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Eco-Peace

FINAL REPORT

Assistance to raising knowledge on industrial safety at universities in Armenia

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The project implementation was also agreed with the UNECE Industrial Accidents Convention Expert Group.

The project implementation in Armenia was supported by the RA Ministry of Nature Protection and the Ministry of Emergency Situations as well as by the Armenian State Engineering University and the Yerevan State University of Architecture and Construction.

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1. BRIEF DESCRIPTION OF THE PROJECT

The last decades of the XX-XXI centuries have been marked by extensive man-made activities and natural phenomena in all over the world, causing social, economic and ecological disasters. Until the mid 20th century no large scale accidents and disasters were registered that were capable of causing irreversible ecological changes in the global scale, such as Chernobyl, Seveso tragedies, as well as the ecological disaster related to oil release from the underwater pipeline.

After the ecological disaster that took place in 2000 in Romania (Baia Mare), with financial support of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety of Germany the technology transfer project aimed at protection of the reservoirs against the impact of industrial enterprises in Romania, Moldova and Ukraine was carried out. It was aimed to increase the safety level of the industrial enterprises in terms of protection of water resources. One of the most important results of this project was the development of the checklist methodology for monitoring and evaluation of hazard-relevant industrial plant. For this methodology the recommendations developed by the International River Basin Commissions of the rivers Rhine and Elbe (ICPR, ICPE) served a basis. They allow carrying out effective control of industrial enterprises and are applicable for study and assessment of any industrial enterprise using materials hazardous for water.

Armenia is not exclusion in terms of industrial accidents, and according to statistics the hazardous natural and man-made processes have increased more than 30% during the last 10 years. Taking into account that so far the low quality, energy and material consuming technologies inherited from the past form a significant part of the industry in Armenia, not allowing for non-risk production, and the new technologies are too expensive for many enterprises, the industrial security issues are becoming a subject of serious attention.

Still 10-15 years ago the problems of providing safe industrial processes were pushed to the background, because after the economic crisis the attention was focused on rehabilitation of various industrial branches. At present various industrial branches are gradually recovered in Armenia and projects are implemented towards reduction of adverse environmental impact.

In recent years, Armenia has adopted a number of legislative documents in the fields of environmental education and policy development.

Joining the Bologna process, Armenia, jointly with other participating countries (Georgia and Azerbaijan of South Caucasus too are members of the Bologna process) has committed itself to harmonizing its higher educational system with the required “general criteria”, forming a part of the European higher educational region that is impossible without implementation of reformations.

Armenia attaches importance to development of national qualification frameworks at national and European levels emphasizing the need of their harmonization.

At the same time, ratifying the UN ECE Industrial Accidents on Transboundary Effects of the Convention (Helsinki, 1992) still in 1996, Armenia ratified its state policy also in this area. However, many provisions of the Convention have not found their proper application in the country so far. The cause for it is that there is a need to enhance the level of the personnel specialized in prevention of emergency situations, the level of readiness of enterprises and to coordinate all these activities.

For assessment of the risk of industrial accidents, their preventing or limiting, purposeful measures are needed, for the priority ranking of which effective methods of systemized and comprehensive analysis are important. By offering short-term, medium-term and long-term measures, the mentioned checklist methodology provides this possibility.

This project was aimed at supporting enriching the knowledge of students of higher educational institutions in Armenia and increasing the level of industrial safety in the county with involvement of young people, particularly the students of technical higher educational institutions, at the same time promoting improvement of the knowledge of the students and industrial enterprises' staff.

Within the framework of the project an attempt was made to apply the mentioned checklist methodology in Armenia's higher education system, with implementation of the following important measures:

- Experts from Germany trained the Armenian sector specialists (including lecturers of universities) on industrial safety and the practical use of the checklist methodology.
- The trained Armenian specialists transferred their knowledge to the student groups involved from different universities.
- The students applied the checklist methodology in 5 the industrial enterprises of Armenia during their educational-industrial practice.
- The checklist application guidelines and 18 separate packages were translated into Armenian.
- Additions and corrections were done by various specialists for harmonization of the checklists with the conditions of Armenia.
- It can be stated that the implementation of the project allows localizing and applying the European experience in Armenia.

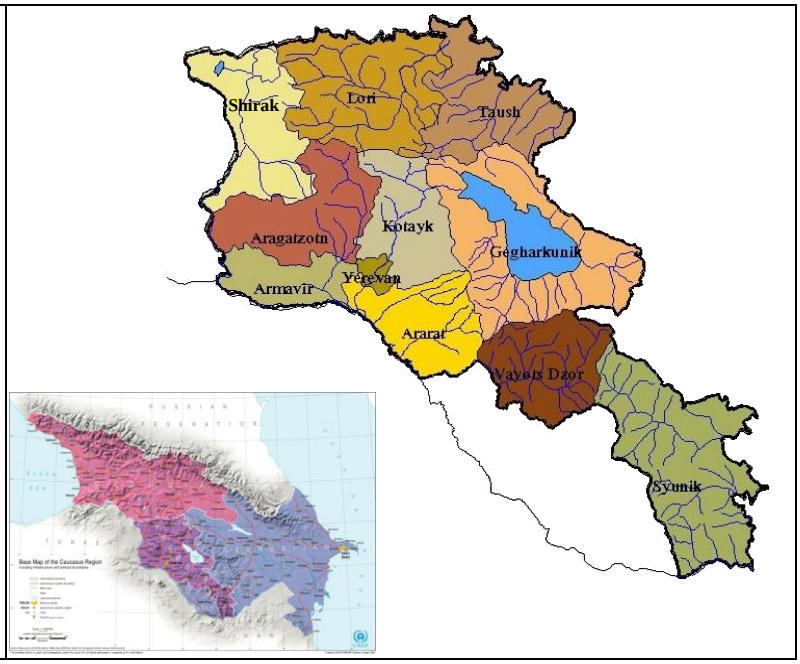
The project results were presented at the international closing meeting held in Yerevan, which was attended by experts from 8 countries of the EEC, at the Conferences of the Parties to the UNECE Industrial Accidents Convention in Stockholm (Sweden, 2012) and in Geneva (Switzerland, 2013), as well as at UNEP/UNESCO/BMU International Postgraduate Training Programme on Environmental Management for Developing and Emerging Countries in Dresden (Germany, 2013).

The information on the implemented activities (including the obtained results) was regularly placed at the web sites of German Federal Agency, RA Ministry of Emergency Situations, project participant universities (SEUA, YSUAC, CMSA), Aarhus Center, as well as UN ECE. Registration, receiving of applications and final selection of participants of the final seminar of the project was implemented thanks to the dissemination of information by the Secretariat of the Convention on Industrial Accidents and by placement of corresponding announcement at UN ECE web site.

Within the framework of the project, through the online network of Aarhus Centre and the REC interpretation of the carried out activities was carried out, thanks to which the information was disseminated at national and regional (Armenia, Georgia, Azerbaijan) levels. Aimed at public awareness raising, information leaflets were distributed at different times during the project implementation.

During the project implementation, the cooperation with governmental and non-governmental organizations that carry out different functions and programs within the scope of their activities connected with the solution of the presented issues played a significant role.

2. PROJECT LOCATION

Republic of Armenia *Area* 29,8 thousand sq. km *Bordering countries* Georgia (North), Azerbaijan (East), Iran (South), Turkey (West). *Population* 3.2 million *Capital* Yerevan (1,2 mln. population)	

The Republic of Armenia is situated in the southern part of Trans Caucasus, at the northern edge of subtropical region and covers north-eastern part of Armenian upland.

Armenia is a typically mountainous country, with complicated combination of uplands, plateaus, river valleys, depressions and has relatively arid, continental climate. The natural complex of the country is characterized with complicate relief, limited land, water and forest resources, unfavorable engineering geological conditions (high seismicity, abundance of geodynamic processes) of the most part of the area. The average altitude above sea level is 1850 m, and about 40% of the area is almost uninhabitable.

The Armenian area is divided into 11 marzes (administrative regions), including capital city of Yerevan.

Still in Soviet times many towns and villages were considered industrial centers, and the main industrial branches currently operating are:

- Mining (ore processing)
- Chemical industry
- Metallurgy
- Mechanical engineering and metal processing
- Textile industry
- Food industry

- Construction.

Students of a number of state universities of Armenia (mainly technical universities) pass their educational practice in the industrial enterprises of Armenia. This allows students not only to strengthen their theoretical knowledge but also to make a smooth transition from educational process to production. The present state educational system of Armenia includes the following higher educational institutions, many of which have branches in different regions of Armenia:

- State University of Armenia
- State Engineering University of Armenia
- State Pedagogical University of Armenia
- State Economic University of Armenia
- State Agrarian University of Armenia
- Yerevan State University of Architecture and Construction
- Crisis Management State Academy of MES RA
- Yerevan State Linguistic University
- Yerevan State Medical University
- Yerevan State Conservatoire
- Yerevan State Institute of Theater and Cinematography
- Yerevan State Academy of Fine Arts
- Armenian State Institute of Physical Culture.

Still during Soviet times many higher educational institutions of the country (particularly technical institutions) have been attractive even for foreign students. During the years of independence the international relations have strengthened and the geography of education has broadened. Presently students from about 40 countries study at Armenian institutions of higher education.

For the implementation of the project the State Engineering University of Armenia (www.seua.am) and the Yerevan State University of Architecture and Construction (www.ysuac.am) were selected in advance. With them a preliminary agreement was gained still in the project preparation stage. The managements of SEUA and YSUAC provided official letters on the support of the project by them.

Copies of the support letters are provided in Appendix 1.

Originally it was intended to involve only these 2 universities; however during the kick-off meeting, there were suggestions that were further taken into account during the future works. As a result, also the third university, i.e., the Crisis Management State Academy (CMSA) of the MES was involved in the project activities.

These 3 higher education institutions are located in Yerevan, not too far from each other. The SEUA and YSUAC prepare different professionals in engineering direction and the CMSA is under the RA Ministry of Emergency Situations and the majority of the students of the Academy

immediately get jobs at various departments of the Ministry of Emergency Situations after receiving the bachelor's degree.

The selection was made taking into account the areas of specialization at the universities. The faculties and chairs, which prepare specialists consistent with the goals and objectives of the project were selected.

The selected departments in the project participating universities are shown below in Table 1.

Table 1. ***Corresponding departments in the project participating universities***

University	Department
SEUA	▪ *Department of Chemical Technologies and Environmental Engineering* ▪ *Department of Mining Engineering and Metallurgy*
YSUAC	▪ *Department of Geoecology and Biosafety*
CMSA	▪ *Crisis Management Department*

The following specialists are prepared at the selected departments:

- Environmental protection and efficient use of natural resources;
- Biosafety and environmental protection;
- Safety in case of emergency situations.
- Environmental protection-engineering,
- Ecological expert examination;
- Crisis management in emergency situations.

Many of the mentioned departments for these professions have been established as a result of educational reform in recent years.

The project was carried out with participation of the departments' lecturers and students, whose choice was made by the management of the departments, taking into account the professional orientation of lecturers and the performance level of the students.

3.IMPLEMENTATION OF THE MAIN ACTIONS PLANNED UNDER THE PROJECT

3.1. PPOJECT KICK-OFF MEETING

The kick-off meeting of the project was held on 20th of March 2012. Representatives of RA Ministries of Nature Protection, Emergency Situations, Health, project participant universities (SEUA, YSUAC), international organizations (OSCE, UNDP, REC CAUCASUS, NGOs, industrial enterprises (RA Institute of Mining and Smelting, "Lusakert Biogas Plant", "Nairit Plant" CJSC, Alaverdi copper smelter factory, Zangezur Copper Molybdenum Plant, representation of the "CRONIMET" Mining GmbH in the Armenia, "Green Lane" NGO, AWHHE NGO and etc.), as well as the funding organization, i.e. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety of Germany attended the meeting.

The meeting was open also for the students.

The meeting was aimed at presentations on the project mission and goal, which is to support increasing the level of industrial safety in Armenia and raising the level of public awareness in the sector with involvement of students of technical higher educational institutions, at the same time promoting improvement of the knowledge of the specialists (lecturers), students and industrial enterprises' staff and providing localization of the European experience in the sector and its application in the country.

Chief of department of Industrial Accidents, Radiation and Chemical Protection of the RA Ministry of Emergency Situations Mr. Karapet Karapetyan opened the meeting and mentioned that the RA MES always attached a special importance to the prevention of man-made disasters and problems of mitigation of their consequences, and that the experience of active public sector integration in this process was welcomed.

Mr. Gerhard Winkelmann-Oei, representative of German Federal Environmental Agency and Ms. K. Sahakyan, president of "Eco Peace" NGO also made welcome speeches, thanking the attendees for their participation and interest towards the project.

In the first part of the meeting, the project manager Kristine Sahakyan presented the activities and the outcomes obtained within the framework of the project. She presented also the details of preparatory works (obtaining support of the RA Ministries of Nature Protection and Emergency Situations, preliminary agreement and official letters issued by the project participating universities' corresponding departments, etc.)

Mr. G. Winkelmann-Oei represented the European experience in the field, the activity of the Ministry of Environment of Germany and other projects funded by the Government of Germany.

During the second part of the meeting the representatives of the RA Ministries of Nature Protection and Emergency Situations made speeches, representing information on 2 UN ECE conventions and the processes implemented in Armenia related to industrial safety sector. Afterwards, Ms. Nune Harutyunyan, regional director of REC Caucasus, represented the details of the activity and the role of their organization in the countries of the South Caucasus.

The third part of the meeting was about the educational system in Armenia, where the representatives of the project participant universities represented the educational process at their university departments, details on organization of training and production practices for the students.

The representatives of the universities noted that the project will promote enriching the knowledge of specialists and teaching staff and students of the Universities in educational, environmental, public safety and awareness raising areas. Since the educational process in Armenia requires reformations, for which new knowledge acquired and experience in professional field are a precondition, the successful implementation of the project would also support the implementation of the Bologna education process in Armenia.

The Agenda and the list of participants of the kick-off meeting are provided in Appendix 2.

During the meetings between REC Caucasus-Armenia and environmental NGO "Eco Peace" was made an agreement regarding the dissemination of information by REC Armenia on the process of project implementation.

The participants represented 2 further recommendations regarding the further course of the project:

- Involvement of Aarhus center in the further project activities;

- Involvement of the Crisis Management State Academy of RA MES in the further project activities.

The recommendations were taken into account in the future, as a result of which the Aarhus center the Crisis Management State Academy of RA MES were involved in the further project activities.

The representatives of industrial enterprises present at the meeting also attached importance to the project implementation and stated about their support and willingness to the project activities.

The kick-off meeting allowed the public, the private and non-governmental sector representatives to exchange information and ideas, to discuss projects, to give their comments and suggestions on further actions, which had a significant positive impact on the efficiency of the project.

The meeting attendees welcomed the project idea and expressed their opinion in regards with project implementation; especially it was underlined that the project implementation agreed with the UN ECE "Industrial Accidents" Convention is in compliance with country's current needs.

