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Final report

Activities for Accident Prevention - Pilot Project - Refineries (RER/03/G31/A/1G/31)

WORKING FOR THE DANUBE AND ITS PEOPLE

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PREFACE

The concept of the project is the fact that compared to the EU standards, the technological and organizational level of the plant safety in eastern European countries present considerable deficiencies. Such kind of deficits lead already in these countries to severe environmental damages, respectively cover-up the potential of short or medium term, inevitable, environment hazards.

The countries along the course of the Danube must improve their safety level with regards to the water protection. For this purpose, the available checklist method for plant assessment and checking is to be presented to the responsible authority inspectors of the countries along the Danube river basin, and proven of its applicability. With the use of the checklists and the help of the trained inspectors the efficiency as well as the comparability of the technical safety checks can be improved.

The core of the project was the improvement and expansion of the checklist methodology. A special refinery checklist should perfect the above mentioned method, in order to include also the safety-related interests of the refineries.

This checklist method should be continuously improved, that after the plant check and assessment by means of the checklist, it should also determine the real risk potential.

Furthermore it should be stated, that the developed methodology is not only for developed industrial countries, but that it should be applied particularly in those countries where safety standards are not so highly developed.

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ABBREVIATIONS

ARC_n	*Average Risk of the checklist n*
ARP_i	*Average Risk of the plant i*
ARSite	*Average Risk of the industrial site*
CL	*Number of the evaluated checklists*
$EQ3_i$	*Equivalent of water risk class 3 of the plant I*
ICPDR	*International Commission for Protection of the Danube River*
K	*Number of the plant units*
M	*Number of the evaluated sub-points of the recommendation*
M1	*Earthquake risk*
M2	*Flooding risk*
M3	*Drinking water recovery area*
MWRI	*Modified Water Risk Index*
RC	*Risk category*
RRP_i	*Real Risk of the plant i*
RRS	*Real Risk of the industrial Site*
SP	*Sub-point (sub-point of the recommendation)*
WRC	*Water Risk Classes*
WRI_i	*Water Risk Index of the plant unit I*
WRI_S	*Water Risk Index of the site*

EXECUTIVE SUMMARY

Based on recommendations of the river basin commissions (UNECE), the German Federal Office for Environment Protection developed a method that allows a systematic and structured check and assessment of plants handling substances hazardous to water, taking into consideration all technical safety aspects.

This method allows the plant weaknesses to be detected objective and consistently. Based on these deficiencies catalogues of measures were created containing short, medium and long term measures that can serve as a basis for an overall investment planning. Here, the priorities are the simple, technological and organizational "low cost" measures that lead to a considerable increase of the safety level, without high financial expenses.

During both training seminars the developed checklist methodology for plant checking and assessment was presented to a large group of local and regional inspectors and its applicability was demonstrated. The participants admitted this method as a useful tool for fulfilling various national and international regulations. Thus, the trained inspectors act as knowledge multiplier in their countries.

The plant check must be performed on plants in the same industry, but at different stages of safety standard development, in order to assure a general and unrestricted recommendation for the applying of the checklist method. This application allows a clear localization and description of the differences.

Therefore, based on this checklist method, a raw oil distillation facility was analyzed, first at a refinery in Germany and the second at an identical plant in Romania.

The first refinery was checked with the checklists available at the beginning of the project. As a result new items were introduced, for example in the storage and in-plant pipeline safety checklists.

The result showed that both refineries are holding different safety policies. Checking the plants with the help of the checklists allows a consistent, structured and simple plant evaluation. The result of these checks clearly showed the weak points in the safety engineering.

Further to this the fact it should be communicated that the methodology developed is not only for developed industrial countries, but that it should be applied particularly in those countries where safety standards are not so highly developed. Thus, this method can be used unlimited, for each plant that handles substances hazardous to water.

The checklist methodology was perfected with a special refinery checklist, so that it should also include the special safety-relevant interests of the refineries. The recommendations are divided in two.

Part 1 handles the basic requirements of the plant safety. Besides these organizational recommendations for application of the safety management system are also given.

The second part offers recommendations for the safety-relevant requirements concerning the water protection at installation and equipment of refineries.

Hence, all production facilities that handle water hazardous substances can be assessed with the resultant checklists. This is another advantage of these checklists and it also closes a big gap in the available checklist method.

Before this project, with the checklist method, there was no possible quantification of the real risk. For this purpose, during the project, a special methodology was developed.

The ICPDR developed a method for assessing potential dangers from environmentally relevant industrial plants. On the basis of the WRI (water risk index) it is possible to establish the accidental risk spots (ARS).

The current risk can only be determined and assessed on the basis of a thorough testing and evaluation of the relevant plant. The checklist method that has been developed is outstandingly suitable for this purpose. The most varied industrial plant can be checked and evaluated simply, in structured form and in accordance with international recommendations by means of this method.

Based on this method it was developed a possibility that characterizes the real risk of a plant.

