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Planning for Environmental Risk Reduction in China: Training Plan and Activities (2013-2016)

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Preface

This report provides documentation of the training activities carried out under the Sino-Norwegian cooperation project “Planning for cost-effective environmental risk reduction”, which began in 2013 and ended Spring 2016. The project involved capacity building of governmental staff in China, working with environmental planning and emergency management.

The report represents a “living document” written and compiled by Rasmus Reinvang during the course of project implementation. As the document has grown over several years, different parts may have slightly different styles. Several other persons have contributed to the text, by authoring different internal project documents (such as separate training evaluations or study tour reports) that partly are included or referred to in different sections of this document. Instead of trying to list all authors that have been involved in producing different pieces of text, we have put Rasmus Reinvang as the author and editor of this report and have in sections quoting larger portions of text by others, mentioned the specific authors where relevant. This is for instance the case with individual study tour reports. At times there is a distinction between the general presentation by Vista Analysis and input from Chinese Academy of Environmental Planning or Statistics Norway (chapter 6.2) in the report. This is clearly marked by noting explicitly that certain input came from CAEP or Statistics Norway. Vista Analysis is responsible for the text as whole, as it stands here.

Dr. Haakon Vennemo

Project leader

Vista Analyse AS

Content

Summary

The Sino-Norwegian cooperation project "Planning for cost-effective environmental risk reduction" (2013-2016) included a training program for governmental staff in China working with environmental planning and emergency management.

The training program consisted of six different activities, under Project activity 6:

- Activity 6a: Training (lecture) of environmental planning methodologies for 100-150 participants from institutions at province and city level, at the annual seminars of the Ministry of Environmental Protection (MEP).
- Activity 6b: Training of 5 trainers from Chinese Acedemy of Environmental Planning (CAEP) - "Training of Trainers" (ToT).
- Activity 6c: In-depth training of 90-120 representatives from pilot provinces Guizhou, Jiangsu) and cities (Anshun, Tongling)
- Activity 6d: Training in GAINS methodology, in China and/or Austria, of about 10 representatives from CAEP and MEP.
- Activity 6e: In-depth training in MSG-6 methodology for one CAEP representative, in Norway
- Activity 6f: Study tour to Norway/Europe for a Chinese team from MEP.

Overall conclusions

The training program was carried out according to plan, with some adjustments reflecting project adaptability and hands on management. Cooperation went well and smooth between Vista Analysis, CICERO and CAEP, in spite of the geographical distance between the Norwegian and Chinese team during most of the project implementation period. Possibly the biggest practical challenge when implementing the training program was the changes of staff in the trainers team at CAEP (activity 6b). This was handled by an increased effort towards the end of the project to bring new CAEP project staff up to speed. Below, we sum up performance versus original plan for the six training activities in the training program.

Table AA: Planned timeline for the trainings (Q1= January-March 2013)

Activities	2013			2014				2015			
	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
6a: Training at MEPs annual seminar		x				x				x	
6b: Training of trainers			x		x		x		x		
6c: In-depth training of target group			x		x				x		
6d: GAINS training		x	x								
6e: MSG-6 training				x	x			x			
6f: Study tour Norway					?	?			?		

Table BB: Ex-post timeline for the trainings (Q1= January-March 2013)

Activities	2013			2014				2015			
	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
6a: Training at MEPs annual seminar		x				x				0	
6b: Training of Trainers	X			X			X		X	X	X
6c: In-depth training target group					X		X		X		X
6d: GAINS training			X								X
6e: MSG-6 training				0	x			x			
6f: Study tour (Germany & Czech Rep)											X
* Differences from the original plan (ref. table A), are marked with "X" or "0" (did not happen)											

Training at MEP's annual seminar (activity 6a)

As shown in tables AA and BB above, Vista Analysis carried out one less training (lecture) at MEP's annual seminar than planned. This was due to convergence of MEP's annual conference with the final training of pilots in November 2015, and core project team (Vista & CAEP) decided to prioritize the final training of pilots. The final training of pilots was especially important, as this was to be led by new trainers at CAEP under guidance and inspection from Vista. We consider that the lack of participation at MEP's annual conference in 2015 has not hampered dissemination of project findings significantly, and was to some extent compensated for by the final conference (ref. chapter 9).

Training of trainers (activity 6b)

As shown in tables AA and BB above, Vista Analysis carried out two more ToT-sessions than planned, towards the end of the project. This was instigated by changes in staff on the CAEP side, making it necessary to make an increased effort to bring the new trainers that joined the project in the last year up to speed. As shown in chapter 3, the project team succeeded in bringing the whole trainers group up to an advanced knowledge level qualifying them to be trainers in their own right after Project end.

In-depth training of target group (activity 6c)

As shown in tables AA and BB above, Vista and CAEP carried out 4 and not 3 trainings of pilots. The extra training in Anshun in Q8, was carried out to compensate for the low participation in the training held in Q6 in Beijing. A comparison of the baseline survey (2013) and the final survey (2016) of knowledge levels in the target group (ref. chapter 4.11), shows a consistent and substantial positive development in the group between the start and end of the project.

GAINS training and MSG-6 training (activities 6d and 6e)

As shown in tables AA and BB above, the GAINS and MSG-6 training was carried out as planned - with some adjustments of the timeline. Study tour reports document learning content and an advanced understanding by the participants.

Study tour to Norway (activity 6f)

As shown in tables AA and BB above (and described in chapter 7), the study tour to Norway was delayed and finally carried out as a study tour to Germany and the Czech Republic. The study tour was well-connected to the training program of the Project, as it included visits to institutions and direct experience of best practise internationally that had been presented in lectures during the trainings. The learning outcome was thus not significantly hampered by the change in destination.

1. Introduction and background

1.1 Introduction

This report provides documentation of the training activities carried out under the Sino-Norwegian cooperation project "Planning for cost-effective environmental risk reduction" (henceforth referred to as "the Project"), which began in 2013 and ended in Spring 2016. The project partners were Vista Analysis and CICERO (Centre for International Climate and Environmental Research - Oslo) on the Norwegian side, and CAEP (Chinese Academy of Environmental Planning) under MEP (Ministry of Environmental Protection) on the Chinese side. The project involved capacity building of governmental staff working with environmental planning and emergency management in China. For a full presentation of the Project, including links to project resources (presentations and reports), please consult Vista Analysis's website.[1]

This report consists of the training plan of the project, as it was planned during the inception phase and adjusted during the implementation of the project. It has been a "living document" during project implementation, and this is reflected in this report. In the next section (subchapter "1.2 Background"), we provide an overview and timeline for the six training activities planned in the project. In the following, the implementation of each activity is presented in an own chapter, as it unfolded.

This report thus provides documentation of the implementation of the training activities in the Project, and we hope this may provide valuable insights for other parties involved in or planning capacity building work in China.

1.2 Background: Target group and training activities

One of the main outputs of the Project are "training on environmental planning and risk reduction methodologies" for MEP, CAEP and provincial and city Environmental Protection Bureau (EPB) staff.

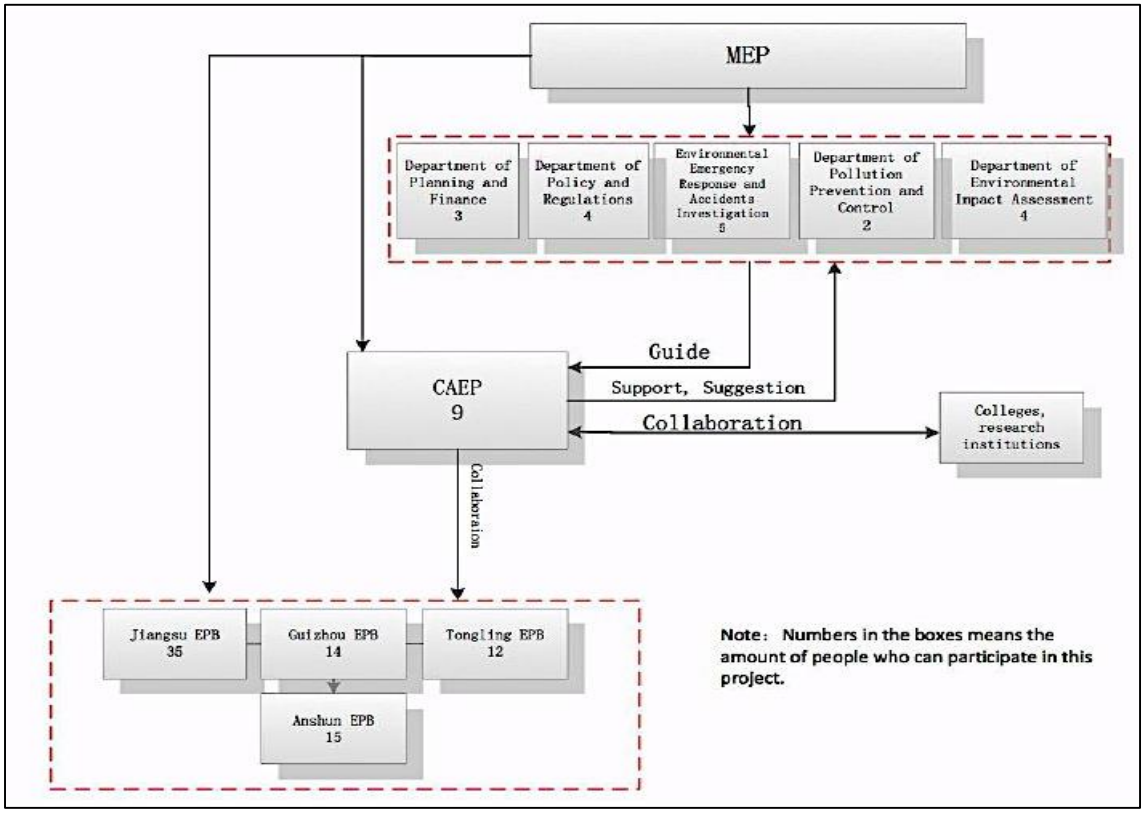
In the project, there is a core project group on the Chinese side consisting of CAEP staff. In addition to participating in the general trainings (ref. chapter 4), they also received special training (ref. chapter 3) aiming at qualifying them to become future trainers in the core project topics.