The participants emphasized that the project created a stable foundation for the process continuation after the project completion and assessed the project implementation as important both for Armenia and the region.

At the end of the meeting it was emphasized that successful implementation of the project could possibly serve good practice and suggested for implementation in Ukraine, Moldova, Georgia, Azerbaijan and etc.

The atmosphere of the meeting was cordial and constructive, creating a stable foundation for the successful implementation of the project.

3.2. TRAINING OF TRAINERS

Within the framework of the project on "Assistance to raising knowledge on industrial safety at Universities", funded by Federal Ministry for the Environment, Nature Conservation and Nuclear Safety of Germany, training courses for trainers on "The methodology of Checklists for Investigation and Evaluation of the Condition of Industrial Plants" were conducted in Yerevan during 29.05 - 01.06.2012 by international experts from Germany.

The goal of the courses was to provide the Armenian participants an opportunity to get acquainted with the European experience in the field, particularly to teach them to work by check lists, which allow carrying out systemized inspections in industrial enterprises. The check lists, which include technical and organizational measures related to industrial safety and have found their application in a number of European countries, have been developed by experts from a number of European countries (Germany, Romania, Ukraine, Hungary, Moldova, Switzerland) and are designed for application in potentially dangerous (especially for water bodies) industrial enterprises.

During the courses the participants applied this methodology in a certain enterprise during the inspection with application of the check lists.

Preliminary visit to the industrial enterprise

With the purpose of carrying out the practical part of the training courses most efficiently, the "Eco Peace" NGO had got the consent of "Pure Iron Plant" OJSC to implement the practical part of the courses there, as a model enterprise of the project.

The enterprise's management willingly agreed to carry out such a measure, attaching a special importance to the organization and implementation of the training courses. Before starting the training courses, Mrs. Kristine Sahakyan, the president of the "Eco Peace" NGO and at the same time the manager and responsible person of the project made a preliminary visit to the industrial enterprise together with the international experts.

Meetings were held with the enterprise's management and staff (chief technologist, environmental expert, heads of departments, etc.); a tour was made within the enterprise. It allowed the international experts to get acquainted with the industrial process and to better understand and perceive the direction of the training courses. The ammonium storage tanks and the tower for 9% ammonium hydroxide were selected as facilities for inspection.

Training courses

Mrs. K. Sahakyan, the project manager and responsible person opened the training session, welcoming all participants. She highlighted the importance of holding the event, which allowed making one step forward on the way of being integrated in the process of the reformations in the sector.

Specialists from the Ministry of Nature Protection and the Ministry of Emergency Situations, Aarhus Centre Yerevan office, as well as lecturers from the project Universities, i.e. from the State Engineering University of Armenia and Yerevan State University of Architecture and Construction, reading lectures on the below mentioned subjects, took part in the courses:

- Environmental protection-engineering,
- Bio-safety and environmental protection;
- Safety in case of emergency situations;
- Ecological expert examination;
- Environmental protection and efficient use of natural resources.

The list of participants and the Agenda of the meeting are provided in Appendix 3.

After representing the participants, Mrs. Kristine Sahakyan briefly represented the project. Afterwards, Mr. Platkowski (R+D Industrie Consult, Germany) and Ms. Tschiedel (LUGV Brandenburg, Germany) conducted the seminar. The first day of the training course was planned for introducing to the participants the methodology of check-lists, their technical direction and systemized and structural analysis.

Mr. Platkowski started his speech with information on various major industrial emergencies taken place in different times, such as, for example, emergencies in Sandoz, Kolin, etc. that made it more obvious what kind of effects can appear because of improper implementation of preventive and other necessary measures.

Ms. Tschiedel and Mr. Platkowski represented to the participants the packages of the existing check-lists. In particular, Mr. Platkowski addressed the following toics:

- Representation of the check-list methodology
- Dividing the factory into smaller units and assessment of potential risk

- Fire prevention
- Pipelines for transporting substances hazardous to water
- Loading and offloading units
- Real risk assessment method

Ms. Tschiedel addressed the following topics:

- Main idea of safety
- Storage units
- Flood protection
- Monitoring systems and decommissioning of units

It is to be noted that the presentation of individual packages of the check lists was accompanied with various questions raised by the participants, sound discussions and judgments, including legal, environmental, technical and various organizational questions.

At the end of the first day the participants were divided into two groups and received tasks in the form of corresponding exercises. As a result of group activities it became clear that the participants had fully comprehended the represented material, which was proved by the correct solutions provided for the tasks.

This approach found its practical application the next day in the "Pure Iron Plant" OJSC.

It is worth mentioning that these UBA check-lists allow determining the safety level of the plant or its individual units as a result of the inspection and assessment, based

on the presence of substances hazardous for water and land in the plant.

Summing up the first day activity of the training course, it can be stated that Mr. Platkowski and Ms. Tschiedel represented the most important items/links, which were needed for the next day visit to the plant to carry out the practical part of the training there.

The represented topics provided a lively discussion, and all the questions raised during the discussion were discussed and analyzed in detail.

Visit to the industrial plant

The theoretical knowledge of the participants was strengthened on the second day of the seminar through its practical application at Yerevan "Pure Iron Plant" OJSC, which is engaged in molybdenum concentrate processing and production of ferromolybdenum, molybdenum powder and molybdenum metal in the form of briquettes and molds.

First, all of the participants, accompanied by the plant staff, made a tour in the plant to better understand the production processes.

During production of pure molybdenum trioxide in the plant ammonium (in the form of 9% solution of ammonium hydroxide) is used. Ammonium is used also during reduction of ammonia metal powder and production of briquettes, in which case ammonium is dissociated in advance. Ammonium reserve in the plant amounts to maximum 40t and is stored in corresponding containers. It is transported to the production units by pipelines.

In case of discharge, liquid ammonium turns into gaseous state very promptly, thus creating a serious danger both for the staff and for the population in adjacent settlements. To minimize the risk of such a hazard, the ammonium storage tanks shall be equipped with sprinkling facilities for settling the possible gas cloud (this has been implemented in the plant). Actually, the possible hazard from ammonium is also transformed to the hazard for water and land; thus the application of the check-lists in this case is fully justified.

The participants applied the check lists in two groups, having the aim to determine the safety level of the two facilities selected for the study, i.e. for the ammonium storage tanks and the tower for ammonium hydroxide production.

Ammonium storage tanks served as a study facility in the plant for the ***first group***. In this stage of the study the

participants first analyzed and determined which one of the numerous check-list packages should be used for studying the given facility. The ones used in this stage were check-lists No. 1, 2, 3, 5, 6, 8, 13, 14).

After carrying out detail visual inspection in this facility under study the Armenian participants discussed the questions in the selected check lists package by package. The discussions were quite intense and included the details of almost all theoretical and practical questions. To clarify certain questions, the plant staff too (environmental specialist, safety specialist, chief technologist) willingly took part in the discussions.

As a result of the inspections implemented here, the participants proposed corresponding short-term, mid-term and long-term measures for improvement of the safety level. The proposed measures were:

- ***Lack of tightness of the floor at the transshipment site***

Short-term measures

- Conduct visual inspection after each transshipment process and repair the detected damages

Mid-term measures

- Cover with asphalt or bitumen the surface used to receive a consignment

Long-term measures

- Construct the sealing surface with material able to resist durably to mechanical stress caused by vehicles and other machines, such as: concrete, steel sheets, mastic asphalt

- ***Lack of containment and sealing system***

Short-term measures

- Staff training and daily inspection by the staff.

Long-term measures

- Installation of appropriate containment with leak detection device.

- ***Lack of pipeline labeling***

Short-term measures

- Labeling of pipelines in accordance with the applied rules.

➢ ***Lack of suitable containment facilities of adequate size for split-flow wastewater***

Mid-term measures

- Plan the sizes of the secondary containments based on the most unfavorable conditions, i.e. for receiving the highest wastewater flows.
- Equip the facilities with shut-off valves to prevent discharge of wastewater into the municipal sewerage system or surface water basins.
- Establish measures for containing, treating or disposing the accidentally contaminated split-flow wastewater as close as possible to the source of discharge.

Long-term measures

- Install automatic and continuously operating monitoring equipment to always prevent the accidental discharge of contaminated split-flow wastewater.
- Equip facilities for split-flow wastewater of a production plant with shut-off which can be operated with an automatic system.
- Build local wastewater treatment plant.

The tower for 9% ammonium hydroxide production served as a study facility in the plant for the ***second group***. The check-list packages *N* 1, 2, 3, 5, 10, 13, 14 were used for studying this facility.

As a result of the inspections implemented here, the second group participants proposed corresponding short-term, mid-term and long-term measures for improvement of the safety level. The proposed measures were:

➢ ***Lack of secondary containment and sealing system***

Short-term measures

- Staff training and daily inspection by the staff.

Long-term measures

- Installation of appropriate containment with leak detection device.

➢ ***Lack of overfill safety systems***

Short-term measures

- Perform filling operations with at least two staff present.

Mid-term measures

- Install overfilling protection devices.

- ***Corrosion of pipelines***

Short-term measures

- Staff training and daily inspection by the staff.

Mid-term measures

- Labeling of pipelines

- ***Lack of secondary containments as level meters under flexible pipes***

Short-term measures

- Staff training and daily inspection by the staff, installation of shut-off valve.

Mid-term measures

- Installation of other level metering device.

Long-term measures

- Installation of appropriate containment with leak detection device.

- ***Possibility of collision with pipelines***

Short-term measures

- Protect the pipelines against the danger of being bumped by means of big stones.

Mid-term measures

- Check the coating of pipelines.

Summary of the carried out activities

On the last day of the training course the representatives of the two groups presented all the works carried out by the participants during the practical training course at the plant. They presented in detail certain drawbacks revealed by them and the short-term, mid-term and long-term measures proposed by the groups for improving the safety level.

It is to be noted that both groups carried out and presented calculation for determination of the real risk for the facilities under study. They made the calculations basing on the report on the real risk quantitative assessment presented by Mr. Platkowski.

The method has been developed within the framework of UNDP-GEF funded pilot project on "Accident Emergency Warning System (AEWS) - oil processing plants" (Danube Regional

Project). At present, the risk can be determined only based upon thorough study and assessment of the industrial enterprise. The check-lists developed for that purpose represent an ideal tool for such a detailed analysis and assessment.

Application of this method allows easily checking and assessing various facilities from structural point of view, based on the international recommendations. At the same time, the method allows characterizing the current/real level of hazard the industrial plant poses.

After calculation of the RRP (real risk of the plant) for each individual facility in the two groups, on the last day of the seminar the WRISite (water risk index for plant parts) and the RRSite (real risk of the site) was determined for the studied sites, as a result of group activity.

- ***Ind. facility No. 1*** *(ammonium tanks)*

  EQ3= 4000 ARP= 5.2 RRP=4.3

- ***Ind. facility No. 2*** *(ammonium hydroxide tower)*

  EQ3= 2000 ARP= 11, 4 RRP=4, 4

The above values were then used for the determination of the WRISite and RRSite, with the resulting values of 4.66 and 5.02 accordingly.

This means that there is a need for improving the safety level at the studied site, since the risk is high in terms of emergency.

During the seminar, also the check list developed for oil processing plants was represented. Though it is of a special direction, its context is applicable for any industrial plant.

The represented methodology was highly appraised by the training course participants. They mentioned that the methodology was the best tool for structural and regular inspection of the industrial plants, as well as for determination of the hazard level. The participants expressed hope that in the future the application of the methodology will serve an input into the process of harmonization of the Armenian safety standards with those of European Union, meeting the national and international requirements.

The seminar ended with official handing over of certificates to the participants.

3.3. TRAINING COURSE FOR STUDENTS

3.3.1. THEORETICAL TRAINING

Within the framework of the project on "Assistance to raising knowledge on industrial safety at Universities" training courses for the students from 3 state universities of Armenia were organized and conducted. The goal of the training course was introducing the students the production processes, their possible ecological risks, production safety issues and national and European experience in this sector.

The courses consisted of the theoretical and practical parts: Total ten theoretical course sessions were organized, starting directly after the end of the academic year at the end of June 2012. It should be noted that students spent their summer holidays in active engagement in the academic process. Since mid-July the theoretical studies were accompanied by practical training conducted in various industrial enterprises. It allowed the students involved in the training to better understand the check list methodology and to apply it during their practice in the industrial enterprise (see more details on practical courses on page 22).

The training sessions were conducted by the lecturers from member universities, as well as by invited specialists (emergency specialist, environmental specialist, health specialist, public relations specialist). The invited experts represented professional topics not included in the curricula, or included with providing only provisional reference to them.

Four university professors from YSUAC and SEUA , who participated in the training course conducted by international experts from Germany in May, presented to the students the European experience in this field and check list methodology during the training course. In this stage of the project, in fact, the trained Armenian specialists shared their gained knowledge with the students of the participating universities.

The students' group consisted of 22 students from 3 universities. Those are:

- Yerevan State University of Architecture and Construction,

- State Engineering University of Armenia,
- Crisis Management State Academy of MES RA

Selection of the universities was done taking into account the availability of appropriate professional departments at the universities in terms of the project direction.

Besides, the fact that the universities organize regular visits to the dangerous facilities (for example chemical plants, hydraulic facilities, mines, etc.) for providing a fluent switch from educational process to production, and the practical production courses for the students are held at various industrial enterprises (chemical, mining, construction, etc.).

The students involved in the seminars are being specialized in the following professions:

- Environmental engineer (SEUA),
- Environmental expert examination (YSUAC),
- Environmental protection and rational use of natural resources (YSUAC, SEUA),
- Safety in emergency situations (YSUAC),
- Crisis management (CMSA).

Students were selected based on their performance.

It should be noted that the students willingly participated in all courses; they made sound discussions on the issues presented to them.

The theoretical courses addressed the following main topics:

1. **Emergency situations specialist**

K. Karapetyan - *RA MES Rescue Service, Head of the Department of Industrial Accidents, Radiation and Chemical Protection*

1.	Industrial accidents; their reasons and possible consequences. Emergency probability at dangerous industrial facilities. Elimination of emergency consequences.
2.	Legislative regulation of the sector. Order of providing information and warning in case of emergency.
3.	Need for increasing staff preparedness level and following the safety rules. Need for establishing mobile fire-fighting group of enterprise and its actions in case of emergency.
4.	Increasing public preparedness level and following the safety rules. Training exercises. Actions by LSGBs, enterprise staff, affected population in case of emergencies at dangerous industrial facility.

2. Environmental expert

H. Nikoghosyan -*"RA Institute of Mining and Smelting" CJSC, Head of Environmental Protection Department*

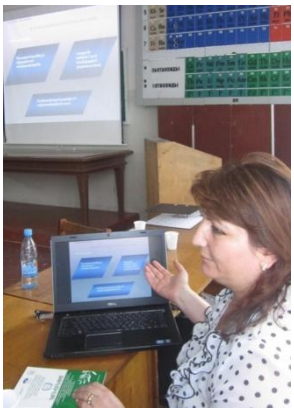
1.	Natural resource use and environmental protection problems. Possible environmental impacts caused by industrial accidents at different industrial enterprises.
2.	Impact of tailing dams on the environment and relevant environmental problems.
3.	Legislative regulation of the sector; actions and responsibilities of appropriate authorities.
4.	Need to conform to the environmental protection norms in industrial enterprises Inspections.