It should be pointed out that this methodology was not yet completely assessed by the ICPD.

As a conclusion, it must be underlined that this project provides a method for plant checking and assessment regarding handling water hazardous substances and allows a simple, structured and global plant evaluation. This method was repeatedly tested for applicability and it can only be warmly recommended.

1 AIM, PURPOSE AND TASK ASSIGNMENT

For the countries along the course of the Danube the plant safety level must be improved with regards to the water protection. For this purpose, the available checklist method for plant assessment and checking is to be presented to the inspectors from the environmental agencies of the countries along the Danube river basin, and proven of its applicability. By usage of the checklists and the help of the trained inspectors the efficiency as well as the comparability of the safety-relevant checks can be improved. The above method is to be perfected through a special refinery checklist that will also include the safety-related interests of the refineries.

Furthermore it should be stated that the developed methodology is not only for developed industrial countries, but that it should be applied particularly in those countries where the safety standards are not so highly developed. This checklist method is to be continuously improved in order to determine the real risk potential (after the plant check and assessment by means of the checklist).

2 INTERNATIONAL RECOMMENDATIONS AND CHECKLISTS

Based on recommendations of the river basin commissions (UNECE), a method was developed that allows a systematic and structured check and assessment of plants handling water hazardous substances, taking into consideration all technical safety aspects.

With the help of this method, plant weaknesses can be detected objective and consistently. Based on these deficiencies catalogues of measures were created, containing short, medium and long term measures, that can serve as a basis for an overall investment planning. Here, the priorities are the simple, technological and organizational "low cost" measures that lead to a considerable increase of the safety level, without high financial expenses.

2.1 INTERNATIONAL RECOMMENDATIONS

In daily practice, accidents in industrial plants can lead to extensive transnational effects in lakes and rivers - in particular leading to a restriction in their use as drinking or industrial water, as well as causing damages to the ecosystem. A remarkable example is the fire disaster of Santos in the Swiss hall (Switzerland) in 1986, which caused a serious pollution of the Rhine. Fishing in and using the Rhine as a source of drinking water had to be interrupted for several days up to a distance of about 1000 km stretching into the Netherlands. This and other events made it necessary to give the development of an international safety standard a clear direction.

The river basin committees for the Elbe, Rhine and Danube can issue recommendations on different aspects of plant safety based on the results of the water and industrial accidents conventions. The black sea commission and other international committees can also make recommendations based on the results of the above-mentioned conventions.

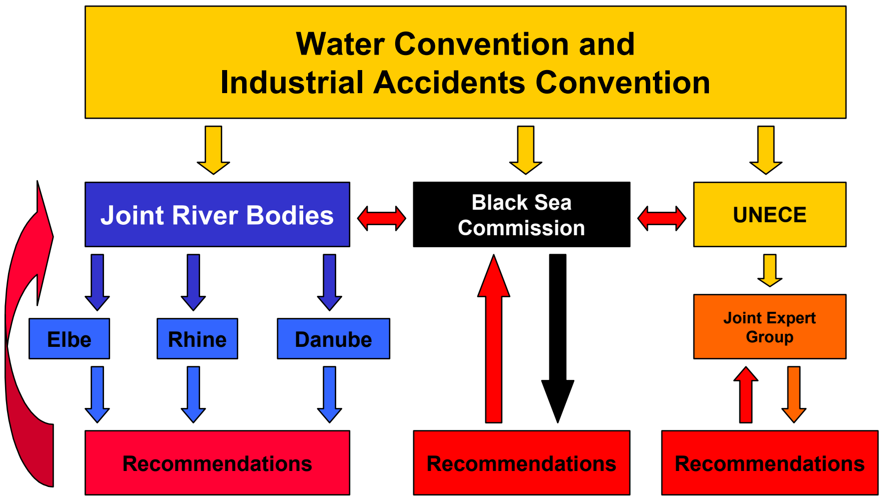


Figure 1: International recommendations

The recommendations given by international groups can therefore serve as a manual of recommendations for improving and updating the international safety standards in the area of plant related water pollution control.

The safety measures are not specific to a particular river basin area; these recommendations for the Rhine, Elbe and Danube can be used for other areas too.

The following recommendations describe the technical and organizational precautions to be taken when operating industrial plants handling substances hazardous to water. They are based on a concept with which chemical danger potentials are controlled by means of a multi staged technical and organizational safety system.

The recommendations can be divided into three major groups:

1. Recommendations for Functional units (e.g. storage, sealing systems, fire prevention, etc.)
2. Recommendations for Branches (e.g. cellulose industry)
3. Recommendations for Risk areas (e.g. contaminated surfaces)

The recommendations can be used in any company handling water hazardous substances and can be considered as the basis for safety policies in the area of plant related water pollution control.

2.2 THE CHECKLIST METHOD

The application of the checklists method allows the verification of compliancy with the basic safety precautions by small plants as well as the verification of compliancy of complex industrial plants with additional plant safety precautions, due to the modular structure of the checklists.