At the beginning of the project (2013), the full target group consisted of 103 persons:

- Central level: MEP and CAEP, 27 persons in total.
- Provincial level: EPBs in Jiangsu and Guizhou provinces, 49 persons in total.
- City level: EPBs in Tongling and Anshun cities, 27 persons in total.

[1] Vista Analysis's website has a webpage dedicated to the project, available at: http://vista-analyse.no/no/fokusomraader/klima-milj-og-energi/planning-for-cost-effective-environmental-risk-reduction-in-china/

Figure 1: The project target group, as defined in the baseline report



Source: Baseline Study of Environmental Planning and Risk Management in China, Vista Analysis report 2013/37.

The training program of the Project was to be provided through activity 6 in the Project plan, which consists of:

- Activity 6a: Training of environmental planning methodologies for 100-150 participants from provincial EPBs and related institutions at MEPs annual trainings.
- Activity 6b: About 5 instructors from MEP/CAEP trained.
- Activity 6c: Follow-up and in-depth training for pilot provinces (total of 90-120)
- Activity 6d: Training in China or Austria of about 10 CAEP and MEP representatives in GAINS.
- Activity 6e: In-depth training on MSG-6 in Oslo, Norway
- Activity 6f: Study tour to Norway for a Chinese team from MEP.

Table A. Planned timeline for the trainings (Q1= January-March 2013)

Activities	2013			2014				2015			
	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
6a: Training at MEPs annual seminar		x				x				x	
6b: Training of trainers			x		x		x		x		
6c: In-depth training of target group			x		x				x		
6d: GAINS training		x	x								
6e: MSG-6 training				x	x			x			
6f: Study tour Norway					?	?			?		

2. Training at MEP's annual seminar (activity 6a)

Training of participants at MEP's annual seminar took place in the form of a lecture by a member of the core project team (Vista), giving an updated overview of best practice with environmental planning and risk methodologies based on the research in the Project.

2.1 Lectures carried out by Vista at MEP's annual seminars

2013:

- "Annual conference for environmental planning in China", Taiyuan, Shanxi province 16-17 August 2013.
- Lecture by Rasmus Reinvang: "Integrated economic and environmental planning: Introduction and international experiences".
- Around 200 representatives of central and local academies for environmental planning attended the conference, and an estimated 35 representatives attended the parallel session where Reinvang presented his lecture.
- Presentation available at: http://www.vista-analyse.no/site/assets/files/6621/integrated_economic_and_env_planning_taiyuan_aug2013.pdf

2014:

- "5th forum of environmental risk and damage assessment", Beijing 21-22 October, 2014.
- Lecture by Rasmus Reinvang: "Environmental risk management in Europe and the United States".
- About 80 representatives of environmental institutions of 10 Chinese provinces participated.
- Program and presentations are available at: http://vista-analyse.no/no/fokusomraader/klima-milj-og-energi/planning-for-cost-effective-environmental-risk-reduction-in-china/

- Beijing, November 2014: It was agreed in the core project group that the lecture "Oslo case: Urban planning and environmental risk management" that was presented at the second training for pilots (ref. activity 6c below), should be given at the next MEP annual seminar.

2015:

- Anshun 20-22 May 2015: Rasmus Reinvang gave an orientation to CAEP staff about the HarbourEx15 full-scale rescue and cooperation exercise in Oslo's main harbor 28-29 April 2015. It was agreed that relevant experiences should be included in the next lecture (about Oslo) at the MEP annual seminar.

- In early fall, date of this year's MEP Annual Seminar set to November 2015.
- Due to convergence with the Suzhou pilot training event (incl. final training-of-trainers session, ref. chapter 4), it was in November decided to prioritize the Suzhou event and cancel the Vista lecture at the MEP annual seminar.

3. Training of trainers (activity 6b)

3.1 The approach to the Training of Trainers (ToT)

The Training of Trainers (ToT) should take place in relation to the in-depth training of the project target group (ref. chapter 4). The main idea is that:

- The trainers should participate in preparation and *support* execution of the training in Q4, which is led by Vista Analysis. Trainers are interviewed post training and receive feedback on their performance.
- The trainers would participate in preparation and *take an equal part* in the training in Q6, which is led by Vista Analysis. Trainers are interviewed post training and receive feedback on their performance.
- The trainers would participate in preparation and *lead* the training in Q10. Trainers are interviewed post training and receive an individual confirmation from Vista Analyse that they have been trained as trainers in a certain topic.

Table B. Planned timeline for the training-of-trainers (Q1= January-March 2013)

Activity	2013			2014				2015			
	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
6b: Training of trainers			x		x		x		x		

Trainers should at the end of this process be qualified to train provincial EPB staff in the following topics:

- Principles and practical application of Cost-Benefit Analysis in relation to environmental planning, risk prevention and control
- Principles for application of Strategic Environmental Assessment methodology in relation to environmental planning, risk reduction and control
- International experiences with planning for cost-effective environmental risk reduction

It was recommended that each person from CAEP have a main area of training competence: CBA, SEA or international experiences in cost-effective environmental risk reduction. The trainers to be trained in these topics were the following CAEP staff: Yu Fang, Cao Guozhi, Dong Jingqi, Jia Qian, Zhou You and Tian Chao.

Note:

- As Dong Jingqi was moved to a different department Spring 2015, she was replaced by Li Chao (from Spring 2015).
- As Zhou You and Tian Chao were moved to a different department Summer 2015, they were replaced by Zhu Wenying and Wang Kunpeng (from Summer 2015).

It was suggested that different trainers were also given responsibility for different main topics, so that two trainers were trained more in depth in CBA (Jia Qian, Tian Chao/Zhu Wenying), two were trained more in depth in SEA (Dong Jingqi/Li Chao, Zhou You/Wang Kunpeng). Responsibilities were determined early in the project.

3.2 Training of Trainers activities

Besides the general follow-up and cooperation with the CAEP-team on scientific issues, which contributes to knowledge development on both sides, the following and more specific TOT-activities may be noted:

2013:

- At the beginning of the project (April, 2013), the baseline knowledge level of the CAEP team with regards to project topics was mapped using questionnaires.
- A summary of the baseline situation was synthesized and discussed in November 2013, and is presented in table C below. Names have here been anonymized.

Table C. Baseline knowledge level of CAEP trainers 2013* (anonymized)

	Education	Degree of knowledge of				
		CBA	*SEA*	*International experience with env. planning*	*International exp. with env. risk management*	*GAINS & MSG6*
A	PhD, Civil and environmental engineering	5	4	4	3	3
B	PhD-candidate, Environmental plan and management.	5	4	4	3	3
C	Master of Science, Environmental plan and management.	2	2	3	3	1
D	Master of Law, Economic and environmental law.	5	2	2	1	1
E	Bachelor of Science, Environmental plan and management.	2	2	3	2	2
F	Master of Science, Environmental and Water Resources Engineering	3	2	2	1	1
G	PhD, Institute of Geographic Science and Nature Resource Research	4	3	3	2	3
H**	Master of Environmental Management	3	2	3	3	1
I***	Master of Engineering, environ. science	2	1	3	2	1
J***	Master of Science, environ. science	2	1	2	3	1
K****	PhD, environmental epidemiology	2	2	2	4	3
Average score		***3.2***	***2.3***	***2.8***	***2.5***	***1.8***
* Mapping of CAEP staff skills of April 2013. F and H have their degrees from US universities.						

** Skills level for H as of April 2015. / *** Skills level for I and J as of 1. September 2015. / **** Skills level for K as of September 2015.

In the survey we distinguished between five knowledge levels;
Level 1 = No knowledge, Level 2 = Basic knowledge (familiarity), Level 3 = Theoretical knowledge, Level 4 = Application level knowledge, and 5 = Expert level knowledge.

2014:

- Haakon Vennemo carried out a 1-day workshop for CAEP-staff at the CAEP office in Beijing 29. March, with the topic "SEA and CBA – introduction and case studies". 5 CAEP-staff participated. The presentation and a report from the training are available from Vista's archive.

- Vista Analysis and CAEP collaborated on development of the lectures and case exercises for the first project workshop in Tongling, 28-29 March 2014 (ref. activity 6c), where presentations were held and the two case study exercises carried out led by Vista Analysis and with assistance by CAEP.

- Rasmus Reinvang carried out a ToT-session at CAEP's premises in Beijing 23. October 2014, consisting of a
    - *Review of the training in Tongling, preparation of the next project workshop in Beijing (ref. activity 6c).*
    - *An exercise (3 hours) where CAEP-staff led a "mini-training" and received feedback. 7 CAEP-staff participated. A report of the ToT-session is available from Vista's archive.*

- Vista Analysis and CAEP collaborated on development of the lectures and refinement of case exercises for the second project workshop in Beijing, November 2014 (ref. activity 6c), where presentations were held and case study exercises were carried out led by CAEP (Jia Qian/CBA and Dong Jingqi/SEA) with assistance from Vista Analysis.

2015

- Beijing, 8-9 April: Rasmus Reinvang carried out a ToT-session at CAEP's premises in Beijing 8-9 April, consisting of a
    - *Review of the training in Beijing November 2014, based on written evaluation from Jia Qian and Dong Jingqi. The written evaluations are available from Vista's archive.*
    - *Preparation of the next project workshop in Guizhou (May, 2015); content and training requirements*

- April, baseline knowledge level of new team member – Li Chao – was mapped using a questionnaire. Main entries are included in the table above.