3. Health expert

S. Hovhannisyan - *State Hygiene and Anti-Epidemic Surveillance Inspectorate, RA Ministry of Health. Head of Department of Labor Hygiene and radiation safety*

1.	Safety and health protection of workers in the RA organizations; legislative regulation of the sectors.
2.	Factors of production environment. Classification and hygienic assessment of labor conditions. Labor safety.
3.	Impact of chemical, physical and biological pollutants on human health. Work load, stress and relevant health problems.
4.	Actions and responsibilities of the Republic agencies in case of emergency at industrial enterprise. First medical aid.

4. Public relations specialist



S. Ayvazyan - *Coordinator of Yerevan Aarhus Center*

1.	Provisions of Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters. Obligations of Armenia as a country that has ratified the Convention.
2.	"Protocol on Pollutant Release and Transfer Register"
3.	Need of "LSGBs-Enterprise-Public" relation and its strengthening in the process of environmental problem solution.
4.	Activity of Aarhus Centers in Armenia. Good examples of active civic struggle in Armenia: return of "Jrvezh" forest, "Gilan" protected area to "Khosrov forest state reserve"; results of initiatives related to "Trchkan waterfall" and "Mashtots park".

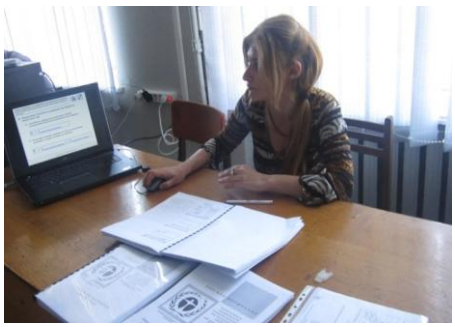
5. Project manager and responsible person

K. Sahakyan - *YSUAC, lecturer at Chair of Geoecology and Biosafety*

1.	Representation of the project; highlighting the role of future specialists in the sector
2.	Industrial accidents and their negative consequences. International experience in the field.
3.	Practical exercises by group, based on the check-list methodology.

6. Representation of the check-list methodology by trained Armenian trainers

- **A. Alexanyan** - *SEUA, Lecturer at the Department of Chemical Technologies and Environmental Engineering*
- **I. Avanesova** - *SEUA, Lecturer at the Department of Mining Engineering and Metallurgy*
- **M. Avagyan** - *YSUAC, Chair of Geoecology and Biosafety*
- **K. Sahakyan** - *YSUAC, Chair of Geoecology and Biosafety*



During the training course, the students were provided with all the necessary materials. Each of them was also provided with the draft Armenian translation of the whole package of the check-lists.

At the end of the course, all students received a certificate from the Eco Peace NGO implementing the project.

The list of participant students is provided in Appendix 4.

3.3.2. PRACTICAL TRAINING

To provide the practical part of the training program and to involve as many industrial enterprises as possible in the project, Eco Peace NGO implemented large-scale works for the organization and conduction of the practical training course for the students. To this end, preliminary agreements have been obtained, visits have been made and meetings have been held with a number of industrial enterprise's leaders. The agreements included also obtaining consent of the enterprises for applying check lists by students during their industrial practice.

As a result of the implemented organizational activity, the students had the opportunity to spend their industrial practice this year in 5 industrial enterprises. Those are:

1. "Alaverdi copper smelter factory", Lori marz (YSUAC, CSMA students)
2. "Lusakert biogas plant", Kotayk marz (YSUAC students)
3. "Akhtala" ore-dressing and processing enterprise, Lori marz (YSUAC, SEUA students)
4. "Zangezur Copper Molybdenum Combine", Syunik Marz (YSUAC, SEUA and CSMA students).
5. "Nairit Plant" CJSC, c. Yerevan (YSUAC, SEUA students)

During the practical training course the students got acquainted with the details of the activities implemented at these enterprises, made a tour inside the enterprises accompanied by appropriate specialists to get acquainted with the technological processes, equipment, safety and automation systems, as well as the necessary documentation on site. During the visit, the students had the opportunity to work by check-lists.

During the practical course the draft Armenian translation of the check-lists was given to the corresponding specialists (safety and environmental specialists) of all 5 industrial enterprises.

The student's visit to all of the industrial enterprises were made with accompany of Eco Peace NGO representatives. Kristine Sahakyan, the project manager and responsible person participated in the activities of students during several days in each of the industrial enterprises. The main purpose of the visits was to follow the course of the implemented works and provide instructions on the application of the check-lists.

The students represented the details of t he carried out work during the additionally organized meeting, which was supported by Yerevan Aarhus Center.

The event was held on September 26, 2012 at the Aarhus Centre premises in Yerevan. During the meeting the students presented the details of the visit to the industrial enterprises, the work done by them, the details of the checklists application and general impression on the whole implemented process.

The presentations made by the students were quite impressive, but it should be noted that the represented study results could not fully express the reality existing at the enterprises, since certain imitations were necessary during the studies, so that the students better understand the principle of checklist application.

Such an imitation was made, for example, in the "Nairit Plant" OJSC, at 4 different departments of which the practice of YSUAC and SEUA students was organized. The reason for that was the fact that the plant has not been operating for more than 2 years, and to allow the students applying not only 1 checklist on the company's short-term closure, but also various checklists by department, it was assumed that the departments were operating at that moment.

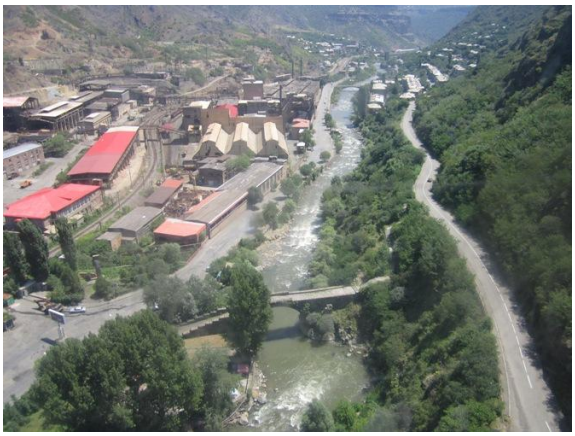
The students represented the carried out works during an additionally organized sum up meeting, supported by Yerevan Aarhus Center. The event was held on 26 September 2012 at Yerevan Aarhus Center office. During the meeting the students represented the details of the visits to the industrial enterprises, the works implemented by them, details of check-list applications and their general impressions of the whole process.

„Eco Peace" NGO and the students of the participating universities express their gratitude to all specialists running this process, the management of the enterprises and the appropriate staff for their support, warm reception and for organizing and conducting the practical course at due level.

Below details are provided on visits to the 5 industrial enterprises and the activities carried out there within the framework of the project.

3.3.2.1. ALAVERDI COPPER SMELTER FACTORY

General information

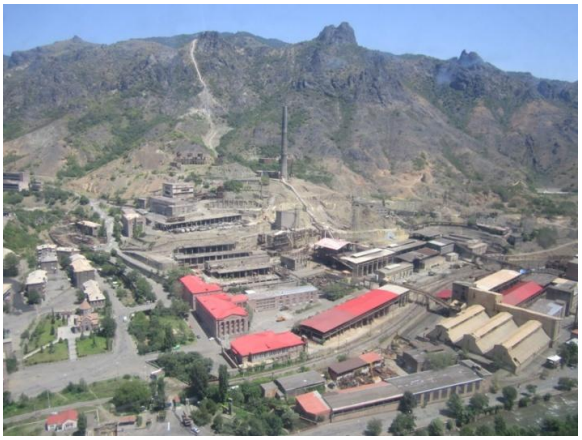


Alaverdi copper smelter factory is located in the northern part of Armenia, in the city of Alaverdi in Lori region, near the River Debed. The area has surface waters, number of water sources is relatively small, and ground waters are lacking.

The factory is located near Alaverdi-Yerevan main highway; it occupies 36 ha area and has one production area. Water intake for industrial purposes is made from the River Debed.

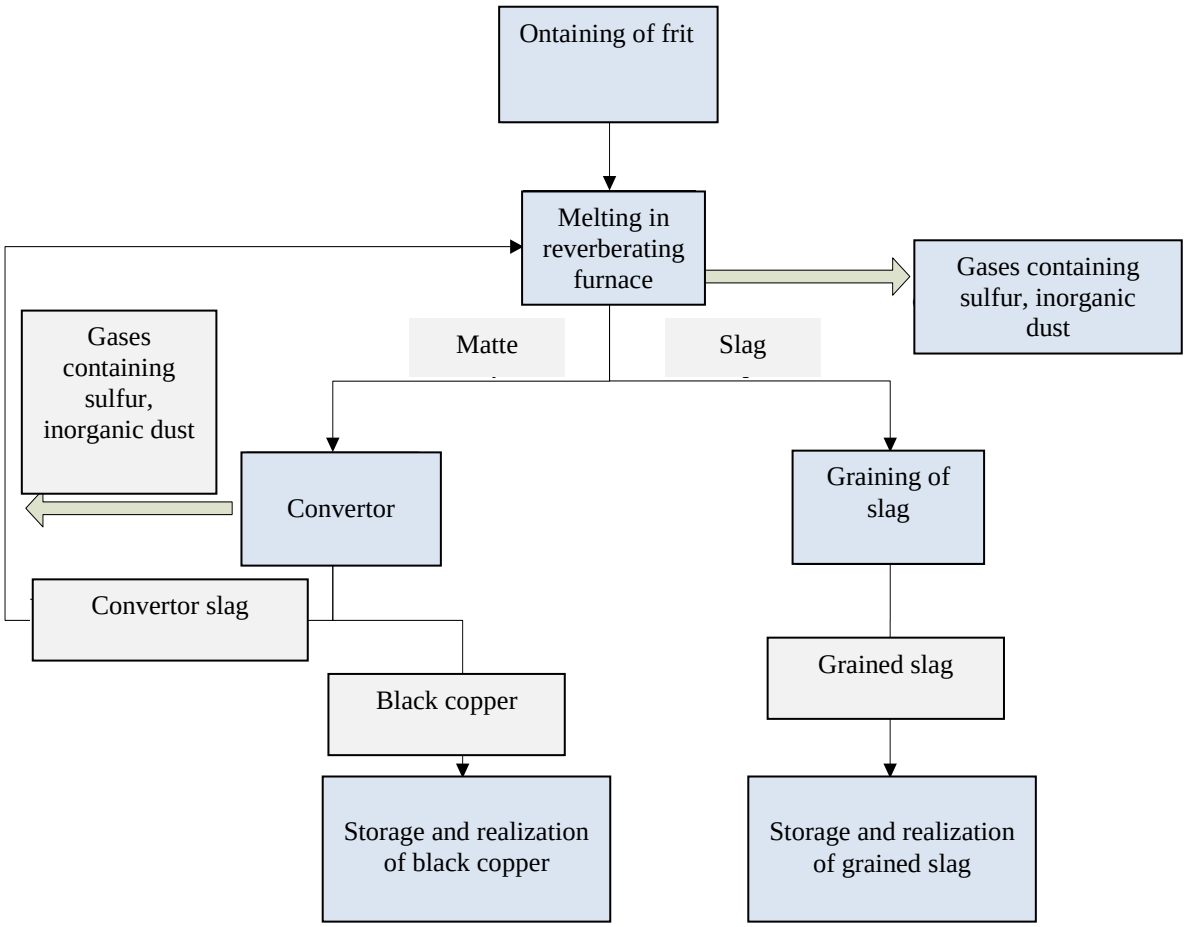
The main activity of the factory is production of black (non-distilled) copper from copper concentrates, through melting of the latter in reverberating furnace, reverberatory and its subsequent converting. As a result, black copper ingots are obtained weighing 750-850 kg. The plant's main workshop is the metallurgical production workshop. There are also auxiliary workshops, such as the ones for mechanical repair, construction repair, electric repair, water pump station, etc.

Alameda copper smelter factory currently produces about 10 thousand tons of black (non-distilled) copper annually. The ethnological scheme of copper concentrate processing is shown below.



In the left reverberating furnace, which is heated by natural gas, fusion occurs, which is a continuous process. Then, in the horizontal convertor copper matte converting takes place. The results of the concentrate melting are:

- **Copper matte**, which is regularly released from the furnace, is filled into plunge basin by gutter, moved and filled into the convertor.
- **Slag,** which is subject to graining by water and is removed to the slag basin. After settling it is withdrawn and stored for further realization.
- **Gases containing sulfur,** which are released to atmosphere through chimney.



Application of checklists in the enterprise

Students of SEUA, YSUAC and CSMA participated in the practical training course at the Alaverdi copper smelter factory. During the practical training the students worked by checklists. First of all they analyzed and determined that what checklists should be used for the study in the given enterprise. They oriented themselves by technological processes and the existing equipment. The questions in the used checklists were discussed package-by-package; for clarification, the corresponding experts of the enterprise helped and guided them.

The following packages were used during the study: 1, 3, 6, 8, 9, 10.

- Materials,
- Pipeline Safety,
- Split flows wastewater,
- Fire protection,
- Industrial plant monitoring,
- Production planning aimed at preventing accidents.

As a result of the studies the following drawbacks have been found:

- *Pipeline Safety - 10.07*
  - Pipes are not corrosion resistant, measurements of the wall thickness are not carried out, there is no labeling.

- *Split flows wastewater - 14.4*
  - Emergency discharge flows cannot be revealed in advance with the help of appropriate monitoring measures and they cannot be contained as close to the source of discharge as possible.
  - Suitable containment facilities of adequate size for accidentally contaminated split-flow wastewater are not provided.
  - There is no water recirculation system, which will exclude water discharge from the slag pond to the Debed River.

In this regard it should be noted that during our students' visit there was a technical problem with pump operation, because of which the water circulatory system was not operating; the factory in general operates with water circulatory system. However, the assessment was made based on the actual situation.

- *Fire Protection - 11*
  - Lack of regular staff training.
  - Lack of containers of sufficient sizes for storing fire protecting means.

- *Industrial plant control -1*
  - Lack of leak detection devices.
- *Production planning, aimed at preventing accidents -1.4*

In the measures restricting the emergency impacts the following have not been taken into consideration:

- warning time;
- definition of scenarios, such as the possibility of leakage, complete failure of containers, pipelines or other equipment;
- Meetings with local governments are not of regular nature.

As a result, average risk of each checklist and then their sum was determined 10, 07 +14.1 +11 +1 +1.4 = 37.87.

The average risk of the industrial enterprise was obtained by dividing this value on the quantity of the used checklists 37.87 / 6 = 6.3.

Then, using the corresponding formula, the size of the enterprise's real risk was determined, which in this case was 3.6.

RRP = 3,6 RRP-WRI = 0,7 (medium risk or medium safety level)

This means that the Alaverdi copper smelter factory has medium risk or medium safety level in terms of water resources pollution.