Suitable checklists were formulated based on the recommendations of the river basin committees (UNECE, see above).

The checklists are divided into four major parts.

1. The first part is the organizational and technical recommendations. These will be quoted from the original text.
2. The second part is the method of querying to ascertain if the recommendations are complied with.
3. The measures to be taken are recommended according to the problem. These are organizational and technical measures which are graded in short-, medium- and long-term measures. They can be used by plant operators as investment plan and by the authority as catalogues of demand.
4. Following the check of one sub-point of the recommendation, the risk category is established (see also "Determining the real risk").

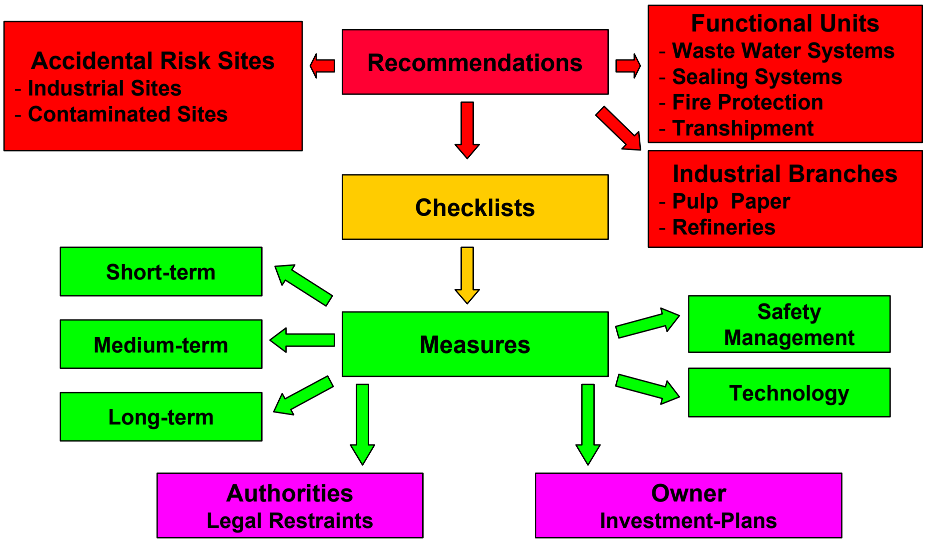


Figure 2: Overview of the checklist method

Measures and catalogue of measures

If the requirements of the recommendations are not or only partially fulfilled, suitable remedial actions must be specified by the assessor. The actions should be differentiated into short-term, medium-term and long-term measures. The following criteria should be considered when deciding on the measures which are appropriate:

Short-term measures

Short term measures are normally low cost measures. Normally, they can be implemented by the plant operator using means that are already available in the factory. They should consist of simple technical or organizational actions with the purpose of immediate improvement of the present condition of the plant with respect to water protection.

Medium-term measures

Medium-term measures are technical or organizational actions with the intention of satisfying the recommendations. The financial capability of the plant operator is taken into consideration.

Long-term measures

Long-term measures should guarantee the technical implementation of proposed measures which fully satisfy the recommendations with the aim of implementing the European standards for plant-related water protection.

The examples of measures contained in each of the sections of the checklists are intended to help the user of the checklists to choose a measure which is applicable to the respective situation.

The checklists should be seen as "living documents". The checklists can and should be revised and improved upon by applying them in the daily practice. The application of the checklists can also help in detecting those problems that have not been considered during the plant checks; this can lead to the formulation of new recommendations.

New information and findings of the river basin committees and other international committees which are to be published as recommendations can also be taken into consideration when revising the checklists.

The constant updating and improvement of the checklists method is thereby guaranteed.

3 RISK ASESSMENT

The fact is not contested that industrial activities can result in serious water pollution. A recent example of this was the accident at Baia Mare (Romania), where some 100 000 m^3 cyanide contaminated water flowed from a mining company from the tributary rivers Somes and Theiss into the Danube. But also the events of the Sandoz accident over 10 years ago have not been forgotten.

3.1 POTENTIAL RISK

The ICPDR developed a method for assessing potential dangers from environmentally relevant industrial plants. On the basis of the WRI (water risk index) it was possible to establish the accidental risk spots (ARS). However, the problem here is that this Water Risk Index takes into consideration only the volume and the water hazard degree of the substances, but not the type of safety level. Thus a company, in which all recommendations of the river basin commissions are converted, is evaluated exactly the same, like a company with serious safety-relevant faults. That requires an evaluation of a plant regarding the current risk.

3.2 METHOD FOR DETERMINING THE REAL RISK

It should be pointed out that this methodology was not yet completely evaluated by the ICPD.

The current risk can only be determined and assessed on the basis of a thorough testing and evaluation of the relevant plant. The checklist method that has been developed is outstandingly suitable for this purpose. The most varied industrial plant can be checked and evaluated simply, in structured form and in accordance with international recommendations by means of this method.

Based on this method a possibility was developed that characterizes the real risk of a plant.