- Anshun, 20-22 May:
    - *Rasmus Reinvang followed up on Li Chao (new SEA-trainer, replacing Dong Jingqi), who had studied relevant case exercise material. It was agreed that Li Chao and Zhou You together will test the SEA case exercise and send it to Rasmus for comment in June.*
    - *Vista Analysis provided CAEP (Jia Qian) with an adjusted version of the CBA and SEA case exercises document. CAEP to check translation by June 30.*

  - *Rasmus Reinvang gave an orientation to CAEP staff about the HarbourEx15 full-scale rescue and cooperation exercise in Oslo's main harbor 28-29 April 2015.[2] It was agreed that relevant experiences should be included in the next lecture at the MEP annual seminar (ref. activity 6a above).*

- June-September / SEA
  - *Rasmus Reinvang provided feedback and follow-up tasks to Li Chao and Zhou You, after they submitted their reply to the SEA case exercise.*
  - *As Zhou You was moved to MEP, Wang Kunpeng was brought in as replacement for Zhou You.*
  - *Li Chao and Wang Kunpeng responded to follow-up tasks from Rasmus Reinvang, after which Rasmus provided final comments and clarifications.*

June-September / CBA

- As Tian Chao was replaced by Zhu Wenying as trainer, it was decided that Zhu will practice by answering the CBA case exercise.
- Haakon Vennemo went through Zhu's answer and provided comments and corrections, to Jia Qian and Zhu Wenying (2 rounds).

October

- Rasmus Reinvang revised SEA case exercise to better address Chinese concerns, after which Li and Wang adjusted and improved Chinese translation.
- Haakon Vennemo revised CBA case exercise to better address Chinese concerns, after which Jia Qian and Zhu Wenying adjusted and improved Chinese translation.

3.3 Final ToT report, Suzhou training November 2015

By Rasmus Reinvang, with input from J.M. Skjelvik, Jia Qian and H. Vennemo.

Background

Castle Hotel in Suzhou was the venue for the final training of pilots 19-20 November, which was to be led by CAEP trainers with support from Vista Analysis. 52 representatives from pilot provinces participated in the training (see list of participants, in Vista Analysis' files).

Due to changes in CAEP personnel, Li Chao (focus on SEA case), Wang Kunpeng (focus on SEA case) and Zhu Wenying (focus on CBA case) had in the preceding months prepared by testing the case exercises. Wang and Zhu only joined the project in the recent months.

During Summer/Autumn 2015, Li, Wang and Zhu submitted written answers to the exercises and received written comments to answers from Vista (Reinvang for SEA,

[2] For more information about HarbourEx15, see: http://www.dsb.no/nn/HarbourEx15/About-the-exercise/

Vennemo for CBA). Finally, the last details were sorted out in email communication to ensure a common understanding of the exercise, including pedagogic design: The learning outcome the exercises are intended to provide and how to stimulate that learning outcome among trainees.

Activities 18 Nov. 2015: Preparations

- A meeting was held in the afternoon between Reinvang and Skjelvik from Vista Analysis and Wang and Zhu from CAEP to prepare for the training of pilots.
- In the meeting details of the exercises were discussed in order to ensure a deep understanding, and some minor corrections were identified and corrected.
- In the meeting Wang and Zhu were taught how to conduct and plan an interactive training session, and how to stimulate discussions facilitating development of understanding among the trainees.

- Due to late arrival of Li Chao, another preparation meeting was held between Vista Analysis and the whole CAEP training team (Li, Jia, Wang, Zhu) in the early evening. At the meeting a common understanding of the following days activities was ensured among the whole group, and the Chinese team was encouraged to discuss and plan in more detail how to guide the trainees and what learning outcome to aim for related to the different questions in the case exercises.
- After the Vista-CAEP meeting, the Chinese team had a separate session discussing and planning the training in more detail.

Activities 19 Nov. 2015: The SEA training

- About 40 participants from 13 counties in Jiangsu were present (see roster)
- After the opening, Li provided a lecture on principles of SEA and Wang presented the main points of the SEA case exercise.
- Li and Wang then guided the trainees through the group work session, with support from Jia and Zhu (after lunch Li left and Wang led the training alone).
    - *The CAEP trainers ensured discipline among the trainees and the groups apparently worked well and focused together.*
    - *The CAEP trainers kept a close eye on the time and the training proceeded according to schedule without any problems or delays.*
    - *Wang led the last plenary session in an authoritative manner, calling different groups to answer different questions and inviting other groups to share alternative answers and/or comment.*
    - *Different groups had different and justified approaches to certain of the questions (especially 3c about the programme of measures), which illustrated the complexity and political trade-offs involved in SEA.*
    - *Wang commented on the answers and stressed different learning points, which contributed positively to the learning outcome.*

- After the training, Vista Analysis and CAEP briefly reviewed the session and all sides agreed orally that the training session had worked well.

Activities 20 Nov. 2015

- About 30 participants from 13 counties in Jiangsu were present (see participant list).
- Jia provided a lecture on the principles of CBA and Zhu presented the main points in the CBA case exercise.

- Jia and Zhu then guided the trainees through the group work session.
    - *The CAEP trainers ensured discipline among the trainees and the groups apparently worked well and focused together.*
    - *The CAEP trainers kept a close eye on the time and the training proceeded according to schedule without any problems or delays.*
    - *Zhu lead the last plenary session in an authoritative manner, calling the different groups to answer different questions.*
    - *The other groups were urged to comment and put forward other views or solutions than the once presented, and there was a discussion around some of the answers.*

- After the session an informal enquiry revealed that none of the trainees had done a CBA before, and several found the tasks difficult to answer. Many of them thought that what they had learnt would be useful for their future work.

- The session was closed at 15.30 as participants needed to leave early for home (this was a Friday). This meant that there was reduced time to answer the questions properly and go through the results (about 1 hr. was used for the discussion). This was unfortunate and it was clear that a full day's work (9-17) is necessary in order to process and discuss findings of the CBA case.

Figure 2: Photos from the training of pilots in Suzhou, November 2015

Overall findings of the written evaluation of participants.

- 31 of 61 participants (50%) filled out a questionnaire evaluation of the training session. (This survey is summed up in a separate evaluation report.)
- 94% of the respondents expressed that they considered the quality of the training to be good and that the case studies were relevant. 97% of the respondents stated that they would recommend the training course to other people.
- For more details from the written evaluation, please consult the full evaluation report (available from Vista Analysis's archives).

Final comments and suggestions for the future, by Vista Analysis and CAEP

- In the final pilot-training of the project, CAEP trainers were able to conduct the training well even though there had been recent changes in the training team.

- Feedback from participants and the mid-term review indicate that there still is a need among EPBs and research institutes for training in SEA and CBA, and through the project CAEP has developed capacity to follow-up on this.

- A recurring theme among participants is that it would be nice to (also) use Chinese case studies, drawing on concrete Chinese experiences. This is something CAEP may look into and include in future training.

- This was the first occasion for several of the trainers to conduct a training. It is recommended that CAEP finds opportunities relatively soon for the trainers to engage in training activities, so that they can continue their development as trainers.

- During trainings it has been observed that capacity to absorb training varies quite significantly between different provinces and institutions. It may be a good idea to distinguish between "high capacity EPBs/research institutes" and "medium capacity EPBs/research institutes", and provide more simple exercises for the latter group. For instance, especially the CBA case exercise is quite difficult and trainees who have no experience with CBA or the use of excel tools, would benefit from a simper version of the exercise.

3.4 Knowledge level of trainers at end of project

In January 2016, a survey was carried out where the trainers self-reported their knowledge levels of key topics in the project, as was done at the beginning of the project (or when a person joined the project). The results are presented in table E below.

In the survey we distinguished between five knowledge levels;
Level 1 = No knowledge, Level 2 = Basic knowledge (familiarity), Level 3 = Theoretical knowledge, Level 4 = Application level knowledge, and 5 = Expert level knowledge.

Table D. Knowledge level of trainers (anonymized); baseline (b) and end of project (b)

Name	Degree of knowledge of									
	CBA		*SEA*		*Int. experince with environmental planning*		*Int. experience with environm. risk management*		*GAINS*	
	b	*e*	*b*	*e*	*b*	*e*	*b*	*e*	*b*	*e*
A*	5	5	4	5	4	5	3	5	3	3
B*	5	5	4	5	4	3	3	5	3	5
C*	2	5	2	4	3	5	3	5	1	5
D*	5	4	2	3	2	4	1	5	1	2
E*	2	4	2	4	3	4	2	4	2	4
F*	3	5	2	3	2	3	1	5	1	3
G*	4	5	3	5	3	5	2	5	3	5
H**	3	4	2	5	3	4	3	5	1	4
I***	2	4	1	5	3	4	2	5	1	3
J***	2	4	1	3	2	4	3	4	1	3
K****	2	5	2	4	2	4	4	5	3	3
Average	***3.2***	***4.5***	***2.3***	***4.2***	***2.8***	***4.1***	***2.5***	***4.8***	***1.8***	***3.6***

* Mapping of CAEP staff skills of April 2013.
** Skills level for H as of April 2015.
*** Skills level for I and J as of 1. September 2015.
**** Skills level for K as of September 2015.

Table E. Planned vs. ex post (red) timeline for ToT (Q1= January-March 2013)

Activity	2013			2014				2015			
	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Planned			x		x		x		x		
Ex-ante	X			X			X		X	X	X

In order to monitor knowledge development in the target group, a mapping survey was carried out at the beginning and at the end of the project. Final results and a comparison with the baseline survey, is presented in Vista Analysis report 2016/12 “Final Survey of Target Group: Results and comparison with Baseline Survey”.