The students provided suggestions for short-term, mid-term or long-term measures for improvement.

- *Short-term measures*
  - Pipeline labeling by flow, transported materials and so on.
  - Regular training and retraining of personnel, updating of emergency scenarios.
  - Obtaining agreements for organizing regular meetings with local authorities.
- *Mid-term measures*
  - Water circulation system repair.
  - Leak detection equipment installation.
  - Pipe wall measurement by ultrasonic method.
- *Long-term measures*
  - Construction of basins for storage of emergency leaks.

According to the student's opinion, working by checklists was very interesting and effective, since they provided not only collection of the necessary information, but also gave the opportunity to acquire new knowledge on various production measures.

On the activities implemented at the industrial enterprise of Alaverdi cooper smelter factory a brief reportage was prepared and broadcasted by the local TV channel. The latter is available also on the internet, at the following address: www.youtube.com/watch?v=nXy5ozPcjj8&feature=plcp.

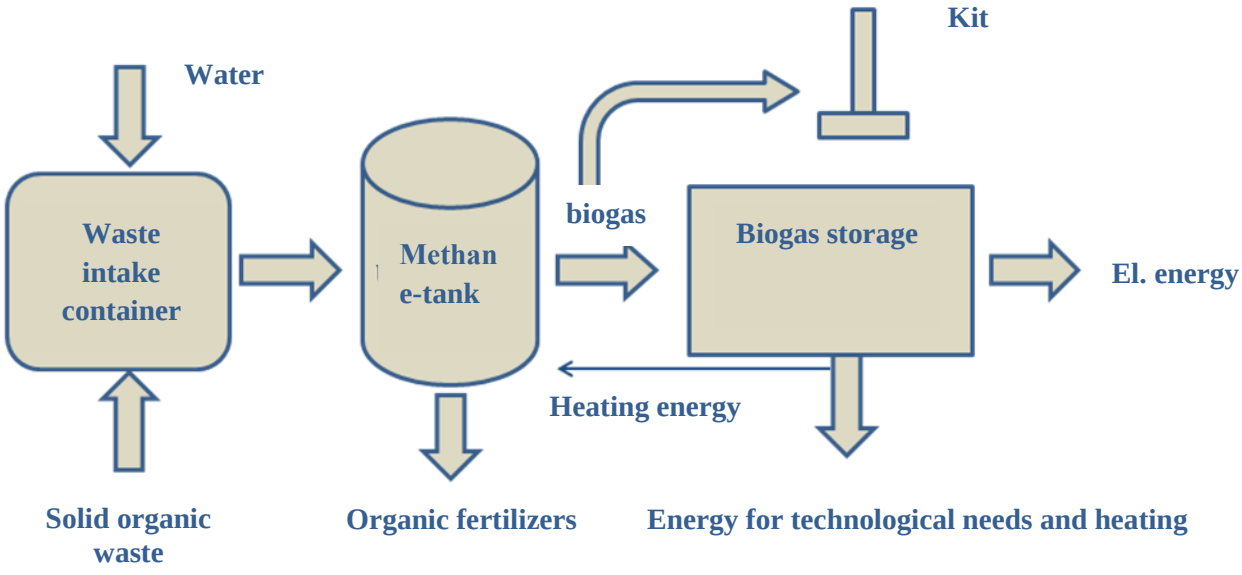
3.3.2.2. LUSAKERT BIOGAS PLANT

General information

Lusakert biogas plant (www.lpb.am) is located in the village Nor Geghi in Kotayk region of the RA and occupies 1 ha area. The plant was built in 2008 with support of Danish and Norwegian companies and is envisaged for the treatment of organic waste generated within Lusakert poultry farm. The plant's productivity by the treated organic waste is 250 m^3/day.

Currently, the treated of poultry waste is carried out in open pond system. The wastewater treated in primary ponds flow into the secondary ponds and after additional treatment there is discharged into Hrazdan-Yerevan sewerage collector.

The biogas manufacturing process has the following schematic picture.



The main volume, of 90% is water and 10% is raw material, is sent to the initial collector, where a homogeneous mass is made. Since there is a large number of grasses, feathers, egg picking, other parts of the chicken body, the liquid waste is pumped into the grinding pump, where grinding of large particles takes place.

Organic waste is pumped by pump container to heat exchanger, the purpose of which is heating the biomass. The latter is carried out in con-generator or boiler by heated water. It should be noted that providing constant temperature is very important for the generation of biogas. The poultry waste is heated by circulating water, and after heating process the conventionally clean water is returned to the boiler.

The water is used for industrial purposes in con-generator, boiler and heat exchanger.

The biomass is then moved to 5000 m^3 capacity fermentation reactor, which is continuously mixed from the top, to avoid settling. The reactor's volume is selected in a way, so as to ensure a 20-day period of waste storage.

The super fermented wastes are pumped to storages, from where they are moved to the open ponds. After settling and drying here, it is used as an organic fertilizer.

The clarified water is pumped into Hrazdan-Yerevan sewerage collector. Usage of super fermented wastes is possible also in liquid state.

In order to keep constant pressure a gasholder is applied, which is placed in a container. The gas is accumulated here, so that all consumers operate under constant pressure. When the gas quantity is high and it is no longer possible to use it for heating or poultry manure heating, the torch is turned on for surplus biogas combustion purposes.

It should be noted that according to the biogas plant design and the comparative characteristics of traditional ponds, operation of such a plant prevents about 60 thousand tones of CO_2 equivalent annual emissions to the atmosphere.

Students visit to the industrial enterprise

The students of YSUAC's Geoecology and Biosafety Department participated in the practical training course at the Lusakert Biogas Plant CJSC. It should be noted that the students of YSUAC were for the first time in this plant and it was possible to arrange their visit to the plant as a result of the preliminary agreements between the Eco Peace NGO and the company's management.

The students saw and got acquainted with the whole technological cycle of biogas production, equipment and the necessary documentation.

Although for production practical courses initially the only the students' visit to Lusakert biogas plant was planned, it was possible to arrange a visit also to the Lusakert Poultry Plant thanks to the efforts of the company's management (the biogas plant and the poultry factory are different enterprises) It allowed the students to better understand the whole process.

Accompanied by appropriate staff of the company, the students saw the following processes during their visit to the poultry factory:

- Transportation of eggs from incubators to the manufacturing department.
- Classifying by size,
- Eggs X-ray inspection,
- Eggs labeling,
- Poultry manure transportation.

The course included the details regarding the activities of the biogas plant. The students' group was very much interested in the full automation of the process. The company experts explained in detail the control process of all of the technological processes, the information mechanism in case of emergency situation or danger of emergency situation and the details of actions by the corresponding specialist.

Application of checklists in the enterprise

During the industrial practice, the students have worked by checklists. First of all they analyzed and determined which checklists should be used in the given enterprise from the many packages. They took decision based on the existing technological processes, equipment, and the visual inspections done by them. The students used the following check list packages here: 1, 2, 3, 5, 6, 7, 8, 9, 10, 13, 14.

The questions in the used checklists were discussed package-by-package; for clarification, the corresponding experts of the enterprise helped and guided them.

The relevant calculations showed a low level of dangerousness, which was expectable, since the company is a newly built one, corresponds to the European standards, there are no hazardous materials, only liquid poultry waste and its volume cannot be compared with powerful plants (such as "Nairit" plant or Kajaran copper plant).

However, the students provided some suggestions for improvement:

- *Short-term measures*
  - Update equipment's, pipeline's labeling in the places where there is a need for it.
  - Identify accident scenarios and their potential impacts.
  - Establish scope of the volume of control measures, their implementation deadlines and warning levels in case of emergency situations.
  - Agree the implementation of the monitoring measures with the local self-government bodies.
  - Improve the process of identifying fires by installation of additional fire detectors.

Summarizing the results of inspections, it should be noted that the operation of the plant was rather efficient and it turn solves environmental problems, such as:

- Reduction of greenhouse gas emissions
- Reduction of local soil and water pollution;
- Creation of a new field of renewable energy;
- Providing necessary organic fertilizer.

3.3.2.3. AKHTALA ORE-DRESSING AND PROCESSING ENTERPRISE

General Information

Akhtala ore-dressing and processing enterprise is located in the Lori region of the RA, at 9km distance from Akhtala station. The plant's productivity is annually 150 thousand tons according to the design.

During 1967-1988 Shamlugh copper ore was processed at the plant. At the same time the plant had a separate line for processing of Akhtala polymetallic ore.

Currently, the plant is recycling the Shamlugh copper ore, which is brought from underground mine to the pant by carriages or is unloaded at the warehouse near the adit exit, from where it is transported by trucks. It is transported by trucks also from the open mines. The copper content in the ore varies in a range of 0,8-1,8%, and 20-25% in the concentrate.

In recent years in the vicinity of the Shamlugh copper ore processing unit a new production line has been put into operation, thanks to which as a result of joint operation of the processing units it became possible to process both copper and polymetallic ores.

In case of parallel operation of the 2 lines, two times more copper ore is processed, and in case of subsequent operation - polymetallic ore.

The plant has the following workshops:

- grinding workshop;
- main workshop;
- dewatering workshop;
- tailings dump.

The main workshop consists of grinding, flotation and reagent sites.

The ore is unloaded in the general bunker of the plant, on which the jigger is installed. By means of laminar supplier the small pieces are moved first to the jaw and then to conical grinders, where they are grinded and stored in 2 bunkers by means of ribbon conveyer.

The ore grinding is done by two stages. The classification of the grinded ore is also done in two stages, first in classifiers and then in hydrocyclone.

The ore dressing is done by flotation, in mechanical flotators with application of appropriate reagents. The reagent amounts are regulated by automatic dosing devices.

In the reagents room hermetically closed containers are placed with xanthate solution, as well as lime silos.

The entire production process can be generally presented in the following way: the raw material comes from the mine to the plant, it is grinded, filled into mills, mixed with water and exposed to flotation, i.e. ore dressing. This is done by means of certain chemicals, i.e. reagents, which provide the necessary medium.

The following table provides the description of the reagents used in the plant and the level of their danger, according to the catalog developed in Germany. Almost all reagents have low level of hazard for water.

Table 2. ***Characteristics of the applied flotation reagents***

Material	Purpose	Packing	Specific consumption	Measurement unit	WGK – hazard class for water
Lime (CaO)	medium regulator	paper sacks or cylinders 40-50 kg	9.0	kg/t	1
Butyl xanthane	oil-wetting agent	metal drums 70-80 kg	0.011	g/t	1
Pine oil (oxal T-80)	foamer	cylinder	0.035	g/t	1
Chloride lime $Ca(OCl)_2$	antiseptic	paper sacks 40-50 kg	5	mg/m^3	2

Flotation is provided, so that the copper particles bubble up to the top with foam and the mining waste goes to the tailings dump. Thanks to the automated dosing devices for reagents all the established standards are met and as a result, the extraction is 93-94%. After dewatering 10% moisture is provided, which allows for the transportation process to be more convenient.

The tailings are moved by gravity to the tailings dam and stored there.

The plant has 3 tailings dams:

- The tailings dam located at 0.5km from the plant in Nazik river bed, which is conserved
- The tailings dam located in the gorge of explosives, which is conserved.
- The tailings dam located at 6.5km from the plant in Nahatak river bed, which is conserved



It is located in the village of Mets Ayrum and was launched in 1978. For the future operation of the tailings dam 20 m long embankment was built and it was raised 7 m. It is almost 1.5 years since it has started to operate and it is expected to operate for another 15 years. About 4,000 tons of waste is discharged there daily. This tailings dam has a full water recycling system, which allows returning the used water to the production process.

The liquid phase of the tailings, which includes a number of resolved ions, is fully returned to the technological process after clarification. Water loss from the tailings dam occurs only at the expense of natural evaporation from the surface of the tailings dam's lake. The enterprise operates with a full recycling system, which excludes industrial wastewater leakage to open basins.

The environmental impact of the plant is controlled by the monitoring center. In the chemical laboratory physicochemical analysis of water samples, determination of the content of copper in concentrate, is implemented, which is carried out also for tailings, with testing of samples from every batch.

Application of checklists in the enterprise

Ten students of YSUAC and SEUA participated in the practical training course at the Akhtala ore-dressing and processing enterprise. During the industrial practice, the students have worked by checklists. First of all they analyzed and determined which checklists should be used in the given enterprise from the many packages. They took decision based on the existing technological processes, equipment, and the visual inspections done by them. The students used the following check list packages here: 1, 2, 3, 5, 6, 8, 9, 10, 13, 14.

The questions in the used checklists were discussed package-by-package; for clarification, the corresponding experts of the enterprise helped and guided them.

As a result of the studies the following drawbacks have been found:

- The pipelines are covered with anticorrosive material, but in some parts they are damaged and need recovery. Labeling is missing on the pipelines.

- There are no data on possible unallowable static weakening caused by corrosion.
- There are no rain water collection and treatment systems. The rain water is discharged from the production chutes to Debed.
- Tanks/containers do not have secondary containers planned for storage of possible spills.
- There is not an alarm systems, acoustic, indicator, planned for fast and reliable identification of the possible fires.

As a result of the works carried out based on the checklists, the students assessed the level of the enterprise's emergency hazard, according to which it was ranked to medium risk enterprises.

ARP = 9,56 RRP = 3,96 WRI = 3,2 RRP-WRI = 0,76 (medium)

In order to improve the safety level the participants offered short-term, mid-term and long-term measures.

- *Short-term measures*
  - Processing of selected sites of pipeline with anticorrosive materials.
  - Measurement of pipe walls' thickness by ultrasonic method.
  - Estimated assessment of the possibility of static weakening of pipelines based on the results of corrosion wear rate measurements.
  - Pipeline labeling by flow, transported materials and so on.
- *Mid-term measures*
  - Installation of appropriate fire alarm devices, lighting, acoustic, with correct selection of the place of their location, in order to detect them quickly.
- *Long-term measures*
  - Construction of basins for rain and emergency water storage.
  - Upgrading tanks in accordance with the size of the secondary containers, which will ensure that the leaks are kept as close to the source as it is possible.

3.3.2.4. ZANGEZUR COPPER MOLYBDENUM COMBINE

General Information

"Zangezur Copper and Molybdenum Combine" CJSC (ZCMC) is one of the major enterprises of Armenia and is a leader in mining sector (www.zcmc.am). The combine is located at the border of Kajaran city in Syuniq marz of Armenia, on the left bank of upstream Voghji River. Distance from Yerevan, the capital of Armenia is around 350 km.

The main water artery of the region is the river Vokhchi with its permanent and temporary tributaries. The Voghji River basin is flood prone.

The topography of the Kajaran area is high relief, with mountains up to nearly 4,000m elevation in close proximity to the mine. The actual open pit operates at an elevation of between 1,890 to 2,130m.

The fact that the reserves are located in the given mountainous are at gives natural advantages to the mine, such as homogeneous layering where usually it is possible to distinguish the re and ore waste from their appearance.

The Company mines and processes a mine with significant approved and forecasted molybdenum and copper resources, producing annually 16 million tons of ore.