This method is used for an entire industrial site. The flowchart on the following page gives an overview of the method.

3.2.1 Introduction of the modified WRI

When determining the real risk the environment of the location must also be taken into consideration.

It is very important if the facilities are endangered by natural events, respectively if, in case of a breakdown, the drinking water supply will be endangered or not. This means, that also the surrounding environment must be checked. Naturally, this requires an exact delimitation, e.g. when an earthquake becomes dangerous and when danger of flooding should be taken into consideration.

It is important to realize, that the real potential danger must be considered only in relation to the risks of the surrounding environment. This is why the modified Water Risk Index is introduced.

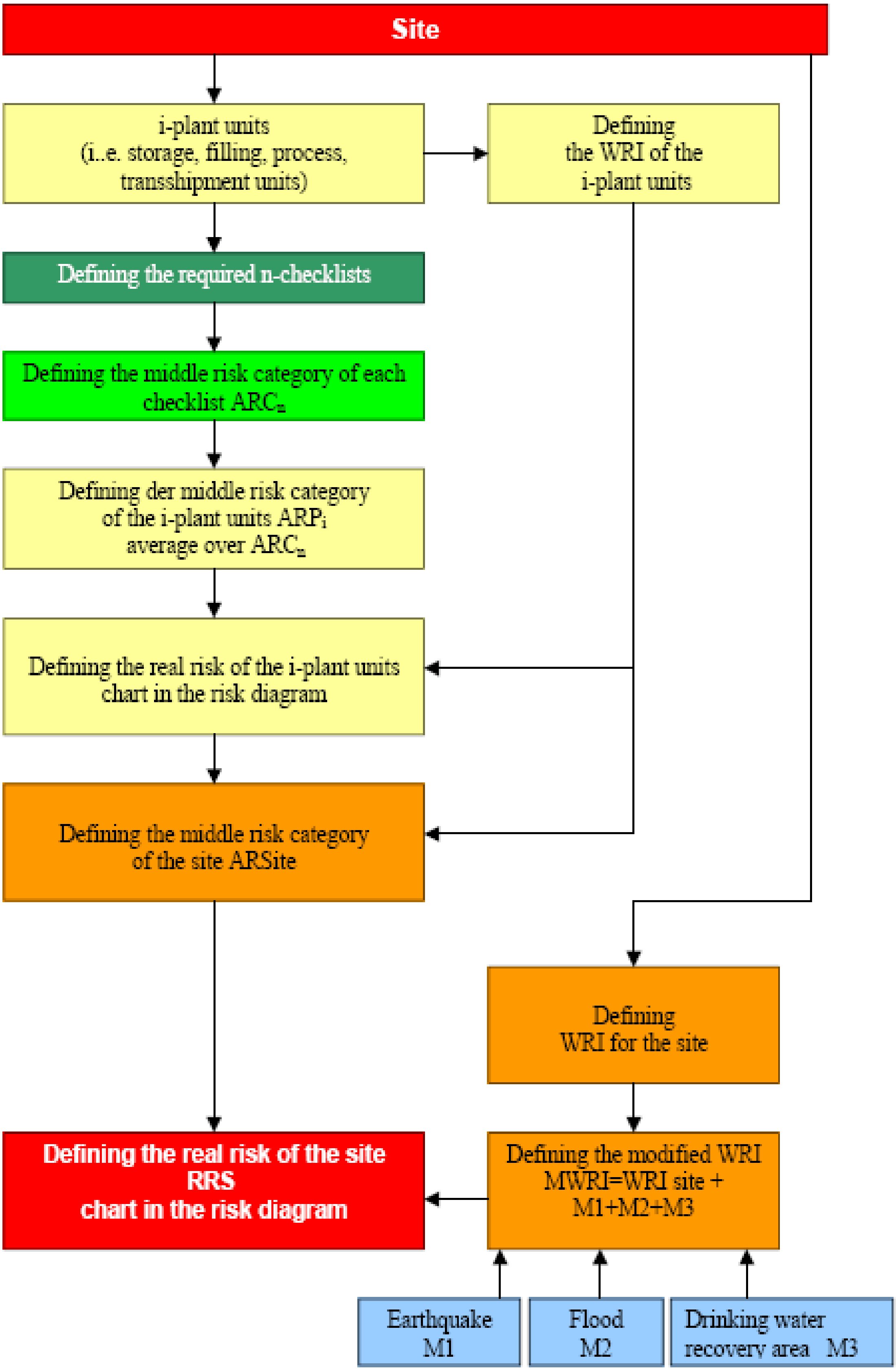


Figure 3: Method for determining the real risk

3.2.1.1 Earthquake

The danger of earthquake must be taken into consideration if in an area can happen a magnitude 4 earthquake on Richter scale. Magnitude 4 on Richter scale means:

it is noticed by most of the population; swinging of a free pendulum; rattling of glasses and dishes; swinging of shutters; loose swing of parked cars; minimum damage.