We here include the part of the summary of this report that describes the training of trainers:

”In the project, there was also a core project group on the Chinese side consisting of 11 CAEP staff. In addition to participating in the general trainings, they also received special training aiming at qualifying them to become trainers in the core project topics. Also here, we did a baseline survey and final survey of skills levels. The average results include all members of the core project group during the project, and it may be

noted that more than 50% of participants in the core group shifted in the course of the project. Nevertheless, the survey (ref. table above) shows consistent improvement on all topics, with an overall development from a familiar to theoretical knowledge level (2 and 3) in 2013, to applicable or expert (4 or 5) in 2016."

4. Training of project target group (activity 6c)

4.1 Timeline and progression (original plan)

There should be three 2-day in-depth trainings of the project target group, in the late fall of 2013, in the spring of 2014, and in the spring (postponed until fall) of 2015. The project target group consists of staff from relevant departments at MEP, CAEP staff, staff from the pilot provincial EPBs and staff from the pilot city EPBs. The output of activity 6c should be three trainings of 30-40 participants from the target group.

It was suggested that training to the extent possible takes place in the pilot provinces and cities, in order to reach the target group in the pilot provinces and cities effectively. In the project, the core project team should meet for an internal workshop every six months. This should to the extent possible be combined with the trainings.

Table F. Timeline for the in-depth training of the target group (Q1= Jan.-March 2013)

Activities	2013			2014				2015			
	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
6c: In-depth training of target group			x		x				x		

The first in-depth training should take place in Beijing in the late fall of 2013, and should be based on experiences and training material from phase 1 of the project; Cost-Benefit Analysis and Strategic Environmental Assessment. This material should be modified to meet the needs of the Phase II target group.

The second in-depth training should take place in xxx (tbd) in the spring of 2014. This training should follow-up on the first training (to some extent drawing on the same material) and also introduce new examples of best practice related to *environmental risk reduction planning methodologies* (utilizing the material from the international experiences report that was to be produced in the fall of 2013).

The third in-depth training should take place in xxx (tbd) in the Spring of 2015. This training should follow-up on the second training (to some extent drawing on the same material) and also introduce the prototype *framework for planning for environmental risk reduction* that has been developed by the core project team during 2014. The training should enable provincial and city EPBs to understand the prototype framework so that they can apply it in the first half of 2015, and report successes and failures.

The need for further training should be considered during project implementation.

4.2 Differences within the target group

A survey of competence levels in the target group is presented in the baseline report (Vista report 2013/37)[3] of the Project and showed interesting differences between

[3] The baseline survey is available in *Baseline study of Environment Planning and Risk Management in China*. Vista Analysis Report 2013/37.

different parts of the target group, which should be taken into account when designing the training:

- At central and city level almost all members of the target group are engaged in environmental planning work, and up to 35% in emergency response work.
- At provincial level 70% of target group members work with emergency response, and about 30% with environmental planning.
- The survey shows clear differences in experience with CBA and SEA between Jiangsu and Guizhou, with Jiangsu being more experienced: In Jiangsu 69% report experience with CBA, and in Guizhou 32% report experience with CBA. In Jiangsu 46% report experience with SEA, in Guizhou 23% report experience with SEA.
- With regards to knowledge of international experiences with environmental planning, there is a big difference between central level (where 28% report no knowledge) and the provinces/cities (where 60% report no knowledge). Also on this topic, Jiangsu EPB has a higher level of knowledge than Guizhou EPB.
- Knowledge of international experiences with environmental risk is higher than knowledge of international experiences with environmental planning, but again there is a clear difference between central level (where 18% report no knowledge) and provinces (where 44% report no knowledge).

Concerning training, the baseline report (Vista Analysis 2013/37) concludes:

- “It is suggested that practical case teaching should be introduced while theoretical training is carried out.” (p. 79)
- “Therefore, introduction, training and study of international experience in environmental risk prevention and control need major attention from this project.” (p. 91)
- “In addition, local environmental protection working personnel are more concerned about the practical use of various theoretical methods and how these methods adapt to work need is a critical problem that needs to be solved. Therefore, it is suggested that while teaching theoretical knowledge, this project can increase the introduction of specific policies and flow for the overseas application of the related technologies and methods in accordance with actual local conditions and conduct case analysis in the light of Chinese policy environment and actual local conditions.” (p. 95)
- “ It is suggested that training should be carried out separately according to the familiarity of different subjects with theoretical contents in the questionnaire, training should be given mainly to those that have great need but lack knowledge other than to those that have the knowledge in order to avoid repeated teaching.” (p. 95)

Some conclusions:

- Training should combine theory with practical examples and cases.
- Central, provincial and city level all need training in all topics, but provinces and cities more than central level, and especially Guizhou/Anshun.
- Generally there is a higher knowledge level of CBA than SEA, but since CBA is more commonly used and applicable a strong focus on CBA as well as SEA should be maintained.
- Generally, there is a higher need for training in international experiences with environmental planning, than in international experiences with environmental risk.

4.3 Experiences and recommendations from phase 1

The Project was a follow-up of an earlier project (2009-2011), aimed at improving effectiveness of environmental 5-year plans at the provincial level. The earlier project is referred to as "phase 1", while the Project is referred to as "phase 2". This earlier project also involved capacity building activities related to CBA and SEA, and this work was continued in phase 2. The phase 1 project did not include the same provinces and cities as in phase 2, however.

The mid-term review of the phase 1 project carried out by Stein Hansen and Guo Xiaomin[4] in February 2011, commented on the training carried out in phase 1 and provided recommendations.

Main points may be summed up as follows:

- "The reviewers recommend that a follow-up project focuses on ensuring deeper penetration of SEA, CBA and integrated planning in the Chinese planning process, methodologies, rather than spreading to new concepts and methodologies." (p. 28)
- "The training courses and materials are suitable to the skill needs of Chinese participants. Especially the group discussion stimulates the enthusiasm of participants and it is good for participants to use the knowledge that they learned from training to solve vases in practice." (p. 27).
- "An import part of the training seminar was the two case studies – one SEA case and one CBA case" (p. 17). Several interviewed participants "said that the "brainstorm-method" in the case study sessions were most useful to their actual tasks at home in their provinces" (p. 19).
- Finally, the reviewers propose to "enlarge the scope of training and deepen the study on specific policy processes of SEA and CBA and how they will be implemented in a Chinese policy context, and establish a systematic modeling training system." (p. 30).

4.4 Suggested generic format of the trainings in phase 2

The format should be a technical workshop.

Table G. Generic format of the three in-depth trainings

Generic format of the three in depth trainings	
Day 0	
	Arrival of core project team
	Preparation together with trainers from CAEP
Day 1	
09.00-10.00	Welcome
10.00-13.00 (break ca. 11.00)	3 different lectures on experiences (2 international, 1 Chinese) - One international lecture on methodology - One international lecture on a case study experience - One Chinese lecture on case study experience

[4] The mid-term review of the phase 1 project was commissioned by NORAD, the Norwegian Agency for Development Cooperation.

13.00-14.00	Lunch
14.00-18.00	Case study exercise with group work: CBA & environmental risk
Day 2	
09.00-12.00 (break ca. 10.30)	3 lectures on experiences (2 international, 1 Chinese) - One international lecture on methodology - One international lecture on a case study experience - One Chinese lectures on case study experience
12.00-13.00	Lunch
13.00-17.00	Case study exercise with group work: SEA & environmental risk
Day 3	
09.00-12.00	Core project team: Summary of workshop result / lessons learnt
13.00-16.00	Core project team: Any other business

With this format, the more experienced participants (often central level) could choose to only participate in the morning sessions. The less experienced participants (often province and city level) should participate in both sessions. One in-depth training should ideally take place in each pilot province/city, to ensure training at the local level and enabling wider local participation according to need.

The content of the trainings would develop through the project, as described in the section “Timeline and progression” above.

A number of training resources were available for the project, and we have mapped them below. New training resources could be developed according to need. Besides presentation of new case studies, this could also be new case study exercises focusing more explicitly on the use of CBA and SEA in an environmental risk planning context to fit the need of our target group. The APELL programme (ref. below) has also produced relevant studies with Chinese partners, and it may be relevant to draw resource persons into the trainings. Exact contents would be discussed and agreed within the core project team ahead of each training module.

4.5 Existing training resources

4.5.1 Training resources from phase 1

- Application of SEA and CBA methodologies in environmental planning.
  - *Book in Chinese (275 p.), which introduces SEA and CBA methodology, a guide for application of SEA and CBA, examples of best practises internationally with using SEA and CBA in environmental planning, and case study exercises for training.*

- Case study exercises on SEA and CBA (each exercise = 4-5 hours)
  - *SEA Case Study: Sustainable Transport Development on Regional Level*
  - *CBA Case Study: Improving Waste Water Treatment*

- Presentations from phase 1 seminars:
  - *Environmental planning: International experiences*
  - *Cost Benefit Analysis as a tool in environmental planning.*
  - *International experiences in environmental planning methodology – and priorities for improved implementation*
  - *Integrated macroeconomic and environmental planning in Norway*

  - *Air pollution control in Europe: Lessons and suggestions for China.*
  - *EU and the distribution of national emissions ceilings (NEC-directive)*
  - *CBA and SEA of hydropower projects and the hydro power plan in Norway*

- Chinese case studies documented in project reports from phase 1:
  - *Application reports from pilot provinces*
    - Hubei: SEA method and the total emission reduction plan
    - Jiangsu: SEA method and atmospheric pollution reduction
    - Yunnan: Application of CBA to total emission control of atmospheric and water pollutants
    - Guizhou: Application of CBA to control of SO_2 and NO_x pollution from the power sector

- International case studies documented in project reports from phase 1:
  - *CBA in air pollution policies: The case of the US Clean Air Act*
  - *CBA in air pollution policies: The case of the EU NEC Directive*
  - *SEA and CBA in water management: The Danube Case in the EU*
  - *SEA and CBA in hydro power planning: The Norwegian Master Plan for national development of hydropower resources*
  - *CBA in planning for improved land-based ecosystem services in the USA*
  - *Integrated land-use management in Murray-Darling Basin, Australia*
  - *CBA and SEA in integrated economic-environmental planning in Norway*

4.5.2 Other training resources (the APELL tools)

Awareness and Preparedness for Emergencies at Local Level (APELL) is a methodological tool developed by UNEP focusing on the local level for identifying possible industrial hazards, raising awareness of these hazards, and building local capacity for immediate, multi-party response. Specific guidance materials have been prepared for the chemical, mining and transport sectors, port areas and storage facilities, which have been applied in more than 30 industrial communities worldwide incl. China. Many of these tools seem to be relevant for the challenges and needs of the pilot provinces and cities in this Project. The core project team (CAEP) may check to what extent APELL tools already exist in Chinese, as China has been and is engaged in the APELL programme through MEP and Renmin and Tsinghua universities (ref. below).