The largest in the region open pit mine extracts copper and molybdenum rich ore which is then processed to produce two separate concentrates, for afterwards processing in Armenia and other countries.

As an industry leader, the combine demonstrate proven expertise in both technology and production methods, which consist of open-pit mining, and in-plant ore processing. The operations also comprise waste dumps, associated mine infrastructure and tailings.

The mine benefits from natural advantages, such as the geographical location of the deposit on a mountain side, large homogenous ore zones with generally visually recognizable ore and waste.

The mine utilizes drill and blast techniques to mine the ore and wastes, followed by a truck and shovel operation with ore sent either via in-pit ore pass and rail haulage to the primary crusher.

The plant consists of the following main departments:

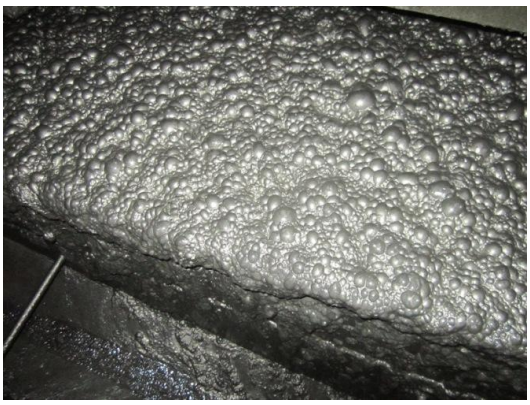
- Crushing department.
- Grinding department.
- Self-grinding department.
- Flotation department.
- Tailings dam.

After coarse grinding of up to 400mm, a part of the ore enters medium and fine grinding sites, and the other part - into self-grinding site. Ore crushing is implemented by three stages: 1 stage of medium crushing and two stages of fine crushing. Before the first fine grinding stage the ore passes a preliminary sieving, and after the second crushing - control sieving.

Waste is trucked to a remote waste dump.

The processing plant utilizes the conventional processes of crushing, grinding and froth flotation to produce separate concentrates of copper and molybdenum.

The flotation flow sheet involves the bulk flotation of copper and molybdenum minerals followed by depression of copper minerals and the flotation, with multi stage cleaning, of molybdenum.



The plant is current treating ore at a rate of 16.0 metric tons per annum. The increase from 12.8 throughout to 16.0 metric tons per annum was possible through the installation of an additional grinding line consisting of large diameter SAG and ball mill.

The flotation capacity of the ZCMC plant was replaced between 2005 and 2009 with the replacement of old, small flotation cells with larger volume pneumatic cells. The new cells operate with low pressure air and have automatic level controls.

The reagent preparation and dosing site is located in the main building. Depending on the reagent expenditure, modern dosing pumps were installed. The precise dosing allows avoiding reagent over-expenditure and reducing their residual concentrations in the industrial wastewater.

The characteristics of the used reagents are provided in Table 3.

The copper and molybdenum concentrates are dewatered in two separate plants. The quality control is ensured by the operations of up-to date equipped laboratories dealing with ore samples and flotation analysis, as well as with various research issues.

The plants tailings gravitate through a series of pipes and channels to the Artsvanik TMF facility at 35km distance.

Table 3. ***Characteristics of the used flotation reagents***

Material	Purpose	Aggregative state	WGK - hazard class for water
Lime (CaO)	medium regulator	10% solution in the form of lime milk	1
Butyl xanthane	collector	5% solution	1
Na_2S	regulator, depressor depending on consumption	9% solution	2
Na_2SiO_3 Natrium metasilicate	transformer depressor	5% solution	1
Na_2CO_3 calcic soda	medium regulator	5% solution	1
transformer oil (T-92)	foamer	-	2
Diesel fuel, oil	oil-wetting	-	2

The pit benefits from low groundwater inflow, which means that only water from precipitation and surrounding creeks and rivers requires draining from the pit. As a result, the requirement for dewatering equipment is minimal. Currently the pit is being successfully dewatered by means of the existing drainage system, consisting of hillside ditches, underground concrete channels and pipelines.

During more than 50 years of operation of the combine the tailings were stored in four river-type tailing dams, which are located in the Darazam, Pkhrout, Vokhchi and Artsvanik River gorges. The first three tailing dams were sequentially operated until 1977, after which they were closed down and fully recultivated. The tailing dams are located at 1400-1700m altitudes above the sea level and at 5-7km distance from Kajaran ore processing plant. In 1977 the Artsvanik tailing dam was launched. The latter has been operated to date.

This tailing dam constructed in the Artsvanik River gorge is of slurry fill type. Slurry filling is made by zenith technique. The distributing tailings pipeline is a 720mm steel pipeline, which has zenith gaps every 11-12m.

In the area of the operating tailing dam no shrinkages, collapses, karst formations and landslides have been revealed.

The tailings are transported to Artsvanik tailing dam through the existing 34,5km long tailings pipeline. The pipeline consists of two lines, one of them being operational and the other one spare. In the tunnel passages the tailings pipeline is a monolithic reinforced concrete canal and in open areas it is a precast canal. The sizes

of the canals are 70 x 100 cm; the floor is covered by stone mold tiles and the walls by slag tiles. In open areas the canals are covered by reinforced concrete slabs

Currently the combine has 3500 employees, not taken into account the 12 industrial enterprises serving the combine.

Being a part of German CRONIMET group of companies allows ZCMC successfully utilize experience and expert knowledge with reliability, competence and global partnership.

Students visit to the industrial enterprise

Ten students of YSUAC, CMSA and SEUA Department of Mining Engineering and Metallurgy participated in the practical training course at the "Zangezur Copper Molybdenum Combine". It is to be mentioned that YSUAC, CMSA students were in this combine for the first time. It was possible to organize their visit to the combine thanks to the preliminary agreements and visits made by Eco Peace NGO to the combine.

The students visited all workshops and sites of the combine and got acquainted with the production processes and equipment.

To better understand the whole production process, the students accompanied by the combine staff started their tour from the visit to the mine where they got acquainted with drill and blast techniques and transportation of the ore.

They were at the site of coarse grinding and studied all stages of ore grinding. They were particularly interested in the ball mill.

The visit was continued to the next technological stage at the new self-grinding site. After, at the main building of the combine the corresponding specialists explained the flotation process and the reagents applied in the combine.

The students got acquainted also with the automation system operation. The details on the corresponding actions of the staff in case of emergency danger or situation at any technological stage were explained to the students.

The students visited also the molybdenum and copper concentrates dewatering and separation sites and saw the process of the final product storage.

A separate visit to the combine laboratory was made where the students' group got acquainted with the principle of laboratory equipment operation and was present during some laboratory tests implemented there.



One training day was planned for the visit to Artsvanik tailing dam located at 35km distance from the combine. Before reaching the tailing dam, the students regularly stopped at the sites where it was possible to approach the tailing dam as close as possible. Accompanied by the combine staff, the group approached the tailing dam in several directions, viewing the process starting from the filling of the tailings and ending with gradual clarification of water.

It is to be noted that Artsvanik tailing dam is ranked to the biggest tailing dams in the world.

Application of checklists in the enterprise

During the industrial practice, the students have worked by checklists. First of all they analyzed and determined which checklists should be used in the given enterprise from the many packages. They took decision based on the existing technological processes, equipment, and the visual inspections done by them. The students used the following check list packages here: 1, 2, 3, 5, 6, 7, 8, 9, 10, 13, 14. The questions in the used checklists were discussed package-by-package; for clarification, the corresponding experts of the enterprise (environmental specialist, safety specialist, heads of departments, etc.) helped and guided them.

As a result of the inspections made here, the students assessed the safety level of the main department in terms of water resources pollution. Taking into account the applied reagents, as a result of the calculations, they obtained medium risk level.



The students identified the following drawbacks.

- During the containers filing process in some of tanks the direct observing of the liquid level is not guaranteed; there are no observation glasses, protection of the existing observation glasses is not guaranteed.
- Pipelines have damaged sites; there is a need to update their treating with anticorrosive materials, there is no labeling.
- There are no descriptions of industrial accident scenarios and assessment of consequences of the impacts of hazardous substances discharged into surface waters because of emergency (by spreading time and space).
- Meetings with local authorities and the training for personnel are not of regular nature.
- Warning and hazard prevention plans are not agreed with the local self-governance bodies.

On the basis of the identified drawbacks the risk was assessed. The main production department of the plant had medium risk level.

Σ ARC	**4,44**
WRI 3 equivalent	10500
RRP	4,65
WRI	4
RRP-WRI	0,65 (medium risk)
ARP	4,44

The students proposed short-term, mid-term and long-term measures for improvement.

➢ *Short-term measures*

- Guarantee observation of liquid level in tanks during the filing process.
- Label the containers by the manufacturer's label.
- Replace the pipeline's damaged parts, develop them with anticorrosive materials.
- Renovate the damaged parts of the existing containers.

➢ *Medium-term measures*

- Provide protection of observation glasses, for example by installation of bars.
- Install reliable device preventing over filling (automatic lockable filler or filling devices regulated by weight).
- Provide the devices with over pressure or under pressure risk with ventilation devices.
- Make the meetings with local government bodies regular; agree with them the emergency scenarios, warning details and risk prevention plans.

➢ *Long-term measures*

- Develop scenarios of industrial accidents including assessment of consequences of the impacts of hazardous substances discharged into surface waters because of emergency (by spreading time and space).

It should be noted that being a part of the group of companies of German CRONIMET, Zangezour plant is trying to use the world experience and knowledge, which is included also in the plant's long-term plans.

- Organizational and technical re-equipment of the enterprise;
- Introduction of modern technologies,

3.3.2.5. NAIRIT PLANT CJSC

General Information

The "Nairit Plant" CJSC is located in Yerevan city's south-western industrial area, at 925-946 m above sea level.

The plant is located in the industrial zone of the city and the nearby industrial facilities are: tire, cables, polyvinylacetate production plants, which currently do not operate.

The area of the main industrial site of the plant is 90 ha. The plant consists of 24 primary and several auxiliary workshops.

The sanitary zone covers an area with 1000 m radius, which is 300 ha. There are not residential missives in the area.

The "Nairit" plant is one of the largest chemical companies not only in Armenia, but in other CIS and Eastern European countries and once it was the main manufacturer and supplier of chloroprene rubber, latex, caustic alkali.

The plant's industrial sites producing and storing the most dangerous substances are chlorine production and storage, as well as liquid ammonia intake and storage areas.

These hazardous manufacturing areas are located in the favorable direction of the winds rose. The seismic resistance of the structures after the new seismic assessment was ranked to 9-9.5.

The monitoring of safe operation of the production at Nairit plant is implemented by the staff, engineering technical employees, as well as professional services. Besides, state monitoring is implemented at the plant. The analysis of production accidents, emergencies at the plant, development of measures and recording is implemented according to the established order. The staff instruction, knowledge testing, as well as organization of training classes is carried out in accordance with the applicable laws, ru les and regulations. During the accidents the staff acts in accordance with the accidents elimination plan (the Regulations) of the given department; the training on the knowledge of the plans is approved by schedule.

Application of the checklists in the enterprise

YSUAC students participated in the practical training at Nairit Plant CJSC, within the framework of which they had the opportunity to apply the checklist methodology at the following production departments of the plant:

- Liquid waste combustion department designed for combustion of the liquid waste generated from production of synthetic rubber, acetic acid and chloroprene. It was put into operation in 1980.
- Liquid chlorine manufacturing and storage department.
- Wastewater treatment department, which is intended for treatment of wastewater generated from the production of chloroprene rubber.
- Cooling department, where ammonia is used for this purpose.

The selection of departments was carried out jointly with Mr. Sargsyan, the Head of Environmental Department of the plant, taking into account the purpose of the checklists, application of which allowed the students to check the implementation of the safety requirements and measures.

Initially, the students used only 1 checklist, i.e. temporary closure of enterprises, because the plant is about 2 years that has not operating. However, since application of only 1 checklist was not sufficient to understand the methodology, imitation was done that the plant was operational and in all 4 workshops the work with checklists was carried out based on that principle.

This allowed to use many checklists for studying the functional nodes.

First of all the hazardous materials and the level of their hazard for water was identified.

Substances	WGK – class of hazard for water
NaCl	1
NaOH	1
H_2SO_4	1
HCl	1
Cl_2	2
NH_3	3

The students used the following checklists in the above departments:

1. Materials
2. Overfill safety systems
3. Pipeline safety
4. Combined storage
6. Split flows wastewater
7. Transshipment
8. Fire Protection Strategy
13. Storage
14. Equipment of tanks

The students found the following disadvantages.

There was no pipe labeling, as well as evidence on the wall deterioration caused by corrosion.

- Tanks were not labeled with manufacturer's label.
- Drainage system was not appropriate for accepting substances with the risk of causing fires or explosions.
- Rapid detection of potential leaks of hazardous materials was not possible; ensuring their keeping as close to the discharge source as possible was impossible; there were no secondary containers.

As improvement measures the students provided short-term, mid-term and long-term measures.

➢ *Short-term measures*

- Pipeline labeling according to existing rules, taking into account the physic-chemical properties of materials and flow direction.
- Labeling of tanks by the material and working conditions.

➢ *Mid-term measures*

- Pipe wall thickness measurement in the selected parts, by ultrasonic method.
- Estimated assessment of the possibility of static weakening of pipelines based on the results of corrosion wear rate measurements.
- Repair of the existing intake containers, planning their sizes by the most favorable conditions, i.e. the largest possible wastewater flow.

- *Long-term measures*
  - Construction of new secondary containers for preventing release of substances caused by leakage, overfilling or emergencies, which will ensure that the substances hazardous in terms of fires and explosions do not enter the sewer system.

It should be noted that the practical training with application of checklists at Nairit plant aroused a great interest not only among the participating students, but also among the other SEUA students that performed their practices at the plant. They too took part in these activities, even though they did not have direct participation in the theoretical classes.

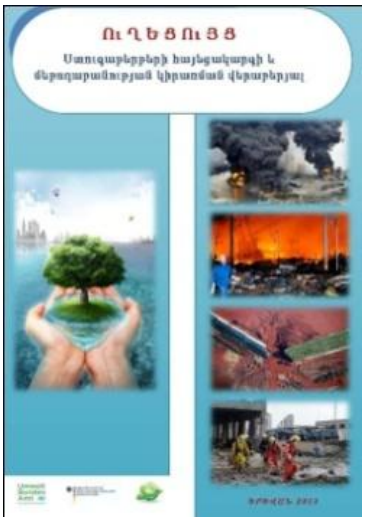
4. ARMENIAN VERSION OF THE CHECKLIST METHODOLOGY

4.1. CHECKLIST'S STRUCTURE AND CONTENT

The whole package of the checklists has been translated into Armenian. The package includes 18 separate packages on a variety of industrial processes and functional nodes, instructions on appropriate actions and application of the checklists. Armenian translation of the methodology was used by the students during the educational-industrial practical courses carried out in industrial enterprises. During the translation both the English, German and Russian versions of the checklists packages were used. It should be noted that in the Russian and English versions there are some differences in some of the questions. In that event the German version of the checklists served as a basis.