3.2.1.2 Flooding

Flooding events are events that happen when rivers overflow, or flooding of lake and sea areas. In order to see if the event happened, the last 100 years must be analyzed.

3.2.1.3 Drinking water recovery area

Water recovery areas are areas where the drinking water for the population is ensured. National parks are also included here. In case of spilling water hazardous substances, there is the danger of highly influencing the population and the environment.

3.2.2 Application of the checklists

It is well known that one entire plant can not be assessed at once. A plant consists of many different small facilities and units. There are transshipment units, filling systems, storage units and processing units. Because the various units are connected through pipelines, it must be done a useful delimitation. That means it must be done a plant split.

The plant unit can be checked and assessed only after determining which checklist will be used. Each single checklist will be worked out and tested, to which extent the recommendations of the international river basins commissions were put into practice.

It must also be evaluated if the individual sub-points of the recommendations were applied. After an evaluation through precise provided values, an average of a checklist can be determined, respectively, during the process, an average value of a plant unit.

3.2.3 Real risk

The real risk of each plant can be defined as the logarithm of the product between the WGK 3 (equivalent of water risk class 3) and the average risk of the plant unit.

After assessing the average, it is possible to combine the average risk categories of the plant units with the average risk category of the industrial site.

The real risk of the industrial site can be defined as logarithm of the product between the WGK 3 (equivalent of water risk class 3) and the average risk of the plant unit, and added to the environment modifying factors.

$$RRS = M1 + M2 + M3 + \lg(10^{WRI_S} \bullet ARSite) = M1 + M2 + M3 + \lg(EQ3_S \bullet ARSite)$$

RRS	Real Risk of the Industrial Site
ARSite	Average Risk of the Industrial Site
WRI_S	Water Risk Index of the Industrial Site
M1	Earthquake danger
M2	Flooding danger
M3	Drinking water recovery areas
$EQ3_S$	WGK 3 Equivalent of the Industrial Site

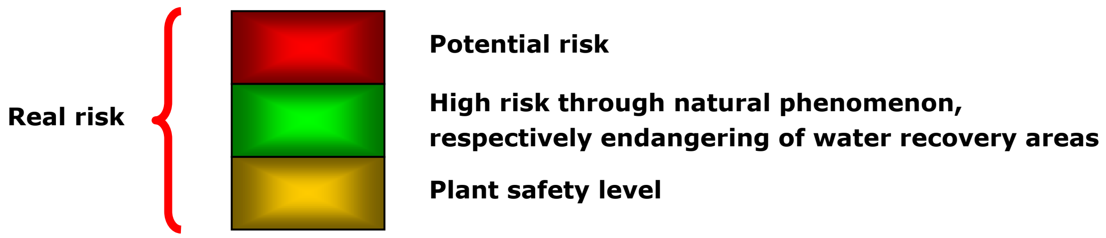
The following evaluation can be defined.

(RRS - WRIS) ≤ 0,4	The safety level is good enough. Still, this classification does not mean that there are no measures required for improvement of the situation.
0,4 < (RRS - WRIS) ≤ 0,8	Important safety systems do not exist or are not sufficient. Measures have to be taken for improving the situation.
(RRS - WRIS) > 0,8	Very low safety level regarding the water protection. Measures for improvement of the situation have to be taken immediately, and afterwards the evaluation will be reviewed.

The real risk of the industrial site can be evaluated as follows:

RRS ≤ 2,0	Low risk A low risk was determined.
2,0 < RRS ≤ 4,0	Medium risk A medium risk was determined.
RRS > 4,0	High risk A high risk was determined.

Thus, the real risk can be added up as follows:



This means, that if the recommendations of the river basin commissions are fully implemented, the real risk equals the potential risk.

3.3 REVISION OF THE CHECKLISTS FOR THE FUNCTIONAL UNITS

For determining the real risk it was necessary to implement this method in the checklists. As described above, each sub-point of the recommendation is assigned to a risk category. For this purpose the author performed an evaluation and assessment of each sub-point. As a rule, the assessor can chose between 1/5/10. But there are recommendations that are very important for the water protection. Therefore, in the risk category it was assessed with values between 1/15/30.

Determination of the real risk

Is the sub-point of the recommendation implemented?

Yes	Partially	No
❒	❒	❒
RC=1	RC=5	RC=10

After finishing the evaluation, a table is prepared for determining the average risk category of the checklist (ARC).

Furthermore, some sub-points of the checklist were modified, because during the seminars the participants made some improvement proposals, in order to avoid comprehension problems.

Summery of the Checklist

Sub-point of the Recommendation	Possible Risk category	Risk categories
1+2	1 / 15 / 30	
3	1 / 5 / 10	
4	1/ 5 / 10	

Average **R**isk of the **C**hecklist **(ARC)**

4 COMPARISON OF REFINERIES

The plant check must be performed on plants in the same industry, but at different stages of safety standard development, in order to assure a general and unrestricted recommendation for the application of the checklist method. This application allows a clear localization and description of the differences.