APELL tools include:

- **Awareness and Preparedness for Emergencies at Local Level: a Process for Responding to Technological Accident** (1988) This “APELL Handbook” provides the basic concepts for the development of emergency response plans at the local level, with an emphasis on community awareness of potential dangers and preparedness for all contingencies.
- **Storage of Hazardous Materials: A Technical Guide for Safe Warehousing of Hazardous Materials** (1990) introduces practical guidelines for safe storage of hazardous materials, including information on key responsibilities, legal frameworks, product evaluation, warehouse siting and management, and fire and environmental protection.
- **Hazard Identification and Evaluation in a Local Community** (1992) describes a hazard analysis method and gives concrete examples of how to implement it. The report also contains several annexes that provide information

to enable local communities to identify and evaluate hazards.

- **APELL for Port Areas: Preparedness and Response to Chemical Accidents in Ports** (1996) sets out a procedure to improve community awareness of activities involving hazardous substances in port areas and to improve or create coordinated emergency response plans.
- **Management of Industrial Accident Prevention and Preparedness: A Training Resource Package** (1996) builds on and supports the APELL process. It can also be used as a freestanding trainers' package, addressing select issues.
- **TransAPELL: Guidance for Dangerous Goods Transport Emergency Planning in a Local Community** (2000) expands the APELL guidance beyond the risks associated with fixed facilities to include those arising from the shipping, distribution and transport of dangerous goods.
- **APELL for Mining: Guidance for the Mining Industry in Raising Awareness and Preparedness for Emergencies at Local Level** (2001) provides a framework for the preparation of an Emergency Response Plan for communities near mining operations.
- **Good Practice in Emergency Preparedness and Response** (2005) is a companion to "APELL for Mining". In 2003, the International Council on Mining and Metals (ICMM) decided to take the APELL process further by analysing emergency preparedness and response capabilities within both its corporate and association membership.
- **Disaster Risk Reduction – A Toolkit for Tourism Destinations, Practical examples from coastal settlements in Asia** (2008) provides information and resources for local municipalities and others involved in emergency planning and response. It includes information on steps such as: preliminary assessment; capacity building; disaster prevention; preparedness planning; and communicating and disseminating key information.
- **Assessing the Vulnerability of Local Communities to Disasters - An Interactive Guide and Methodology. Community Risk Profile Tool** (2008) provides communities with a means of making a rough estimate of the various types of risks they are exposed to, supporting the decision-making process, especially as to whether or not further assessments are needed. It is also a tool that can be used to support awareness raising and capacity building activities.
- **Disaster Risk Management for Coastal Tourism Destinations Responding to Climate Change – A Practical Guide for Decision Makers** (2009) provides disaster managers, local and municipal planners, as well as other stakeholders in the tourism sector, with practical guidance on how to better prepare for disasters in coastal destinations.
- **APELL Multi-Hazard Training Kit for Local Authorities – For Community Vulnerability Reduction, Prevention and Preparedness** (2010) consists of 15 modules containing information regarding a specific aspect of community preparedness for emergencies or a common industrial or natural hazard. It provides a summary of the most important principles and steps in improving emergency preparedness, as well as some of the most common hazards found worldwide.
- **Promoting Safer Operations and Emergency Preparedness in the Value Chain of the Chemical Sector - Case Study on APELL Implementation in China** (2011) captures results and lessons learned from a 2-year pilot project implemented by UNEP, the Ministry of Environmental Protection (MEP) of the People's Republic of China, and The Dow Chemical Company in the Yangtze International Chemical Industry Park in Zhangjiagang, China.

As listed above, a case-study on APELL implementation in the chemicals sector in China was conducted in 2011, with MEP as a partner (ref. Ren Longjiang, Division Chief, Environmental Emergency Response and Accident Investigation Centre, MEP). One of the outputs of the project was a "Guideline for Environmental Emergency Management in Chemical Industrial Parks", which was disseminated at national level. Another output was the establishment of a new "Policy and Regulation Research Institute on Environmental Emergency Management and Chemical Accident Prevention and Preparedness" at Renmin University and an "APELL/Responsible Production Research Centre" at Tsinghua University. The Global APELL 25th Anniversary Forum was held in Beijing in November 2011.

Especially the "APELL Multi-Hazard Training Kit for Local Authorities" (in which module 4-8 covers emergency planning, risk communication, fixed industrial installations, transport of hazardous materials and the role of small and medium enterprises) and the case study on the value Chain of the Chemical Sector in China, seem very relevant and may provide a basis for training modules in the project. Please note that the case study on the value Chain of the Chemical Sector in China is not available on the internet, as far as we (Vista) can see. It is worth checking whether this study is available from MEP.

4.6 Additional points brought forward by CAEP

- Trainings may be carried out in different groups, such as on "CBA", SEA" and "International experiences". Different trainers will be involved in different groups and target group member can sign up to groups according to interest and need.

- The case studies from Jiangsu and Guizhou produced during phase 1 give a good starting point for developing the training aimed at these provinces and should be studied during preparation of trainings.

- We can use the case studies from phase 1 on the US Clean Air Act and the EU NEC Directive, and more explicitly draw out the environmental risk reduction aspects.

4.7 The first training of pilots, in Tongling May 2014

The topics for the lectures and the case studies of the first training presented below, are taken from the range of methodologies and cases presented in the (draft) report "Tackling environmental risks with environmental planning: International experiences".

The case study exercises on CBA and SEA (Vista Analysis Report 2014/21) [5] were introduced in this training, and refined during the course of the project.

The training followed the format suggested above.

[5] Vista Analyse (2014): *Case Exercises: Using CBA and SEA to Reduce Environmental Risk in China*. Report 2014/21. By Rasmus Reinvang et al.

Table H. Program for pilot training in Tongling, May 2014

Program for pilot training in Tongling, May 2014
Day 0, May 27
- Arrival of core project team - Preparation with trainers from CAEP
Day 1, May 28
International lecture on methodology - "Seveso: EU's framework to reduce major environmental accident risks in industry" - Rationale: Preventing accident risk in chemicals, mining and smelting industries is a major concern in Jiangsu, Guizhou, Anshun and Tongling. - Comment by CAEP: Some of the pilots suggest we give a lecture on industrial park/regional environmental assessment and management methodologies and cases study. So we suggest this lecture focus on environmental risk identification, assessment and response of environmental risk not only for a single plant but also for industrial park/region (we think the assessment and management of industrial park/region environmental risk is based on single plant, but have more to consider, such as the domino effect), if the Seveso framework contains such methodologies, we can use them and give one or two cases. International lecture on case experience - "How to identify risks related to contaminated sites and prioritise response actions: The methodology from Superfund in the USA" - Rationale: Contaminated sites constitute a major environmental risk problem in especially Guizhou province and Tongling and this lecture may be helpful - Comment by CAEP: Suggest to add some introduction on the relationship between damage and risk of contaminated lands, and how different land use types or remediation targets influence the assessment and remediation actions. The methodologies and case presented here are knowledge basis and references for the case exercise in the afternoon. Chinese lecture (CAEP) - "Regional environmental risk assessments of heavy metals for local plan in Guangxi or Hunan province" - Rationale: Based on recent CAEP experience with three regional environmental risk assessments of heavy metals for local plan in Guangxi and Hunan province, and we can give a lecture on heavy metal environmental risk assessment based on such experiences. Case-study exercise Cost Benefit Analysis (CBA) - "Using CBA to decide on cost-effective reduction of risks from contaminated sites" - Examples of cases are presented with cost estimations. Participants in groups carry out cost-benefit analysis. Vista and CAEP guide the participants. Results are presented and discussed in plenary at the end.
Day 2, May 29
International lecture on methodology - "Co-control: Integrated and cost-effective approach to air pollution and GHG emission reduction is emerging in EU and USA" - Rationale: Air pollution and GHG emissions are crucial challenges in China today, including in the pilot provinces and cities.

- Comment: Suggest to focus on the air quality standards, such as how and why does the standards evolve in EU and US (pollutants included, values, etc.), how were the standards formulated (based on health risk consideration?), what policies and measures were formulated to reduce emission to comply with the standards, and the effect. International lecture on case experience - "Integrated river basin management in the Rhine river: EU's approach to regional cooperation in protecting water resources and reducing risks to health and ecology" - Rationale: Ensuring regional cooperation and handling water pollution is a crucial challenge in China, including in the pilot provinces and cities. Chinese lecture (CAEP responsible) - "Chinese experience with APELL pilot to reduce risk in Yangtze River International Chemical Industry Park in Zhangjiagang" - Rationale: Knowledge of the experiences from this pilot will be useful for CAEP and the pilot provinces and pilot cities. Case-study exercise Strategic Environmental Assessment (SEA) - "Securing an integrated approach to reduce environmental risk on river basin level" - A fictional river basin case similar to Chinese circumstances is presented with questions and exercises to be answered in group-work, taking the participants through the stages of SEA in the context of river basin management. Vista and CAEP guide the participants. Results are presented and discussed in plenary at the end.
Day 3, May 30 (morning session)
- Lessons learnt and next work plan - Meeting with FECO

Evaluation report of the Tongling training

Participants filled out a questionnaire after having participated in the training. A full summary report is available in Vista's archives.