After the translation the appropriate specialists (environmental, emergency, health, public relations experts) made corrections and additions to harmonize them to the conditions of Armenia. As a result 2 books were prepared and published in Armenian, which together make the entire set of the Armenian version of the methodology.

The books have the following contents.



- **BOOK 1** - Guideline on the concept and application of the methodology of checklists, which in turn consists of 3 sections:
  - General information on the Recommendations of the International River Basin commissions;
  - Instructions on the application of the checklist methodology, including quantitative assessment of the safety level;
  - Useful information, which includes information on fire safety, collective and individual protective measures by the operating staff, other safety measures and first medical aid.
- **BOOK 2** - Armenian version of the checklists package on surveying and assessing industrial plant handling materials and substances which are hazardous to water, consisting of 18 separate packages on various production processes and functional nodes. These packages are:
  1. Materials
  2. Overfill safety devices
  3. Split-flow wastewater
  4. Joint storage
  5. Sealing systems
  6. Split-flow wastewater

7. Transshipment of substances hazardous to water
8. Fire prevention strategy
9. Industrial plants monitoring
10. Internal alarm - and Hazard control planning
11. Industrial Plant in Areas with a Risk of Flooding
12. Basic structure of Safety Reports concerning hazards to water
13. Storage
14. Equipment of tanks
15. Temporary closure of enterprises
16. Long-term closure of enterprises
17. Oil processing industrial plants Part 1: Safety Management System
18. Oil processing industrial plants Part 2: Requirements to the Structure and Equipment of Industrial Plants

The whole checklist package in 2 books was printed out in color publication in 150 copies. Besides, 150 copies of the CD were prepared as well. The books and CDs were disseminated among all stakeholders.
The published books and the prepared CD are attached to this report.

4.2. OPINIONS ON THE CHECKLIST METHODOLOGY

The most part of the printed books and CDs were disseminated among the stakeholders before the final meeting, and some part of them during the final meeting.

The checklist packages were provided to the following parties:

- Ministry of Nature Protection
- Ministry of Emergency Situations
- Ministry of Education and Science
- Ministry of Health
- Yerevan State University of Architecture and Construction
- State Engineering University of Armenia
- State Academy of Crisis Management under the MES
- Industrial enterprises
- International organizations
- Aarhus Centers' Network (1 central and 14 regional centers)
- Regional Environmental Centre for the Caucasus (REC Caucasus).

The universities and industrial enterprises sent also official letters to the Eco Peace NGO on the methodology. Below the most remarkable passages in the letters are provided.

MINISTRIES

- **RA Ministry of Nature Protection** *(issued on 26.03.2013, signed by the Head of the State Environmental Inspectorate A. Avagyan)*

The letter states that in its activities the Inspectorate carries out the RA Government's decision No. 1562-N as of 22.11.2012 on "Approval of the general description of the risk-based monitoring methodology and the criteria determining the risk level by the RA MNP State Environmental Inspectorate" and the checklists corresponding to the requirements arising out of this decision. Thus the represented methodology shall be compared with the adopted checklists.

UNIVERSITIES

- **YSUAC**

A copy of the minutes of the session No. 6 of February 22, 2013 at Geoecology and biosafety department was provided, which in particular noted that during the session it was decided to include the checklist methodology into the curricula of "Environmental protection and the Safety in case of emergencies "professions during practical and thesis work (education-production practice).

Attached to the Minutes also the opinions given by the lecturers of the department were submitted, where they mentioned the following:

- Such a methodology can be taken into account in the reformation process of inspections in Armenia.
- It is applicable to educational purposes, as it allows for having compact information on production enterprises and assess the level of emergency hazard.
- It is a measure for prompt and objective assessment of safety measures implemented in the industrial enterprises, as well as for introducing measures increasing the safety level.

- **SEUA** *(the letter was received on 12.03.2013, signed by the Chair of the department A. Hovhannisyan)*

Department of Mining Engineering and Metallurgy expressed its commitment to apply the checklists methodology for the students of "Environmental protection and efficient use of natural resources" profession. It is mentioned that the methodology enables the use of innovative approaches to the detection of needs at production enterprises and it is desirable that such a checklist is developed also for the mining sector enterprises, especially tailing dams.

- **CMSA of MES RA** *(issued on 26.02.2013, signed by the Rector H. Mathevosian)*

The management of the university expresses its readiness to apply the checklists methodology for its students (especially for those specializing in crisis management) during the industrial practice. It was noted that it would allow raising awareness and level of readiness of future professionals in emergency situations prevention.

INDUSTRIAL ENTERPRISES

- **Alaverdi copper smelter factory** *(issued on 28.02.2013, signed by the Director of the Armenian Copper Program CJSC G. Arzumanyan)*

Highlighting the importance of implementation of projects aimed at environmental, in particular water resources protection, as well as the positive role of the checklists in preventing accidents in the production process, the company's management expressed its willingness to apply the checklists in organization works for production processes.

- **Lusakert Biogas Plant CJSC** *(issued on 28.02.2013, signed by the Director of Lusakert Biogas Plant CJSC A. Manukyan)*

The company's management noted that the general idea of the methodology is interesting and innovative. The management expressed his interest in and readiness to their practical application, since such an approach would allow ensuring purposeful work and continuous improvement in the production safety sector.

- **Akhtala Ore-dressing and Processing Enterprise CJSC** *(issued on 18.03.2013, signed by the Director of the Enterprise M. Tashjyan)*

The company's management noted that the checklists can occupy a significant place in the industrial enterprises' operation process, raising the level of efficiency of the audits and providing innovative practices in Armenia.

- **Zangezur Copper Molybdenum Combine** *(issued on 22.03.2013, signed by the ZCMC technical director A. Margaryan)*

The plant's management welcomed the activities in industrial safety sector and expressed its willingness for application of the methodology, noting that its application for more correct implementation, control and monitoring of the processes in the enterprise will increase the effectiveness of the implemented measures.

- **Nairit plant CJSC** *(issued on 05.03.2013, signed by the General Director H. Hakhinyan)*

The plant's management welcomed the experience of German Federation in the field of environmental protection and the introduction of the experience in the educational institutions. It was noted that the project found its practical application in the Nairit plant CJSC. The restoration and renovation works for the existing secondary containers were included in the company's reconstruction and development plans.

Attached are the copies of the letters (Appendix 5).

5. PROJECT FINAL WORKSHOP

5.1. GENERAL INFORMATION

The project final workshop took place on 26 March 2013 in Yerevan. The meeting was devoted to the discussion of the activities implemented under the project, future processes and possible cooperation in the sector.

The meeting was attended by representatives from Ministries of Nature Protection, Emergency Situations, Health, Education and Science RA, Universities (YSUAC, SEUA, CSMA), representatives from international (UNDP, UNICEF, OSCE, Armenian Red Cross Society, Aarhus Centre - including their regional branches, Armenian caritas) and non-governmental organizations, specialists from industrial enterprises (Alaverdi cooper smelter factory, Akhtala ore-dressing enterprise, Zangezur copper Molybdenum combine, Lusakert biogas station, "Nairit Plant" CJSC and etc.).

Students of State Engineering University of Armenia, Yerevan State University of Architecture and Construction, Crisis Management State Academy of MES RA made speeches at the meeting, presenting their activities within the framework of the project, in particular:

- details of theoretical courses held within the scope of the project and specifics of application of the checklist methodology,
- Practical training courses in Alaverdi copper smelter plant, details and results of the studies carried out in the plant,
- YSUAC students' training and production practice in Lusakert biogas station,
- Students' practice in Akhtala ore mining and processing enterprise, inspections conducted by the students with application of checklists,
- Activities implemented by students in Zangezour copper molybdenum plant,
- Practice and -industrial processes with application of checklists in Nairit plant.

The participants highly appreciated the results of the studies carried out by students and the proposals made by them for improvement measures by each plant. The activities implemented by the students and their presented speeches allow us to state that the checklist methodology adopted in a number of European countries has been well understood also by Armenian thanks to the theoretical and practical training courses carried out within the framework of the project. The future specialists also expressed their interest and willingness to further use the checklist methodology.

Along with the Armenian party, also representatives of technical universities of 8 UNECE countries (experts, specialists with lecture reading experience in different technical universities in Czech, Romania, Moldova, Russia, Ukraine, Belarus, Uzbekistan, Tajikistan.) attended the meeting, making speeches on educational processes in industrial safety sectors in their countries.

The meeting participants discussed the possibilities of further processes and cooperation in this area, recommendations and conclusions on the efficiency of transfer of information between the universities in UNECE countries.

The agenda and the list of participants are provided in Appendix 6.

The participants presented a set of recommendations for implementation of future processes, development of cooperation between universities in different countries in industrial safety sector (joint diploma works, exchange of experience between the lecturers' staffs, production practices in other countries, summer schools, etc.).

Although the meeting was attended by representatives from different educational systems and institutions of different countries, who meet each other for the first time, the impression was that everyone knew each other for a very long time. It was proved by cordial and constructive atmosphere and expressed willingness to cooperate, which evidences about the efficiency and importance of the activities implemented under the project (for more information on the meeting, see item 5.2).

5.2. THE FINAL WORKSHOP AND ITS PROGRAMME

The information about workshop is given on the UNECE Industrial Convention's website. Registration of international experts participating at the sum up meeting of the project, adoption of applications and final selection of participants was done thanks to the information dissemination by the Secretariat of Industrial Accidents Convention and placing an appropriate announcement at the UN ECE web site http://www.unece.org/env/teia/mtgs/Yerevan2013.

Without Armenia (as the organizers of the events), the representatives of the following countries participated to the workshop:

- ***Germany*** (as the supervising organization of the project) - Federal Environmental Agency (UBA);
- ***Czech Republic*** - VSB - Technical University of Ostrava;
- ***Romania*** - Babes Bolyai University;
- ***Russian Federation*** - Kaliningrad State Technical university, Perm National Research Polytechnic University;
- ***Republic of Belarus*** - The State Educational Establishment "Command and Engineering Institute" of the Ministry for Emergency Situations of the Republic of Belarus;
- ***Republic of Moldova*** - State Hydrometeorological Service;
- ***Uzbekistan*** - Namangan State University;
- ***Tajikistan*** - Khujand Polytechnic Institute Tajik Technical University.

The objectives of the workshop and the exercise were to discuss:

- the activities implemented under the project, the project outcomes;
- Safety of industrial processes in Armenia, assessment of emergency hazards, emergency prevention and control in EECCA countries;
- Making industrial safety compliant to recognized international standards, and with application of national laws and regulations;
- Enriching the professional knowledge of students of technical universities, increasing the level of education and exchange of experience in the field.
- Developing and strengthening cooperation between universities in UNECE countries;
- Need for further activities, projects, possible cooperation.

The workshop was opened by Ms. Anahit Aleksandryan, Ministry of Nature Protection RA (head of division of hazardous substances and waste policy), Mr. Karapet Karapetyan, Ministry of Emergency Situation RA (chief of department of Industrial Accidents, Radiation, and Chemical Protection), Mr. Gerhard Winkelmann-Oei, German Federal Environmental Agency.

The workshop was divided into 4 sessions:

- **Session I** Project activity in Armenia, project results;
- **Session II** Organization of the educational process in the field of industrial safety in EECCA - countries;
- **Session III** Approaches to provision of industrial safety in EU countries;
- **Session IV** Discussion and wrap-up

After the opening, the project manager Kristine Sahakyan presented the activities and the outcomes obtained within the framework of the project. She presented also the official letters issued by the project participating universities and industrial enterprises on application of the check-list methodology and their possible further application within the project.

The details of the theoretical and practical training courses organized within the Project for students were presented by the students participating in the project. Total 6 students from the 3 project participant universities (YSUAC, SEUA, CSMA) represented the course of the theoretical training, details on their training and production practice in 5 industrial enterprises and the results of the studies and assessments implemented there by the check-list methodology.

The results of the studies implemented by the check-list methodology were quite interesting and they were highly appreciated by all participants. Application of the checklists allowed the students to assess the level of hazard of 5 industrial enterprises in terms of water resource pollution. According to the results of the studies, 4 enterprises were assessed as medium and 1 as low risk industrial facilities. The calculations implemented by the students and the corresponding improvement measures (short-term, mid-term and long-term) proposed to the enterprises evidenced that the students had excellently performed their tasks, fully understood the nuances of the methodology and are ready to apply it in the future.

The representative of the RA Ministry of Education and Science emphasized the importance of such a check-lists methodology as a study tool in educational institutions, including vocational training institutions, attaching importance to future training of lecturers and students, as well as not formal trainings.

The representatives of Aarhus Center welcomed the activities implemented within the framework of the project, mentioning that the check-lists methodology can be efficiently used in public monitoring processes. They proposed to support in organization of meetings in their regional centers, where the project-participant students will have the opportunity to represent the studies implemented by them under the project. Aimed at receiving the opinions and suggestions of different specialists on the methodology it was proposed also to use the Center's web-site, where the Armenian version of the whole package the check-lists would be placed under the section "Projects".

The representatives of the Ministry of Emergency Situations and the international organizations participating in the meeting proposed to cooperate also with the Armenia's "National Platform for Disaster Risk Reduction (NPDRR) related to future activities, the participants of which are the Governmental bodies of the RA, the Ministry of Emergency, international and donor institutions functioning in the DRR field, Armenian Red Cross, as well as scientific institutions and individual experts engaged in the field.

The representatives of the SEUA Department of Mining Engineering and Metallurgy attached importance also to the development of similar checklists for mining engineering sector and particularly for assessment of tailing dams. Mr. Winkelmann (UBA, Germany) added that activities to this end have been already implemented.

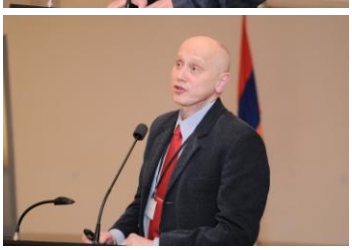
The following representatives from EECCA countries represented speeches on organization of the educational process in the field of industrial safety and representatives from EU about approaches to provision of industrial safety in EU countries.

- Risk Management Courses for different categories of citizens in the Republic of Moldova;
- Organization of the educational process in the field of industrial safety in Belarus;
- System of preparation of industrial safety specialists in Kaliningrad Technical State University;
- Preparation of specialists on "Techno-sphere Safety" in Perm National Research Polytechnic University;
- Innovative activity of Namangan State University,
- The view of Khujand Polytechnic Institute on the activity in the field of industrial safety,
- The Romanian education in technological risk assessment and disaster management in the frame of Seveso Directive,
- Principles of risk analysis and management in the context of industrial accidents.







The workshop and its presentations led to discussing on the activities implemented under the project, the project outcomes, further processes and possible cooperation in the field of university-level education on industrial safety.

The participants presented a series of justified proposals on the discussed topics, which were addressed to universities, regulation

authorities, collaborative NGOs and donor organizations.

