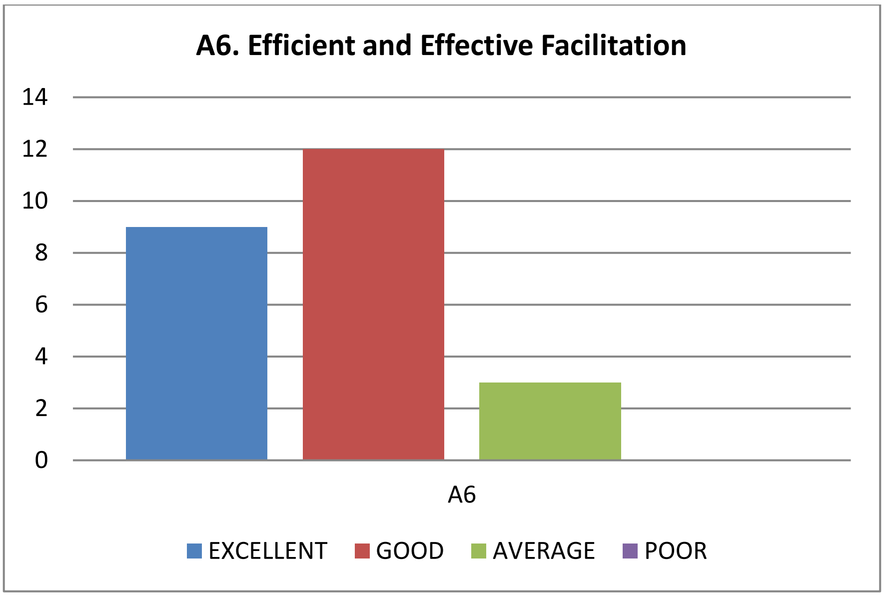





A3. Presentations correspond and contribute to the planned objectives and are conducive to enhanced shared understanding and participation on addressed topic
15
10
5
0
A3
EXCELLENT
GOOD
AVERAGE
POOR


A4. Clarity, coverage and sufficiency of concepts, objectives, anticipated outputs and outcomes
12
10
8
6
4
2
0
A4
EXCELLENT
GOOD
AVERAGE
POOR


A5. The materials distributed were helpful
14
12
10
8
6
4
2
0
A5
EXCELLENT
GOOD
AVERAGE
POOR



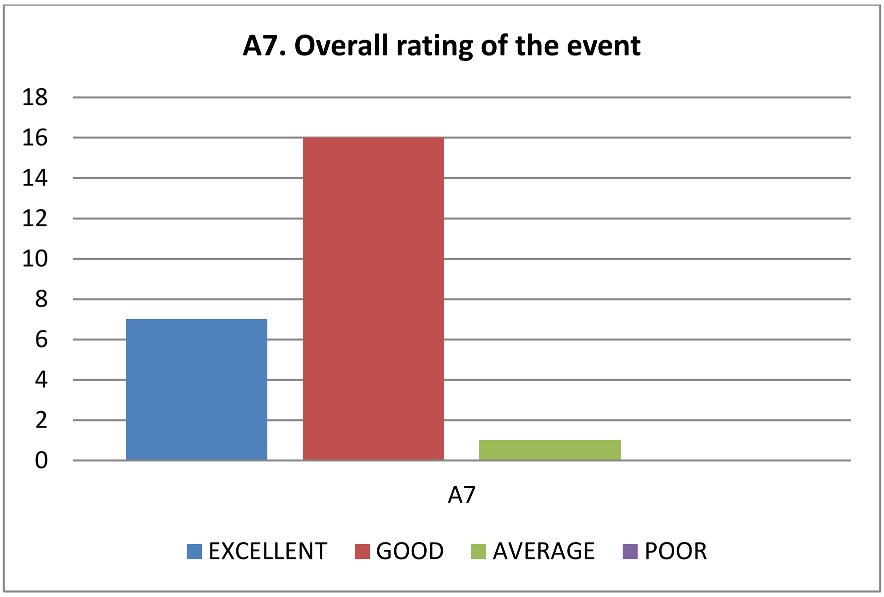


Table 1. Participants' feedback on technical aspects of the event.