22 representatives from province- and city-EPBs participated: 4 from Jiangsu, 6 from Tongling, 4 from Guizhou, 4 from Anshun and 4 from Chengdu.

Main conclusion of the summary report by CAEP:

"Participants in the training course were generally satisfied. This training session was moderately difficult with a reasonable time length. Group case practice, in particular, increased participation, and people involved have gained a lot of useful information. Most of the participants were interested in one or more cases and considered them helpful. They generally thought they had gained a lot in terms of theoretical approaches, practical experience and other aspects with respect to environmental risk prevention and control and were willing to take part in follow-up training.

Since most of the participants are practitioners from environmental planning and emergency response, sentering the recommendations and areas of interest that are provided by the participants, they hoped more training contents and cases in

combination with their actual situation of work could be added, in which way to help digest, absorb and well apply what they had learned from the training course."

Idea for November training

As Jiangsu province seems to have come further and have higher standards in environmental risk planning and management, it could be relevant to have Jiangsu EPB present some best practises for the other pilots. Maybe it is good to do this at the November training, so that the pilot provinces and pilot cities in the first training are treated equally and get a common basis.

4.8 The second training of pilots, in Beijing November 2014

Program

Table I. Program for training 18-19 November 2014 in Beijing

Program for Training 18-19 November 2014, in Beijing		
Main program		Parallell session
Day 0	Arrival of core project team	
	Preparation by CAEP, Vista Analysis, CICERO	
Day 1	18. November	
09-09.30	Welcome	
09.30-12 (break 10.30)	Three lectures: - Seveso Directive & Industrial Parks *– by H. Vennemo, Vista Analysis* - Oslo case: Urban planning and environmental risk management *– by R. Reinvang, Vista Analysis* - Regional environment risk assessment method *– by Jia Qian, CAEP*	
12-13	Lunch	
13.30-18	Case study exercise with group work: SEA & environ. risk *– led by Dong Jingqi (CAEP) assisted by J.M. Skjelvik (Vista)*	Framework workshop *
Day 2	19. November	
09.-12. (break 10.30)	Three lectures: - APELL with focus on handbook for chemicals *- by K. Aunan, CICERO* - Safety distances and land use planning *- by J.M. Skjelvik (Vista Analysis)* - Environmental risk mapping and management in Jiangsu *- by representative from Jiangsu EPB*	
12-13	Lunch	
13-17	*Case study exercise with group work: CBA & environ. risk* *- led by Jia Qian (CAEP) assisted by J.M. Skjelvik (Vista)*	Framework workshop *

** Led by Cao Guozhi (CAEP) and H. Vennemo (Vista). For available project core team and senior officials from Jiangsu, Guizhou, Tongling and Anshun EPBs.*

When planning the November training, it became clear that there was a need for discussing the development of a framework for assessing acute and accumulated risk (activity 3 in the project) with the representatives of pilot provinces and cities. In order to do this in a cost-effective manner, a parallel framework workshop for senior officials was planned during the case exercise work in the afternoons.

Evaluation report of the Beijing training

Participants filled out a questionnaire after having participated in the training. A full summary report is available in Vista's archives.

14 representatives from province- and city-EPBs and other environmental institutions participated: 1 from Jiangsu, 3 from Tongling, 3 from Guizhou, 2 from Anshun, 2 from Beijing Normal University, 1 from Nanjing University (in Jiangsu), 1 from MEP, Planning and Finance Department, and 1 from MEP, Emergency Center.

Main conclusion of the summary report by CAEP:

"The participants in the training course were generally satisfied. This training session was moderately difficult with a reasonable time length. Case study exercises, in particular, increased participation, and people involved have gained a lot of useful information. Most of the respondents were interested in one or more lecture or case and considered them helpful. They generally thought they had gained a lot in terms of theoretical approaches, practical experience and other aspects with respect to environmental risk prevention and control, and expressed willingness to take part in follow-up training. Many respondents pointed out that the presentations including the experiences of environmental risk prevention in Europe, such as the Oslo city planning, safety distances, etc. and Jiangsu province, were very practical and useful.

The SEA and CBA case study exercises had been improved since the training in May 2014 (Tongling) with regards to the background, questions and answers. This made it easier for trainees to understand and answer the questions. These are good experiences and helpful information for the following training. (As indicated in the attached report on case exercise trainings, there are still some room for refinement of the case exercise trainings)."

Additional comments

When evaluating the training, Vista Analysis and CAEP agreed that the participation from pilot provinces and cities were lower (9) than expected and wished for. This may partly be explained by the fact that the training took place in Beijing, and not in one of the project pilots. (On the other hand, the location in Beijing allowed for increased representation from MEP and Beijing Normal University.) The case exercise training session was also hampered by the fact that most participants at the training chose to follow the framework workshop in the afternoon, reducing the number of participants in these sessions to a handful. It was agreed that it is important to ensure better participation from pilots in the final training.

With regards to the output goal of activity 6c, the first training lacked participation of 8 representatives of the target group and the second training of 16 representatives of the target group. This should be compensated for in the last training(s).

4.9 Framework workshop and training, in Anshun May 2015

When planning for the third training to be held in Spring 2015, it became clear that there was a need for a workshop with pilot provinces and cities about the experiences with testing the framework for acute and accumulated environmental risk assessment (ref. activity 3, 6 and 7 of the project). The experience from the November-training had been that it did not work well to combine this with normal training activities. It was therefore decided to postpone the regular training until the fall of 2015.

However, in order to capitalize on having a number of pilot representatives present and to compensate for a backlog in training of the target group, several lectures was included in the framework workshop program. The only normal training activity not included in the program, was thus the case study exercises (ref. program below).

Program

Table J. Program for workshop and training 19-22 May 2015, Anshun

19 -23 May 2015, in Anshun, Guizhou province	
Day 0	19 May - Tuesday
Afternoon	Arrival of core project team
	Preparation CAEP, Vista, CICERO with Guizhou and Anshun EPBs
Day 1	20 May - Wednesday
09:00-09:15	Welcome (vice mayor of Anshun), chaired by Bian Jinshun, director of Guizhou environmental emergency center.
09:15-09:45 09:45-10:30 Break 10:45-11:30 11:30-12:00	Chaired by Cao Guozhi, CAEP 7-step framework introduction: - Overall introduction of the framework – Vista/CICERO - PAM (Principles, Approaches, Models) – Vista/CICERO *Break* - Acute and accumulated environmental risk assessment method - CAEP - Questions and discussion of methods (Haakon chair)
12:00-14:00	Lunch
14:00-15:30 Break 16:00-17:30	Chaired by Haakon Vennemo, Vista Report of Jiangsu province: - *Process of testing the framework* - *Findings and analysis* - *Suggestions for improvement* *Break* Report of Tongling City: - *Process of testing the framework* - *Findings and analysis* - *Suggestions for improvement*
Day 2	21 May – Thursday
09:00-10:30 Break 10:45-11:15 11:15-12:00	Chaired by Rasmus Reinvang, Vista Report of Guizhou province: - *Process of testing the framework* - *Findings and analysis* - *Suggestions for improvement* *Break* Report of Anshun City: - *Process of testing the framework* - *Findings and analysis* - *Suggestions for improvement* Overall discussion of testing experience from pilots
12:00-14:00	Lunch
14:00-14:30 14:30-15.00 15:00-17:30 (break15:40)	Chaired by Dong Zeqin, Guizhou Environ. Science Research Academy - Environmental risk indicators in EU and USA, by Vista/CICERO - Chinese case example for assessing regional environmental risk, by CAEP Concluding session (CAEP chair): - Review and summary of workshop - Next step plan for framework
Day 3	22 May - Friday
Morning	Core project team: Summary of workshop result / lessons learnt
	Core project team: Next step work plan

Participant list

Table K. Participant list, Anshun May 2015

Name	Affiliation	Position
Wen Chen	Foreign economic cooperation office, MEP	Project officer
Cao Guozhi	CAEP, MEP	Department director
Jia Qian	CAEP, MEP	Assistant researcher
Zhou You	CAEP, MEP	Assistant researcher
Li Chao	CAEP, MEP	Assistant researcher
Fu Jiang	Env. Emergency Center Jiangsu Prov.	Investigator
Wang Jianqiu	Env. Emergency Center Jiangsu Prov.	Section head
Li Wenshuo	Env. Emergency Center Jiangsu Prov.	Associate section head
Bian Jinshun	Env. Emergency Center Guizhou Prov.	Principal
Zhang Shu	Envi Emergency Center Guizhou Prov.	Section head
Dong Zeqing	Guizhou Academy Env. Science and Design	Associate dean
Chen Feng	Guizhou Academy Env. Science and Design	N/A
Wang Chengcheng	Guizhou Academy Env. Science and Design	N/A
Guo Zhong	EPB, Tonglin	Chief engineer
Cui Zhuanzheng	EPB, Tonglin	Principal
Guan Songtao	EPB, Anshun	Director
Shang Dayong	EPB, Anshun	Associate director
Tian Lu	EPB, Anshun	Principal
Zhang Huan	EPB, Anshun	Section member
Peng Xianlun	Municipal government of Anshun	Vice mayor

+ Haakon Vennemo & Rasmus Reinvang, Vista Analyse

Comment

The framework workshop included 15 representatives of the project target group: 3 from Jiangsu, 5 from Guizhou, 2 from Tongling, 4 from Anshun, and 1 from MEP, Foreign Economic Cooperation Office (FECO). This may be considered a compensation for the relatively low participation in the second training in Beijing, November 2014.