The participants represented the following proposals on the discussed topics:

- **Safety of industrial processes in Armenia, assessment of emergency hazards, emergency prevention and control in EECCA countries**

Addressed to Regulation authorities

- Integrate the tools implemented by the project in the safety assessment process of industrial operators,

Justification: The assessment of major emergency hazards, their prevention or control requires that certain measures be taken. Systemic, integrated and effective methods of analysis are needed to prioritize these measures. A check-list can be a useful tool for the carrying out of such large-scale studies. The application of a checklist may allow the assessment of the level of hazard at a given enterprise, establish the necessary technical and organizational short-, medium- and long-term measures, and so reduce the possible environmental risks threatening water resources (including transboundary waters).

Addressed to Universities

- Provide training on a wider spectrum of safety related topics (starting from the check-list methodology) in order to achieve a higher level of expertise in the field of industrial safety.

Addressed to collaborative NGOs

- Disseminate this initiative, methodology and best-practice package on a wider scale, through campaigns, workshops, trainings etc. in order to raise awareness about industrial safety within the general population. Focus on prevention, preparedness, awareness as keywords.

Justification: The public sector's role, *raising the level of awareness among various segments of society and the need for public monitoring is important in the processes implemented in the sector. This methodology* or similar studying tools *can also be applied in the public monitoring process.*

- **Making industrial safety compliant to recognized international standards, and with application of national laws and regulations**

Addressed to Regulation authorities

Adaptation of the check-list methodology to the current national standards, including:

- Standardization of the used methodology
- Introduction of the check-list methodology in risk assessment procedures
- Development and approval of the guidelines on the application of checklist methodology at the relevant national agency/ministry.

Justification: This process also contributes to the implementation of provisions of the 1992 Helsinki Convention on the Transboundary Effects of Industrial Accidents in Armenia and EECCA countries. In case of such an approach application of the check-list package as an integral part of

the environmental audit process is possible, the results of which can be used by the industrial operator as an investment plan, and by government agencies as a catalogue of or guideline to legal requirements.

- **Enriching the professional knowledge of students of technical universities, increasing the level of education and exchange of experience in the field**

Addressed to Universities

- Inclusion of a check-list methodology in the curricula of corresponding specialized departments of technical universities (including vocational training institutions) and their application during practical training.
- Implementation of integration activities for harmonization of educational programs in the field of risk management, in particular:
  - exchange of experience among the lecturers, organizing regular lectures by invited lecturers from other countries,
  - organization of works aimed at development and harmonization of joint academic programs,

Justification: Possible application of such a methodology in the educational process will allow raising public awareness and more efficiently organizing the practical experience of students. Such an approach will allow more efficient organization of practical courses for students, thus producing more competent specialists before their employment in industry, as well as presenting brief information on the whole industrial process. Such an approach will provide new professional knowledge and experience acquired in the field, promoting the process of education sector reform and the preparation of highly-qualified specialists.

- **Developing and strengthening cooperation between universities in UNECE countries**

Addressed to Universities and donor organization

- Promotion and development of interuniversity cooperation in UNECE countries, in particular in partnership with relevant professional departments of technical universities:
  - development of joint diploma theses,
  - organization of training and production practice or study tours at the industrial enterprises abroad,
  - organization of summer schools with participation of students of the universities in other countries,
  - Implementation of joint projects between universities in different countries (including student exchange program).

Justification: Since industrial safety issues are an important component in the environmental development of the economy of any country, the exchange of experience and continuous enriching of knowledge in the area is necessary. This should be reflected in the curricula of technical universities.

This will promote cooperation between countries, enriching of lecturers' and students' knowledge and experience exchange.

➢ Need for further activities, projects, possible cooperation

Addressed to donor organization

- Implementation of such a project in Armenia, as an example for other UNECE countries.
- Implementation of continuous activities in the field, with involvement of international donor organizations, giving preference to bilateral and multilateral projects that will promote cooperation and exchange of experience between countries.
- Taking into account the problems revealed and the solutions proposed during implementation of corresponding projects and obtaining support from the part of governmental agencies.

Justification: Many former Soviet republics (Ukraine, Republic of Moldova, Russian Federation, Georgia, etc.), are also participating in the Bologna Process (which aims to ensure comparability in the standards and quality of higher education qualifications) and are implementing education sector reforms. The countries of Eastern Europe, the Caucasus and Central Asia have many environmental problems in common, among which industrial safety issues can be emphasized. Therefore, any positive result and experience addressing these common problems can serve as a model for other countries and might be applied by them.

The president of "Eco Peace" NGO K. Sahakyan thanked the participants for their attention, professionalism and for the active contribution towards elaborating concrete conclusions and recommendations from the workshop.

Mr. Gerhard Winkelmann-Oei from German Federal Environmental Agency expressed the appreciation to the Armenian organizers, in particular to Ms. K.Sahakyan and her team for the good organization of the workshop and thanked the participants of all countries for their active involvement. He closed the meeting.

The full Report on the final workshop also is available in UNECE web site.

The meeting allowed the participants making certain arrangements on the development and presentation of possible joint projects in the industrial safety sector.

6. PROJECT RESULTS AND SUSTAINABILITY, COVERAGE OF IMPLEMENTED WORKS

6.1. PROJECT RESULTS AND SUSTAINABILITY

This project is of innovative nature for Armenia and creates stable prerequisites for ensuring the continuity of the process after completion of the project.

Before implementation of works, the following results were anticipated that the project implementation would:

1. serve a basis for application of checklists during the practical courses of the corresponding departments of the participating institutions, providing introducing of the process in Armenia and continuation of the process;
2. promote enriching the knowledge of the sector specialists teaching in the HEIs and the students in educational, environmental, population safety and awareness fields;
3. promote introducing the idea of application of checklists in industrial enterprises, as an integral part of safety provision. This would allow providing the project continuity;
4. promote preparation of highly qualified personnel.
5. expanding the scales and involving new industrial enterprises in the process;
6. promote preparation of highly qualified specialists;
7. successful implementation of the project would serve an example for other countries, such as Georgia, Azerbaijan, Ukraine, Moldova and others, which are members of Bologna educational process.

As a result of the project implementation it was possible to introduce the checklist methodology into the participating universities' curricula. Application of this methodology will be particularly effective for the students having their pre-diploma practice in various-oriented industrial enterprises, which was also emphasized in the official letters given by the universities. Throughout the project implementation process the industrial enterprises were of great importance and they were involved in the project activities still in the early stage of implementation. This allowed forming an atmosphere of cooperation, mutual understanding and mutual trust, which provided the implementation of the project actions at a high level.

On the other hand, the idea for implementing the checklist methodology was introduced also into the industrial enterprises thanks to the project implementing organization and a group of students. It is noteworthy that in all official letters provided by the plants the opinions on the methodology are positive and there is a willingness to use them in the future. Some measures proposed in the

checklists have found bases for their practical application in one of the involved industrial enterprises.

The main outcomes of the project are:

- Application of checklist methodology at relevant professional departments of the participating universities (YSUAC, SEUA, CSMA) during the practical and thesis works (industrial internships in industrial enterprises), presentation of the study results in the graduation/diploma works (appropriate thematic papers) as an integral part (official letters issued by the universities).
- Application of the knowledge gained during the project implementation during implementation of activities for expertise of dangerous facilities' security certificates by the Ministry of Emergency Situations.
- Information of corresponding staff of the MES on the checklist methodology and its application during the command training.
- Testing of checklist methodology by the trained professionals and students in 6 industrial enterprises of Armenia, interest of the enterprises in the methodology and expression of willingness by 5 of them (the letters issued by the enterprises) to apply it in their enterprises.
- Practical implementation of the measures mentioned in checklist methodology in "Nairit Plant" CJSC, i.e. equipping the appropriate containers of the plant with secondary receiving containers, renovation of the existing ones.

Comparing the gained outcomes with the expected ones, it can be stated that the major part of the expected outcomes have been achieved.

It should be noted that the project stimulated the cooperation between the participating universities and the Aarhus Center. As a project outcome can be considered the fact that the participating students are now more aware of the details of the Aarhus Centers' activity present in Armenia. Their visits to Aarhus Centers became more frequent; they are actively using the literature present at the Centre, conducting various activities enthusiastically participating in various activities organized by the Aarhus Center, etc.

For formation of cooperation, mutual understanding and mutual trust atmosphere within the framework of the project also the permanent dissemination of information on the implemented actions and the process transparency served a basis.

The project outcomes allow us to state that it can also serve as best practice for other countries.

6.2. DISSEMINATION OF INFORMATION ON THE PROJECT ACTIVITIES

During all phases of the project implementation a special attention has been paid to the elucidation of the project activities. The information on the carried out activities (including the obtained results) was regularly placed in the web sites of the RA Ministry of Emergency Situations, project participant universities, Aarhus Center.

Within the framework of the project coverage of the ongoing activities was regularly implemented via the REC Caucasus and Aarhus Center internet networks, thanks to which the information on the project was disseminated both at national and regional (Armenia, Georgia, Azerbaijan) levels. Aimed at public awareness raising information leaflets were disseminated during different periods of the project implementation.

Information leaflets in English and Russian were also prepared and placed on the web pages of the UBA and the UNECE, as well as disseminated during the closing meeting of the project.

Beside the information leaflets, also the newspapers of the 3 universities (YSUAC's newspaper "Engineer", SEUA's newspaper "Polytechnic", CMSA's newspaper "Crisis Manager"), the weekly magazine of the Ministry of Emergency Situations were used for that purpose. Information on the project was published in the "Hayastani Hanrapetutyun" ("Republic of Armenia") official daily newspaper and the "Irates de facto" (realistic de facto) newspaper. On the activities implemented at the industrial enterprises of Lori region a brief reportage was prepared and broadcasted by the local TV channel. The latter is available also on the internet, at the following address: www.youtube.com/watch?v=nXy5ozPcjj8&feature=plcp.

All of the information leaflets prepared during the project implementation and the published newspapers containing information on the project (once copy each) (total - 4 info information leaflets, 12 newspapers), are attached to this report.

The project information was also regularly posted on the web pages of the UBA and the UNECE, including information about the final international seminar, which was attended by experts from 8 different countries. Registration of participants was conducted through EC web site that disseminated this information also through Focal Points of Convention on Industrial Accidents.

Thanks to this, in addition to the funding party, we had participants from 8 different countries' technical universities.

The project outcomes were represented at different international meetings, such as:

- Meetings of the Bureau of Industrial Accidents Convention in Stockholm (Sweden, 2012) and Geneva (Switzerland, 2013);
- At meetings in Berlin and Dresden (Germany, 2013), accordingly at UBA and UNEP/UNESCO/BMU International Postgraduate Training Programme on Environmental Management for Developing and Emerging Countries, which were attended by high-qualified participants from America, Asia and Africa. Along with the information on the project, also the features of the check list methodology were presented to the participants.

Full information on the activities implemented during the stages of the project is available at the following web pages:

➢ **Kick-off meeting**

English	➢ http://www.ysuac.am/data/eng/news/n2012_03_24a.html
Armenian	➢ http://www.ysuac.am/data/am/news/n2012_03_24a.html ➢ http://www.seua.am/?module=news&utility=show_news_item&news_id=189&category_id=1&lang=am
Russian	➢ http://www.ysuac.am/data/ru/news/n2012_03_24a.html

➢ **Training of trainers**

English	➢ www.ysuac.am/data/eng/news/n2012_07_02a.html ➢ www.aarhus.am/index.php?option=com_content&view=article&id=1011:assistance-to-raising-knowledge-on-industrial-safety-in-higher-education-institutions&catid=15:news-and-announcement-en&Itemid=119&lang=en
Armenian	➢ www.ysuac.am/data/am/news/n2012_07_02a.html ➢ www.aarhus.am/index.php?option=com_content&view=article&id=1009:
Russian	➢ www.ysuac.am/data/ru/news/n2012_07_02a.html

- **Training for students**

English	➢ www.ysuac.am/data/eng/news/n2012_09_28a.html ➢ www.seua.am/eng/?module=news&utility=show_news_item&news_id=112&category_id=1&lang=am ➢ www.aarhus.am/index.php?option=com_content&view=article&id=1170
Armenian	➢ www.ysuac.am/data/am/news/n2012_09_28a.html ➢ www.seua.am/?module=news&utility=show_news_item&news_id=277&category_id=1&lang=am ➢ www.aarhus.am/index.php?option=com_content&view=article&id=1162
Russian	➢ www.ysuac.am/data/ru/news/n2012_09_28a.html

- **Final workshop**

English	➢ www.ysuac.am/data/eng/news/n2013_04_05a.html ➢ www.aarhus.am/index.php?option=com_content&view=article&id=1476: ➢ www.ecolur.org/en/news/mining/alaverdi-copper-smelting-combine-zangezour-copper-and-molybdenum-combine-and-nairit-are-mediumrisk-enterprises/4739/ ➢ www.unece.org/fileadmin/DAM/env/teia/doc/otherevents/ArmeniaMar2013/Information_notice_eng_.pdf
Armenian	➢ www.mes.am/index.php?obj_id=1796&nt=2 www.seua.am/?module=news&utility=show_news_item&news_id=391&category_id=1&lang=am ➢ www.ysuac.am/data/am/news/n2013_04_05a.html ➢ www.aarhus.am/index.php?option=com_content&view=article&id=1457: ➢ www.ecolur.org/hy/news/mining/alaverdi-copper-smelting-combine-zangezour-copper-and-molybdenum-combine-and-nairit-are-mediumrisk-enterprises/4739/
Russian	➢ www.ysuac.am/data/ru/news/n2013_04_05a.html ➢ www.ecolur.org/ru/news/mining/alaverdi-copper-smelting-combine-zangezour-copper-and-molybdenum-combine-and-nairit-are-mediumrisk-enterprises/4739/

The detailed information on the project will be placed also on the web page of "Eco Peace" NGO, at www.ecopeace.am.

6.3. PROPOSALS FOR CONTINUITY OF THE PROJECT ACTIVITIES AND FUTURE COOPERATION

Along with the discussion of the project outcomes, the final meeting of the project allowed the specialists from different countries to exchange ideas on the future activities in the sector.

Attaching importance to the further continuation of activities and exchange of experience in the sector, the meeting participants mentioned also that this project could serve as a pilot/demonstrative project as best practice for other countries.

A special importance was attached to implementation of bilateral/multilateral projects, within the framework of which certain agreements were obtained for developing new project proposals.

An especially close cooperation was established between "Eco Peace" NGO and Perm National Research Polytechnic University.

Though the representatives of Ukraine were not able to attend the meeting in Yerevan, because of unfavorable climate conditions (termination of flights in Kiev airport), the Ukrainian party too was actively engaged into the whole process through keeping contact with "Eco Peace" NGO via internet.

After the completion of the final meeting, "Eco Peace" NGO and the participants from other countries directly initiated development of new ideas for future projects. As a result of joint discussions and exchange of ideas, two bilateral project proposals were developed - Armenia-Russian, Armenia-Ukraine.

The two developed proposals are interesting and perspective; each of them in its format can be considered as a logical continuation of the "Assistance to raising knowledge on industrial safety at universities" project. The parties participating in the development of the proposals had corresponding professional experience and capacities of implementation of various projects; thus, they are ready to implement each of the proposals.