FEEDBACK ON TECHNICAL ASPECTS	No. of replies
B1. Coverage of the event	
All the topics necessary for a good comprehension of the subject	12
Some topics covered are not necessary	8
Some additional topics should be included	4
Total Replies	24
B2. Level of difficulty	
Difficult	2
Adequate	15
Elementary	7
Total Replies	24

B3. Length of the training	
Longer than needed	3
Sufficient	18
Shorter than required	3
Total Replies	24

Table 3. Participants replies to the open-ended questions

	Open-ended questions	**Participant's replies**
B4	**What is the most valuable thing you learned during the workshop (knowledge or skills)?**	▪ how the developed countries deal with waste and their experience (2) ▪ how olive oil tanning can be managed to reduce environmental pollution and what is needed for this ▪ how to deal with liquid waste on olive industry ▪ the liquid waste characteristics and its effect on environment (3) ▪ about olive oil mills waste (2) ▪ about new techniques ▪ knowledge about the olive oil industry ▪ the problem in soil and water ▪ got a lot of experience from the case studies ▪ realized the gap of backwardness of Palestine vis-a-vis the sustainable development of the EU ▪ about EMSs and ISO 14001 (2) ▪ knowledge about tannery in Italy and some data about BAT ▪ the new technology (4)
	Total Replies	**21**
B5	**How do you think that the current event will assist you in your future work on the subject?**	▪ to improve our property ▪ by trying to apply what we learnt in our country ▪ this event will open new window to environmentally friendly olive oil tanning and green industry ▪ it will help me to create a plan and procedures to deal with ▪ giving us new information about the new technology all around the world and also from now one we will concern more about the environmental problems and try to solve them using our resources ▪ it will help me to develop my project in the future ▪ how to protect water quality by using new techniques ▪ to better monitor ▪ it gives us knowledge about the new technology used around the world and it makes us concern about the environmental problems and how to deal with them (3) ▪ it will give us experience in monitoring hazardous waste in Palestine ▪ perseverance, enhancement and feedback ▪ in the field when we inspect ▪ it will help me in auditing and while conducting field visits for tanning industry ▪ how to make internal and external audit ▪ to look for new technology (4)
	Total Replies	**20**
B6	**Please indicate whether (and how) you could transfer part of the experience gained from**	▪ focus on EMSs terms & study on these systems in order to be able to implement them in our country ▪ train my colleagues (2) ▪ yes, by arranging meetings

	the event to your colleagues in your country?	▪ giving speeches in different events ▪ yes, in my work and my colleagues (2) ▪ yes, but we need a translated guide in order to transfer the knowledge between our partners and colleagues (3) ▪ arrange meetings with the Agricultural Extension Unit in the Ministry of Agriculture ▪ share the presentations with my colleagues; ▪ holding identical seminars and spreading the essence of this workshop to my absentee natives ▪ giving lectures to my colleagues ▪ discuss what i learned with my staff (4)
	Total Replies	**18**
B7	What did you like most about this event?	▪ the trainer ▪ the knowledge i gain about EMSs & BEMP ▪ the new technique in olive oil mills ▪ everything as it is a good step to improve our business (2) ▪ the waste methods ▪ Brazili new technique to stop discharge of Zibar ▪ the impact of the industry ▪ the discussion and the new knowledge I gained (2) ▪ that the training was related to my work ▪ the value of this stable food material for the growth ▪ technical information about tanneries ▪ the discussion during the workshop (3)
	Total Replies	**16**
B8	What needs to be improved?	▪ to match the training with our situation since it is very special case ▪ to include a field visit ▪ the material should be simpler since most of attendees are farmers ▪ expert in liquid waste management and financial help to improve the mills ▪ more trainings ▪ nothing everything was fine (2) ▪ experts (Arabic) on liquid waste management and written procedures in Arabic (3) ▪ longer workshop duration ▪ brainstorming for traditional practitioners of olive producers, copying with modernity, globalization and compliance with perfection and fidelity ▪ technical and scientific information about tanning process ▪ include practical sessions (4)
	Total Replies	**17**