4.10 The third training of pilots, in Suzhou Fall 2015

At the project team meeting in Anshun in May 2015, the third training was planned to take place in Nanjing in October – on the condition that this did not coincide with the CAEP study tour to Norway/Europe. Due to convergence it was decided in a project team meeting in Beijing 4 September, to carry out the training in week 47 (16-20. November). City and venue were to be decided.

During fall 2015, it was decided to hold the third training in Suzhou, Jiangsu.

Program

Table L. Program of training workshop (incl. team meeting), Suzhou November 2015

Agenda for Training workshop in Suzhou, November 2015		
Time	***Topics***	***Speaker***
16. Nov	***Arrival of core project team***	
19.00	Dinner (core project team)	
17. Nov	***Internal project meetings (core project team)***	
09:00-10:00	Policy recommendations introduction	CAEP
09:00-10:30	Discussion of policy recommendations	
10:30-10:45	Tea break	
10:45-12:00	Discussion of policy recommendations	
12:00-14:00	Lunch break	
14:00-14:30	Overall framework and introduction	Vista
14:30-15:00	Indicators introduction	CAEP
15:00-15:30	Discussion of overall framework and indicators	
15:30-15:45	Tea break	
15:45-17:30	Discussion of overall framework and indicators	
18. Nov	***Internal project meetings (core project team)***	
09:00-09:40	Pilot progress introduction	Pilots
09:40-10:30	Pilot progress discussion (including framework and indicators)	
10:30-10:45	Tea break	
10:45-12:00	Pilot progress discussion (including framework and indicators)	
12:00-13:30	Lunch	
13:30-17:00	Preparation of trainers (trainers+Reinvang&Skjelvik)	Discussion of indicators
19. Nov	***SEA-training of pilots***	***Internal workshop***
09:00-10:00	Lecture on SEA (CAEP+Vista, Reinvang)	Work on indicators, policy recommendations, framework and summary according to need. (CAEP+Vista)
10:00-10:30	SEA case introduction (CAEP, Vista observes)	
10:30-10:45	Tea break	
10:45-12:00	SEA case exercise training (CAEP, Vista observes)	
12:00-13:30	Lunch break	
13:30-17:00	SEA case exercise training (CAEP, Vista observes & comments)	
20. Nov	***CBA-training of pilots***	***Internal workshop***
09:00-10:00	Lecture on CBA (CAEP+Vista, Skjelvik)	Work on indicators, policy recommendations, framework and summary according to need. (CAEP+Vista)
10:00-10:30	CBA case introduction (CAEP, Vista observes)	
10:30-10:45	Tea break	
10:45-12:00	CBA case exercise training (CAEP, Vista observes)	
12:00-13:30	Lunch break	
13:30-17:00	CBA case exercise training (CAEP, Vista observes & comments)	
21. Nov	***Wrap-up***	
	TBD	

Participant list

Table M. Participant list, Suzhou, November 2015

	Organization	Name	Title
1.	Nanjing EPB	Huang Heping	Section Chief
2.	Liuhe EPB of Nanjing	Wang Kun	Section Chief
3.	Nanjing Zhuangde Company	Li Wanwan	Engineer
4.	Environmental Emergency Center of Wuxi	Huang Yongshun	Vice director
5.	Environmental Emergency Center of Wuxi	Sun Tao	Section Chief
6.	Environmental Emergency Center of Wuxi	Ren Si	Engineer
7.	Environmental Emergency Center of Xuzhou	Wang Hongyang	Director
8.	Environmental Emergency Center of Xuzhou	Yan Weichai	Section Chief
9.	Tongshan EPB of Xuzhou	Chen Shuquan	Director
10.	Jiangsu Zhicheng Company	Yan Fangting	Director
11.	Changzhou EPB	Miao Fu	Section Chief
12.	Jintan EPB of Changzhou	Jiang Yibin	Assistant captain
13.	Changzhou Research Academy for Env. Science	Jing Chunyan	Engineering
14.	Environmental Emergency Center of Suzhou	Xia Jianwei	Director
15.	Environmental Emergency Center of Suzhou	Gu Yingjie	Engineer
16.	Changshu Env. Emergency Center of Suzhou	Ni Guoqiang	Director
17.	Nantong Environmental Emergency Center	Cui Jun	Director
18.	Rudong Env. Emergency Center of Nantong	Guo Yifeng	Director
19.	Nanda Company of Environmental Protection	Lin Shulei	Engineer
20.	Env. Emergency Center of Lianyungang	Sun Jianguo	Director
21.	Environmental Emergency Center of Huaian	Chen Hongxia	Director
22.	Xuyi Env. Emergency Center of Huaian	Mei Jice	Section Chief
23.	Nanjing Kehong Company	Yang Liangliang	Engineer
24.	Environmental Emergency Center of Yanchen	Mao Jianqiu	Director
25.	BInhai Env. Emergency Center of Yanchen	Jiang Ruiqing	Director
26.	Jiangsu Research Academy for Env. Science	Li Guoping	Engineer
27.	Environmental Emergency Center of Yangzhou	He Jilie	Assistant captain
28.	Dujiang Env. Emergency Center of Yangzhou	Cai Qizhi	Vice director
29.	Environmental Emergency Center of Zhenjiang	Ye Jiazhou	Director
30.	Zhenjiang EPB	Ren Shanghua	Section Chief
31.	Jiangsu Bailingtiandi Company	Li Feng	Chief engineer
32.	Jiangsu Bailingtiandi Company	Guo Quan	Engineer
33.	Environmental Emergency Center of Taizhou	Yu Shirong	Director
34.	Taizhou EPB	Long Guilin	Section Chief
35.	Academy for Env. Planning of Nanjing University	Jiao Tao	Vice director
36.	Academy for Env. Planning of Nanjing University	Chen Haiquan	Engineer
37.	Environmental Emergency Center of Suqian	Miao Gangsong	Director
38.	Environmental Emergency Center of Suqian	Yang Bangyun	Section Chief
39.	Suyu Env. Emergency Center of Suqian	Fan Zhenli	Vice director
40.	Su Yu EPB of Suqian	Chen Xiuzhen	Engineer
41.	Shangge Company	Sun Haibo	Engineer
42.	Shangge Company	Chen Jia	Engineer
43.	Jiangsu Environmental Emergency Center	Wang Huizhong	Director
44.	Jiangsu Environmental Emergency Center	Fu Jiang	Vice Director
45.	Jiangsu Environmental Emergency Center	Hua Juan	Section Chief
46.	Jiangsu Environmental Emergency Center	Li Wenqi	Engineer
47.	Jiangsu Environmental Emergency Center		Engineer
48.	Guizhou Environmental Emergency Center	Bian Jinshun	Director
49.	Guizhou Environmental Emergency Center	Zhang Shu	Section Chief
50.	Tongling EPB	Guo Zhong	Chief Engineer
51.	Tongling EPB	Cui Zhuanzheng	Assistant captain
52.	Anshun EPB	Chen Jingyao	Engineer
53.	Haakon Venemmo	Vista Analysis	Director

54.	Rasmus Reinvang	Vista Analysis	Doctor
55.	John Skjelvik	Vista Analysis	Doctor
56.	Kristin Aunan	CICERO	Doctor
57.	Chinese Academy For Env. Planning (CAEP)	Yu Fang	Director
58.	CAEP	Cao Guozhi	Section Chief
59.	CAEP	Jia Qian	Engineer
60.	CAEP	Wang Kunpeng	Engineer
61.	CAEP	Li Chao	Engineer
62.	CAEP	Zhu Wenying	Engineer

Training evaluation

Participants filled out a questionnaire after having participated in the training. A full summary report is available in Vista's archives.

The Suzhou training included 52 representatives from pilots, including a number of different stakeholders from Jiangsu province (ref. table M above).

Main conclusions of the summary report by CAEP:

"The training workshop was held in Beijing November 18-19, 2015. Representatives from pilots of Jiangshu, Guizhou, Tongling and Anshun, and other representatives from local environmental authorities of Jiangsu Province as well as staff of environmental companies participated in this training workshop. Almost all of the 61 representatives participated in SEA and CBA case study training workshop for the first time. 31 questionnaire-based feedbacks were received, a response rate slightly above 50%."

"Most of the respondents replied that the overall quality of the training course is good, and both the course design and case selection are reasonable and proper. [-] Also, 94% of the participants indicate a satisfaction with the case selection, meaning that they consider the two cases as good examples of case study and can generally follow the designed logic."

"Almost all the participants (29 out of 31) who have submitted the evaluation questionnaires thought group discussion in this training helped improve the learning effect, and only 1 participant voted "not helpful" to this question. Some of them thought the content of group discussion inclined towards emergency disposal and risk assessment. 28 (93%) of the participants would like to continue studying in the follow-up training and to apply what they have learned in this course to work practice, while 2 of them wouldn't continue participating.

Suggestions and opinions are similar to the previous ones we received from the workshops, which mainly concentrated on the training content. They hoped that successful examples of China's own experience in environmental risk assessment, precaution and emergency response could be added to the training, as well as the successful experience of foreign environmental risk assessment and management planning on an urban scale."

"Prior to the workshop the case study document was revised. The revised case study greatly improved the overall flow of this training and avoided unnecessary time in clarifying the information that was already provided in the text. In addition, participants generally thought they had gained a lot in terms of theoretical approaches, practical experience and other aspects with respect to environmental risk prevention and control and were willing to take part in follow-up training."