Items 6.3.1 and 6.3.2 below briefly represent the mentioned proposals for future activity.

It is to be noted that during the proposals development process, certain preliminary agreements were obtained with all parties to be involved in the activities.

In case of approval, each of the proposals will be represented in more details to get financial support.

6.3.1. International Summer School "Ensuring Environmental Safety in Urban Areas" (Armenia-Russia)

In the goal of the project proposal the exchange of experience gained during the implementation of two projects of the Program of advisory assistance of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety of Germany is laid:

- "Assistance to raising knowledge on industrial safety at universities in Armenia", 2012-2013, Armenia.
- "Development of long-term vision for waste management in the city of Khanty-Mansiysk", 2010-2012, Russia.

The goal of the project proposal: Obtaining of knowledge by students in the field of providing environmental safety and waste management, in particular:

- Exchange of experience in the field of environmental risk assessment at hazardous production facilities;
- Exchange of experience in the field of waste management and providing safety of the processing facilities and waste disposal;
- Establishment of international teams of young researchers;
- Attracting young people to participate in joint international projects.

Brief Description of the project proposal

In 2012-2013, the NGO "Eco Peace" (Yerevan, Armenia) successfully organized and implemented the project on "Assistance to raising knowledge on industrial safety at universities in Armenia", financed by the Ministry of Environment of Germany.

The aim of the project was to contribute to increased knowledge and awareness of students of technical universities on industrial safety, while improving the knowledge of experts (lecturers) and the employees of the companies in this field. The project brought together lecturers and students from 3 universities of Armenia (SEUA, YSUAC, CSMA). To implement the project, particular importance was attached to the cooperation with governmental and non-governmental organizations (ministries, universities, Aarhus center, etc.).

The knowledge obtained in the course of the project implementation (checklists methodology for study and evaluation of industrial facilities) can be used in the preparation of technical students in other universities, including the preparation of students with major "Technosphere Safety." In this case, the developed approaches to risk assessment can be adapted and used for the development of projects to ensure environmental security in industrialized areas.

In 2010-2012, funded by the German side, the project on "Development of long-term vision for waste management in the city of Khanty-Mansiysk" was implemented. The aim of the project was

to teach the representatives of the city authorities to develop and implement the concept in the field of waste management. Based on a comprehensive analysis the possible ways of utilization of valuable waste fractions were jointly worked out. Employees of the Russian universities, including Perm National Research Polytechnic University, took an active part in this project, conducted various seminars and reports to inform the public. The project results were presented in joint events in other cities in the region, in order to promote the development of such programs and projects in other cities.

For the promotion and dissemination of the results obtained during the implementation of the above two projects, it is planned to hold a joint Armenian-Russian Summer School on "Ensuring Environmental Safety in Urban Areas" with the participation of students from Armenia and Russia.

To participate in the summer school it is planned to attract students of the universities of Yerevan who participated in the project “Assistance to raising knowledge on industrial safety at universities in Armenia” and having the knowledge and experience in the field of risk assessment and safety of hazardous industrial facilities, as well as students of Perm National Research Polytechnic University (PNIF) with major in "Technosphere Safety", whose specialty is establishment of waste management systems in urban areas. In addition, other interested persons can join to participate in the project. Joint work of the students and professionals from Armenia and Russia will allow using the knowledge in the field of risk analysis to assess the safety of the disposal sites.

The international summer school is planned in two phases:

- **Stage 1 - Yerevan, Armenia, 1 -10 July 2014**

The first stage of the project is planned to be held in Armenia with the participation of students from Russia, from the Perm National Research Polytechnic University (PNIF).

The choice of the university in Russia was based upon the fact that Perm National Research Polytechnic University is one of the leading technical higher schools in Russia. It is the largest educational, scientific and cultural centre in the Western Ural. Currently at the PNIF department of "Environmental Protection" bachelors and masters are trained on "Technosphere Safety".

On the other hand, the city of Perm is a typical industrial city, and the issues of industrial and environmental safety are particularly acute here. In the city, a number of industrial enterprises are running, which may be the subject of empirical research of the participants of the international summer school. The participants of the school will be able to use in practice the knowledge gained in Armenia in the first stage, carrying out a number of studies at the industrial facilities of city of Perm, including waste disposal sites.

During the first stage of the project, the students and lecturers who participated in the project “Assistance to raising knowledge on industrial safety at universities in Armenia”, may be involved as participants, lecturers and supervisors of the international summer school. In Armenia, the participants will have the opportunity to meet and share their knowledge with the participants of

this project, visit the industrial enterprises, which have been used for new approaches to risk assessment, to gain theoretical and practical knowledge in the field of industrial safety. A key aspect of the first stage of the Summer School will be the development of risk assessment methodology. To do this, experts on emergency situations, nature conservation, public health, public relations, with extensive experience in the implementation of projects in the field of environmental protection will be invited to read and hold classes. As a result, students will gain theoretical knowledge and practical ability to apply knowledge of building integrated safety systems in the industry.

- **Stage 2 - Perm, Russia, 15 -25 August 2014**

The second stage of the project is planned to take place in Perm with students from Armenia. A key aspect of the second stage of the Summer School will be gaining knowledge in the field of solid waste management. To do this, PNIF staff will be invited to read lectures and classes, since they who have extensive experience in implementing projects in the field of environmental protection. During the last two years they were the experts involved in the project in Khanty-Mansiysk. PNIF performs a wide range of activities for the design of environmental protection facilities, including processing facilities and waste disposal. In addition the university has a lot of experience in organizing and conducting summer schools.

Exchange of information and experience in this area will be very useful for the participants from Armenia, since in this area there are still many unanswered questions. The waste generated in the country, is currently not processes and are disposed without pre-sorting to the rapidly filling landfill, and sometimes discharged to illegal dumps. Although it is discussed much on this, but to date no measures have been undertaken and implemented for the processing and disposal of waste.

As part of the Summer School also visits to the enterprises for processing of waste, solid waste landfills and Research Center of opto-mechanical waste sorting in Perm will be organized.

The knowledge gained in the city of Perm can then be used in Armenia for the development of integrated systems of waste management.

The format of the event

10-15 students from Armenia and 10-15 students from Russia work in five teams of three people from each country to exchange ideas, experiences and establish close international contacts.

Each team gets a separate exercise, the design of which the team develops over the stage. At the final stage of the school activities a scientific-practical conference will be held, where working groups will represent the results of their research work in the form of reports, articles and presentations.

In the course of implementation of the International School the participants will participate in various training workshops and master classes by leading experts in the field of industrial safety,

visit industrial enterprises. In order to establish informal contacts between the student's excursions and familiarity with the culture and customs of Armenia and Russia are planned.

Project duration: 10-12 months

The working languages of the school: English, Russian

Expected results of the project:

1. Joint development of projects in the area of environmental safety at industrial enterprises.
2. Joint development of projects in the field of providing safety at processing facilities and waste disposal.
3. Organization of regular international communication between students and lecturers of Armenia and Russia.
4. Attracting young people to the problems of industrial and environmental safety.
5. Conducting the final conference and presentation of the results of the project to a wide range of specialists.
6. Formation of an international research team to develop and implement new environmental projects, joint publications of scientific and practical results.

Prospects for the project

Development and implementation of such events in Armenia and Russia, as well as in the partner countries, establishment of working groups of youth research, establishment and implementation of joint international research projects in the field of industrial safety and environmental protection.

Organizers of the project

- **NGO "Eco Peace" (Yerevan, Armenia):** organization of the school in Armenia, holding of lectures, seminars, workshops, round tables and dissemination of the results of the school.
- **Perm National Research Polytechnic University (PNIF, former Perm State Technical University):** organization of the school in the city of Perm, holding of lectures, seminars, workshops, round tables and dissemination of the results of school.

Experience in similar projects

- Organization and implementation of international environmental summer camps for children, students, post-graduates jointly with the Office for the Environmental Protection of Perm Region. Since 1996, 12 camps have been organized, with the participation of undergraduate and postgraduate students of Perm, school to high school students of Perm region and the students from Germany, Austria, Denmark, Switzerland and Vietnam.
- Since 2008, in collaboration with the Union of Sport, Nature and Art (c. of Fuerstenau, Germany) PNIF has been annually participating and organizing international school and student camps in Germany and Russia. 19 camps in Germany and five camps in Russia (Perm) were organized and conducted.

- Participation in European projects TEMPUS-TACIS:
  - 1997-2001: A joint project of Perm State Technical University, Technical University of Vienna (Austria) and the Technical High School in Wiesbaden (Germany), "Introduction of Environmental Science into engineering education in Perm GTU".
  - 2003-2005: a joint project of PSTU and EPCEM (Holland, France, Hungary) on "Preparation and opening of State Technical University Master's program on "Environmental Management" in Perm.
- Organization of international projects supported by Verein für Sprach-und Kulturaustausch in Mittel-, Ost-und Südosteuropa (MitOst eV), Germany:
  - 2010: project on "Bildungsakademie Kulturaustausch durch Ökologie"
  - 2011 Project on "Fokus: Kultur in einem Mülleimer".

6.3.2. Introducing the Checklist methodology in industrial enterprises of Armenia and Ukraine by developing/updating industrial safety passports (Armenia-Ukraine)

Goal of project proposal: Develop/update Industrial Security passports (ISP) at the industrial enterprises of Armenia and Ukraine through the application of a unified system of checklists.

Project scope: 3 potentially dangerous industrial facilities in Armenia and 3 - in Ukraine, 1 or 2 of them (in each country) have toxic tailings dams (there is already a prior arrangement with companies both in Armenia and Ukraine).

The idea of the project proposal is to conduct a series of training workshops on developing/updating of Industrial safety passports (ISP) in industrial enterprises of Ukraine and Armenia, taking into account the application of the checklists methodology for employees of the 3 selected enterprises in each country. The seminars will be attended by staff from the regional environmental offices and Aarhus Centers, where the project facilities are located.

For starting the project in Ukraine it is needed to obtain support and approval by the Ministry of Ecology and Natural Resources of Ukraine, as well as from the participants of the project on "Prydniprovsk State Academy of Civil Engineering and Architecture" of city of Dnepropetrovsk and "National Mining University" of Dnepropetrovsk.

For starting the project in Armenia it is needed to obtain support and approval by the Ministries of Nature Protection and Emergency Situations of Armenia, and also from the Yerevan's Mining and Smelting Institute.

A team of German experts is preparing a group of Ukrainian and Armenian experts (8 people from each country) who develop the technology of application of a common system of checklists to industrial enterprises, including enterprises with tailings dams at 3 selected facilities in each country.

The groups of Armenian and Ukrainian experts are as follows:

Armenia

- 1 project manager of "Eco Peace" NGO, Yerevan;
- 2 experts from the State Engineering University of Armenia (Departments of Mining Engineering and Metallurgy, Faculties Faculty of Chemical Technology), Yerevan;
- 1 expert from the Ministry of Nature Protection of Armenia;
- 1 expert from the Ministry of Emergency situations of Armenia;
- 1 expert from "Mining and smelting Institute" CJSC;
- 1 expert from National Center of Technical Safety SNCO
- 1 expert from Aarhus Centre.

Ukraine

- 1 project manager of "Center for Environmental Auditing and clean technology" OJSC Dnepropetrovsk;
- 1 project expert from "Center for Environmental Auditing and clean technology" OJSC Dnepropetrovsk;
- 2 project experts from the Department of Ecology of Prydniprovska State Academy of Civil Engineering and Architecture;
- 2 project experts from the Department of Open Cast Mining "National Mining University", Dnepropetrovsk;
- 1 expert from the Ministry of Ecology and Natural Resources of Ukraine.
- 1 expert from the Institute for Nature management Problems and Ecology (Dnepropetrovsk), National Academy of Sciences of Ukraine.

The German experts hold lectures, presentations and workshops directly at the enterprises in Germany for the groups of Armenian and Ukrainian experts to get them acquainted with the experiences in Germany.

After returning the group of experts organized training of specialists from the three selected industries in their respective countries.

According to the training results the specialists of industrial enterprises jointly with the experts develop Industrial safety passports (ISP) for their enterprises by applying the checklists methodology.

Following the development, a review and analysis of technical measures for preventing accidents and limiting their potential consequences for people and the environment, included in the Industrial safety passports (ISP) are made for each project facility.

A joint closing session of training seminars is held to assess the developed Industrial safety passports (ISP) to confirm that the implementation of the necessary measures included in the ISPs will minimize all possible serious risks in accordance with the practices and techniques used in Armenia, Ukraine and the EU.

The project implementation results are summed up.

- **Proposed duration of the project**: 2 years.
- **Brief schedule of the project implementation:**

- Obtaining letters of approval of the project by:

Armenia

- Ministry of Nature Protection of Armenia;
- Ministry of Emergency situations of Armenia;
- "Mining and smelting Institute" CJSC;

Ukraine

- Ministry of Ecology and Natural Resources of Ukraine;
- Prydniprovsk State Academy of Civil Engineering and Architecture;
- National Mining University

- **Main actions:**

1) Determination of the composition of the expert group in each country;
2) Determination of the project facilities - industrial enterprises;
3) Appointing responsible persons from industrial enterprises to participate in the project;
4) Identifying the date of the lecture-presentation of the project and training seminars;
5) Developing and proposing the technical measures applicable to the selected facilities of the project;
6) Developing Industrial safety passports (ISP) for project facilities;
7) Evaluating the Industrial safety passports (ISP) for the project facilities.

- **Responsibility for the project milestones**

№	*Main stages of the project*	*Responsibility for implementation*
1.	The approval of the project by Armenia and Ukraine	Armenia - project manager of "Eco Peace" NGO Ukraine - project manager of "Center for Environmental Auditing and clean technology" OJSC
2.	Preparation of the team of Armenian-Ukrainian experts	German experts
3.	Training of the specialists of the project facilities - industrial enterprises	Prepared expert team
4.	Development of technical measures for preventing accidents and limiting their potential consequences for people and the environment for each project facility	Expert team and specialists of the project facilities (probably under leadership of German experts)
5.	Development of Industrial safety passports (ISP) by specialists of the project facilities	Ukrainian expert team and specialists of the project facilities (probably under leadership of German experts)
6.	Assessment of the developed Industrial safety passports (ISP)	Armenian-Ukrainian expert team

- **Preliminary list of industrial facilities** (there is already a preliminary agreement with them)

Armenia

1. Agarak Copper and Molybdenum Combine (c. Agarak)
2. Pure iron plant (c. Yerevan)
3. One of the 5 enterprises that participated in the project on "Assistance to raising knowledge on industrial safety at universities in Armenia".

Ukraine

1. Nikopol Ferroalloy Plant (NFP) (c. Nikopol);
2. "Northern Mining and Processing Plant " OJSC (c. Krivoy Rog);
3. Zaporizhstal Integrated Iron & Steel Works JSC (c. Zaporozhye).
4. Prydniprovsk Thermal Power Plant of "Dneproenergo" CJSC, (c. Dnepropetrovsk).