Based on this checklist method, a raw oil distillation has been analyzed: in a refinery in Germany and an identical plant in Romania.

The raw oil distillation represents the first production step in the mineral oil refineries. The standard product crude oil is processed and refined through many technical steps into useful final products, like gasoline and various kinds of distillate products.

The standard and the intermediate products are water hazardous substances, therefore technical and organizational measures for the soil and water protection have to be taken during the crude oil distillation.

The crude oil distillation process was checked in two different refineries. The checked items were availability and technical status of the safety equipment, as well as the availability of the required operational and organizational measures.

4.1 REFINERY 1

The PCK GmbH refinery is a crude oil processing plant in Schwedt/Oder in the north-east of the county Brandenburg (Germany). The company was founded on the 13th of January 1959, and its share of the German oil processing market is around 10%. The PCK GmbH refinery is processing mostly crude oil from Russia. Besides the crude oil pipeline from Russia, they can also obtain crude oil from the Rostock-Schwedt pipeline. The company annually processes 10.5 million tons of crude oil.

4.2 REFINERY 2

The Rompetrol refinery is a crude oil processing plant near Constanta, on the Black Sea coast (Romania). The refinery was built in 1975; it is the second biggest refinery in Romania, with a market share of 40%. The company annually processes 3.5 millions tons of crude oil.

4.3 RESULTS OF THE COMPARISON

The first refinery was checked with the checklists available at the beginning of the project. As a result we introduced new items, for example in the storage and in-plant pipeline safety checklists. Furthermore, it lacked of special recommendations and checklists for the entire plant, since their development was part of the project.

After revision of the checklists and the development of the recommendations/checklists for refineries, the second plant was visited.

The first refinery fulfills the basic requirements for handling water hazardous substances. Especially the secondary containment ensures control in case of a breakdown or malfunction.

The second refinery does not have, for example, separate sewer systems for products and waste water. The status of the draining surfaces, the missing containment edges and the missing blocking devices could lead in case of a breakdown or malfunction to soil and water contamination.

The result showed that both refineries were holding different safety policies. Checking the plants with the help of the checklists allows a consistent, structured and simple plant evaluation. The result of these checks showed the weak points in the technical safety precautions.

It was demonstrated that with the help of the checklist method, even at plant checks of the same industry, the result clearly points out the differences in the technical safety status. This shows the unlimited applicability of the method in any plant handling water hazardous substances.

5 RECOMMENDATIONS FOR REFINERIES

5.1 BACKGROUND

Based on the UNECE „Water"- and „Industrial Accidents"- Convention, the international river basin commissions in Europe can issue and do issue out recommendations regarding different aspects of the plant safety.

These can help in raising and adjusting international safety standards in the area of plant-related water protection.

The recommendations describe the technical and organizational precautions for operating plants handling water hazardous substances. They are based on a concept, with which chemical danger potentials are controlled by means of multi-level technical and organizational safety systems.

The recommendations can be divided into three major groups:

- Recommendations for functional units (e.g. storage, sealing systems, fire protection, etc.)
- Recommendations for branches (e.g. pulp industry)
- Recommendations for risk areas (e.g. contaminated sites)

The recommendations can be used in any company handling water hazardous substances.

On the basis of already existing recommendations of the river basin commissions for the Rhine, Elbe, Oder and the Danube, corresponding checklists were compiled and introduced as checklist method as a result of several consultation projects organized by the German Federal Office for Environment Protection. The application of the checklists method allows the verification of the compliance by small plants to basic safety precautions and, at the same time, through its modular structure, the verification of extended plant safety precautions of complex industrial plants.

This method was successfully tested in different countries and different industry branches.

In 2004 ICPD passed a resolution to use this method for the examination and evaluation of plants in all Danube neighboring states.

For further validation, the method is to be tested in plants of the same industry with different level of technical safety. Technical safety differences can thus be clearly located and described.

At the same time the method is to be extended for safety-relevant evaluation of refineries.

5.2 ACCIDENTS

The following list represents accidents that happened in refineries, during the last years. These information were compiled from the media and the ZEMA database (Zentralen Melde- und Auswertestelle für Störfälle und Störungen in verfahrenstechnischen Anlagen = database of the central reporting and evaluation office for hazardous incidents and incidents in process engineering facilities). As far as it is known, the cause of the accident is also named, in order to recognize which recommendations are required for refineries.

- Several substances release in China, 2006
- Substance release at a sealing, during winter temperatures, 2006 Austria
- Fire caused by substance release, 2006 Great Britain
- Substance release caused by sinking of the foundation of a storage tank, 2005 Belgium
- Explosion after malfunction of a column fill level measurement as well as human behavior, 2005 USA
- Fire caused by broken pump (possible missing maintenance), 2000
- Fire caused by leakage after repair, 1998
- Substance release caused by operating error, 1998
- Heavy sooting flare after power outage, 1997
- Substance release as a result of faulty welding, 1996
- Fire at maintenance works after usage of a pump, that was unsecured against explosions
- Fire caused by an ignition operating error at a hot flange, 1994
- Fire caused by welding activities, 1994
- Explosion caused by leakage of a pipeline, 1994
- Substance release caused by malfunction of a control valve, 1994
- Fire caused by breaking of a not properly fixed screw joint, 1987

5.3 THE RECOMMENDATIONS

When refineries are being evaluated and examined the following, already existing recommendations and checklists, should also be considered apart from the recommendations presented here.

1 Substance
2 Overfill safety systems
3 In-plant pipeline safety
4 Joint storage
5 Sealing systems
6 Wastewater split-flows
7 Transshipment
8 Fire protection policy
9 Plant monitoring
10 Internal alarm and hazard control planning
11 Industrial plants in areas with risk of flooding
12 Structure of safety reports
13 Storage facilities
14 Equipment of tanks

Based on this, organizational and technical recommendations are given.

The recommendations are divided in two parts.

Part 1 deals with the basic questions of the plant safety. Besides the general requirements, organizational recommendations can be found for the implementation of the safety management system.

Recommendations for technical safety requirements on the structure and equipment of refineries, with regards to water protection, are given in part 2.

At a closer look on the substances used in a refinery, we come to realize that liquid substances are most hazardous to water. These recommendations were created to improve the water pollution control and since gaseous substances are not hazardous to water, they were barely taken into consideration. But the solid substances are considered here, because there is a certain possibility that they could get into the water by being washed out (e.g. with the waste water).

Besides the release of substances due to leakages, there is also an increased danger of fire-outbreak and explosion in refineries. These kinds of events can also lead to water pollution. For this reason, this point will be dealt with in details.

Furthermore, the flare in refineries is a very important safety device which disposes off media in a safe manner via a safety valve.

Also a refinery holds a large number of cooling and heating devices that are going to be discussed in details.

An overview of the recommendations gives the following configuration. You can find here the subjects for which recommendations were developed.

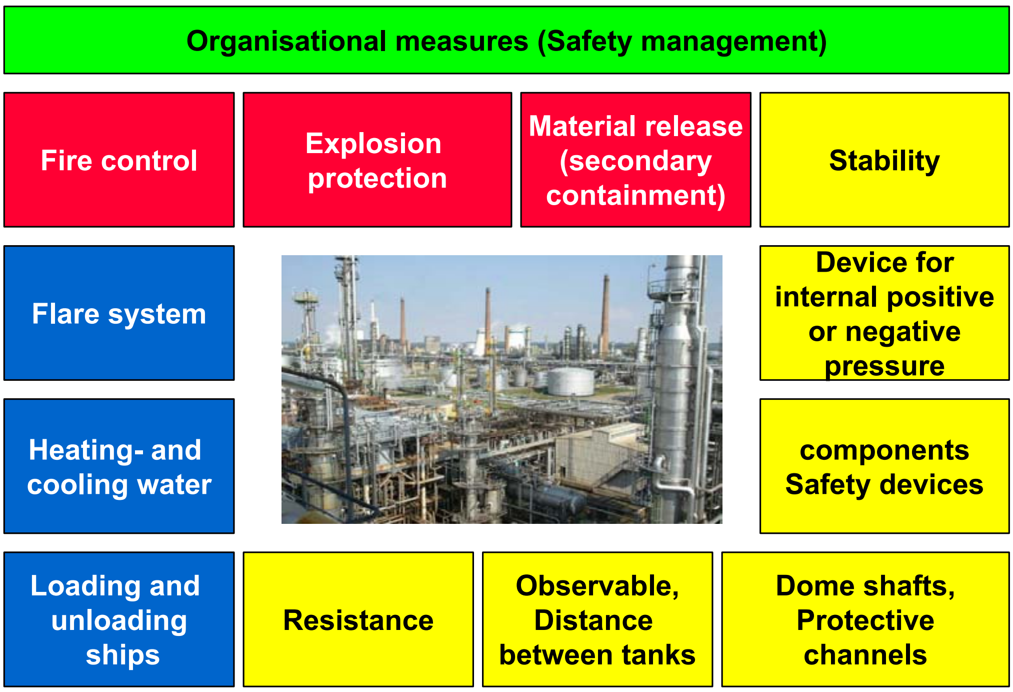


Figure 4: Structure for the recommendations for refineries

6 SEMINARS

The available checklist method for plant assessment and checking was presented to a selected group of inspectors belonging to the responsible authority of the countries along the Danube river basin, and proven of its applicability, during the training seminars. With the use of the checklists and the help of the trained inspectors the efficiency as well as the comparability of the technical safety checks can be improved.

This represents the base for an improvement of the plant safety status with regards to water protection; therefore, the trained inspectors act as knowledge multiplier in their countries.

Two four-day seminars were conducted.

1. from 19.09.2005 to 22.09.2005 in Schwedt/Oder, Germany
2. from 18.07.2006 to 21.07.2006 in Venus, Mangalia - near Constanta, Romania

The first seminar should present the status of the safety equipment in a modern refinery. Its outcome should be the development of ideas for the recommendations for refineries.

The second seminar turned its attention to the presentation of the difference in the safety policy, and linked to it, the difference of the safety level of two refineries in Eastern and Western Europe.

The seminar should also observe if the presented method for plant checking and assessment is suitable for checking of plants of the same industry at different stages of safety level.

Furthermore, the current development status of the new recommendations and the method for determining the real risk was presented and discussed.

6.1 PARTICIPANTS

The attendance on both seminars was of about 20 inspectors belonging to the environmental protection agencies of the 13 countries bordering the Danube. ICPD proposed 2 inspectors from each of the 13 countries, who were properly informed and invited. Unfortunately, there were different responses of the countries bordering the Danube River. For example, the Czech Republic did not participate at any of the seminars.

6.2 SEMINAR IN SCHWEDT/ODER, GERMANY

The method for checking and assessment of the plants handling substances hazardous to water and the checklists and their applicability were presented during the first two days of the seminar.

The development of the PCK GmbH refinery to an environmentally conscious and efficient enterprise was explained during several presentations. They spoke on topic like emissions, safety engineering and the problem wastewater and water hazardous substances.

The theoretical knowledge acquired during the last two days of the seminar was to be applied practically on the third day. For this purpose, in coordination with the PCK refinery GmbH, a common unit was selected in every refinery. This is important because a refinery in Romania will be the focus of the next year's visit and a conclusion will be drawn on the different level of the safety engineering in the refineries.

The crude oil atmospheric distillation number 3 was chosen for the plant visit.

Figure 5: Participants of the plant visit - PCK GmbH refinery

Divided into two thematic groups, the participants used the checklists on different subjects:

The first group examined the storage as well as the desalting of the crude oil and the second group visited the actual atmospheric distillation.

The first step after the visit was to split the plant into smaller components and then determine which of the many checklists should be applied. The question about which of the checklists is appropriate was then discussed thereafter. This discussion was used by the inspectors to table and clear all theoretical and practical details.

The last day ended with intensive discussions of the topics in groups as well as presentation and discussion of the result.

The last point on the agenda was the presentation of the first draft of the Recommendation for Refineries. This draft, based on the BAT (Best Available Technique) for refineries, takes in consideration all refinery specific safety aspects regarding water protection.

6.2.1 Results

All participants agreed that this method is very suitable for plant checking and assessment. They were surprised how complex the examination could be when applying the checklists method. However, the participants still do not have the assessment regarding the quantification of the actual risk, which will be a component and an important result of the project.

Furthermore, there was the wish that the industrial plant site visit and the practical training with the checklists should be expanded. Training on the application of the checklists using theoretical examples will be expanded in the next seminar. Trying to expand the industrial plant site visit will be asking too much from the plant operators.

6.3 SEMINAR IN CONSTANTA, ROMANIA

The second seminar implemented the wishes of the first's seminar participants, to extend the practical part.

Therefore, the first day ended with a common exercise. A storage facility was presented and checked via the storage checklist.

Theory and practice were combined also on the second day. The presented subjects were sealing systems, in-plant pipeline safety and fire protection policy. These topics were enhanced by small practical group tasks.

The improved recommendation for refineries and the checklist for contaminated sites were presented and heavily discussed during the afternoon of the second seminar day.

On the third training day, the theory had to be put into practice. For this purpose, together with the "ROMPETROL" refinery in Constanta, a similar facility was selected, as already done during the last year in Schwedt/Oder, at the PCK GmbH refinery.

The crude oil atmospheric distillation was chosen for the plant visit.

Figure 6: Seminar participants

Divided into two thematic groups, the participants used the checklists on different subjects:

The first group visited the crude oil storage and the second group visited the actual atmospheric distillation.

After the visit, the plant was divided into the proper plant units and it was analyzed which one of the various checklist must be applied in each case. Afterwards, each item of the checklist was discussed. The inspectors used the discussion round to find out all theoretical and practical details.

The last day ended with intensive discussions of the topics in groups as well as presentation and discussion of the result in a large group.

The seminar ended with the presentation and subsequent exercise on the method for determining the real risk.

6.3.1 Results

All participants agreed that this method is very suitable for plant checking and assessment and becomes more effective through the result of this project.

The participants discussed mostly the method for quantification of the real risk. They all agreed to some important indications that will be introduced in the further development of the project documentation.

7 PRESENTATION, COMMUNICATION

This project is "kept alive" through the effect of multiplication. Therefore, the communication of the aim, the intermediate results and the final results are very important for the success of the project. The following were achieved:

1. Creation of a web page and regular updating
2. Preparation of 2 flyers
3. Preparation of the proper quarterly reports
4. Attendance on the 32nd APC EG Meeting in Berlin, on 23.09.2005
5. Presentation of the tasks at the first convention of the Accident Prevention Task Group, held at the same time