Comments

- The Suzhou training included 52 representatives from pilots. This brought the total number of representatives from pilots (the project target group) who have participated in trainings up to 98 (22 in Tongling, 9 in Beijing, 15 in Anshun, 52 in Suzhou).
- For an assessment of the CAEP trainers' performance at the Suzhou training, see chapter 3 "Training of trainers (activity 6b)".

4.11 Results

Planned versus ex-post results

As shown in table N below, we carried out 4 and not 3 trainings of pilots. The extra training in Anshun in Q8, was carried out to compensate for the low participation in the training held in Q6 in Beijing.

Table N. Planned versus ex-post (red) timeline for pilot trainings (Q1= Jan-March 2013)

Activities	2013			2014				2015			
	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Planned			x		x				x		
Ex-post					X		X		X		X

As shown in chapter 1, we planned to train 90-120 representatives. In total, we trained 98 representatives during the four trainings. We thereby achieved the planned outreach.

The outcome of the trainings

In order to monitor knowledge development in the target group, a mapping survey was carried out at the beginning and at the end of the project. Final results and a comparison with the baseline survey, is presented in Vista Analysis report 2016/12 "Final Survey of Target Group: Results and comparison with Baseline Survey".

We here include the main parts of the summary of this report, with the numbering of figures adjusted to the numbering in this report:

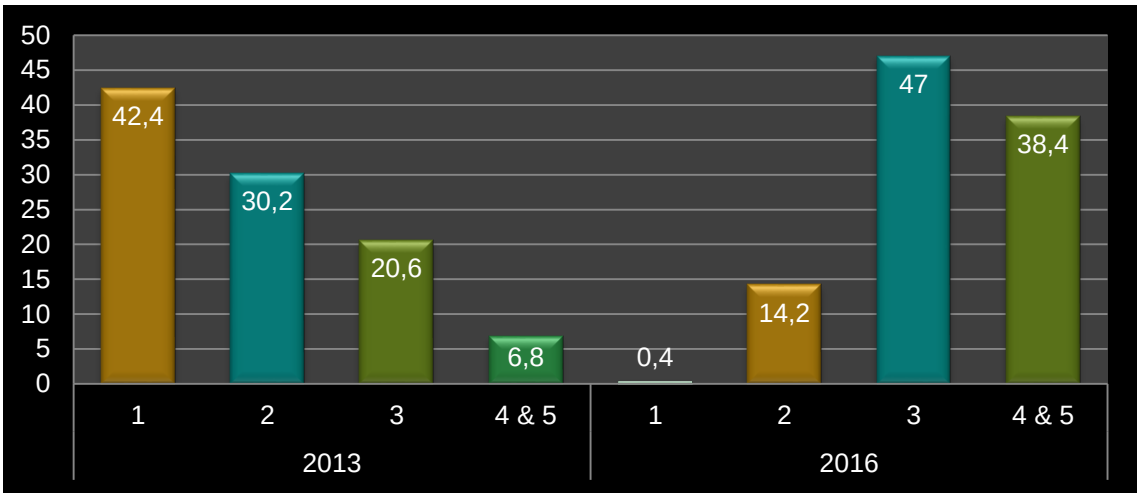
"In 2013, the target group consisted of 103 persons from the Ministry of Environmental Protection (MEP) and Chinese Academy of Environmental Planning (CAEP) (27 person in total), the provincial Environmental Protection Bureaus (EPB) in Jiangsu and Guizhou (49 persons), and the city EPBs in Tongling and Anshun (27 persons). The mapping consisted of self-reporting from project participants, using questionnaires. 90% of those who filled in the first baseline questionnaire also filled in the final questionnaire. The mapping was carried out by CAEP, with guidance from Vista Analysis.

There are drawbacks with using self-reporting to measure knowledge development, such as a risk of participants not reporting honestly or accurately due to possibilities for different interpretations and/or different degrees of self-knowledge in the target group. A development in knowledge levels may also be attributed to other factors than this project, and we have in the surveys not attempted to investigate that in depth. All in all we consider that the surveys give a robust indication of the impact of the capacity building activities on the target group of the project.

A consistent and substantial positive development in knowledge levels

A comparison of the two surveys – the baseline survey and the final survey – shows a consistent and substantial positive development of knowledge in the target group.

Figure 3: Development in knowledge levels, 5 main topics aggregated (in % of group)

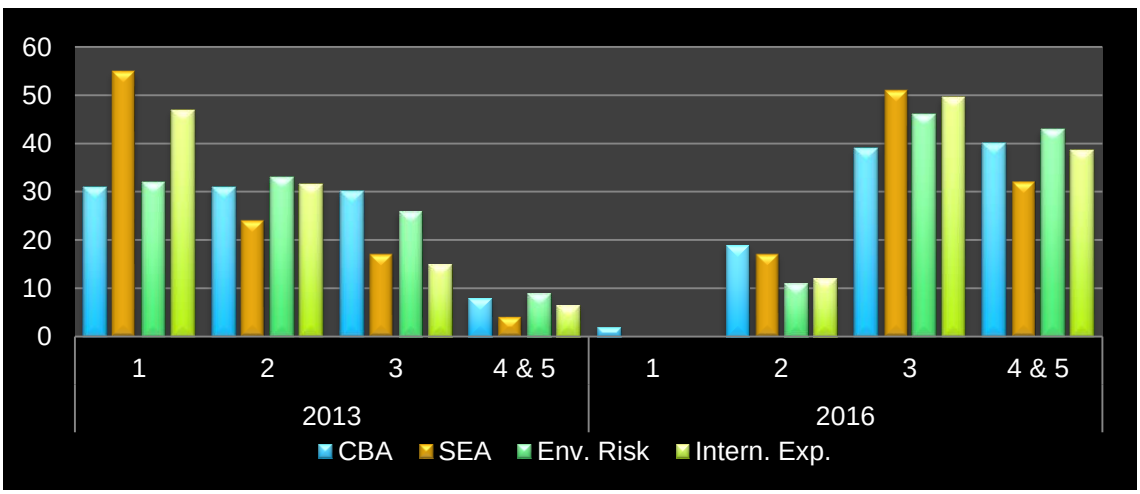


In the survey we distinguished between five knowledge levels;
Level 1 = No knowledge, Level 2 = Basic knowledge (familiarity), Level 3 = Theoretical knowledge, Level 4 = Application level knowledge, and 5 = Expert level knowledge.

In the survey we asked respondents to rank their knowledge of main topics in the project: Cost Benefit Analysis (CBA), Strategic Environmental Assessment (SEA), environmental risk reduction methodologies, as well as knowledge of international experience with environmental planning and environmental risk reduction methodologies.

When we aggregate the responses on these five topics (ref. figure three above), we see that 27% of the group were at knowledge level 3, 4 or 5 in 2013 and that this increased to 85% in 2016. The share stating their knowledge level is 1 has fallen from 42% to 0.4%, the share with knowledge level 2 has fallen from 30% to 14 %, the share with knowledge level 3 has risen from 21% to 47%, and the share with knowledge level "applicable" (4) or "expert" (5) level has increased from 6.8% to 38%.

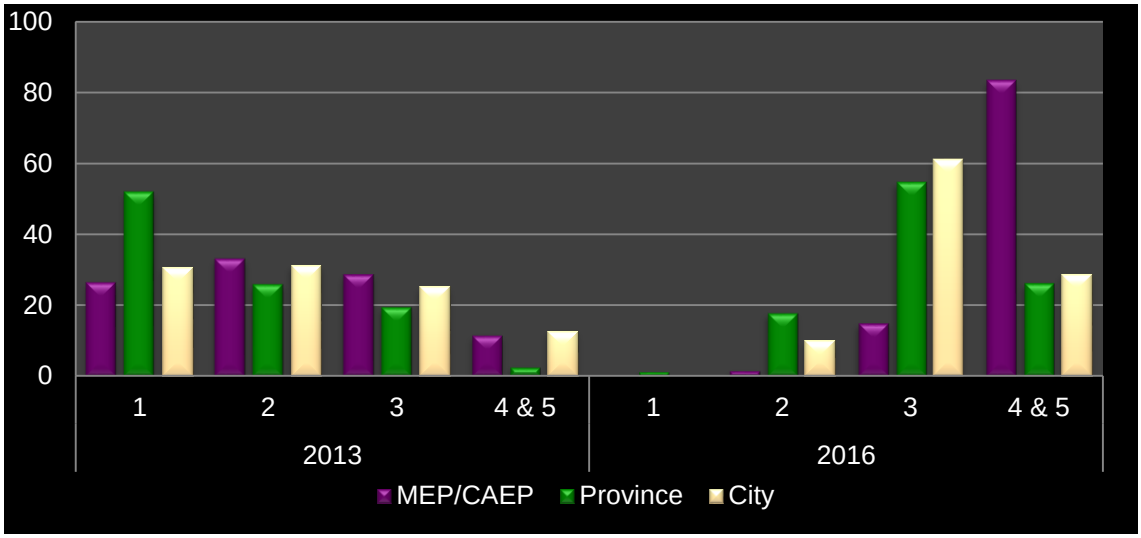
Figure 4: Development in knowledge levels, different topics (in % of group)



As shown in figure four above, the increase in knowledge levels generally shows the same positive pattern for the different main topics: CBA (total of 79% on level 3, 4 or 5), SEA (total of 83% on level 3, 4 or 5), environmental risk reduction methodologies (total of 87% on level 3, 4 or 5), and international experiences (total of 88% on level 3, 4 or 5) in 2016. The topic 'Environmental Risk Reduction Methodologies' got the highest share of experts, with 43%.

We do, however, see differences between the main groups of the project; government officials at central level (MEP/CAEP), provincial level (Jiangsu and Guizhou) and local city level (Tongling and Anshun), ref. figure C below.

Figure 5: Development in knowl. levels, main topics (aggregated) by groups (% of group)

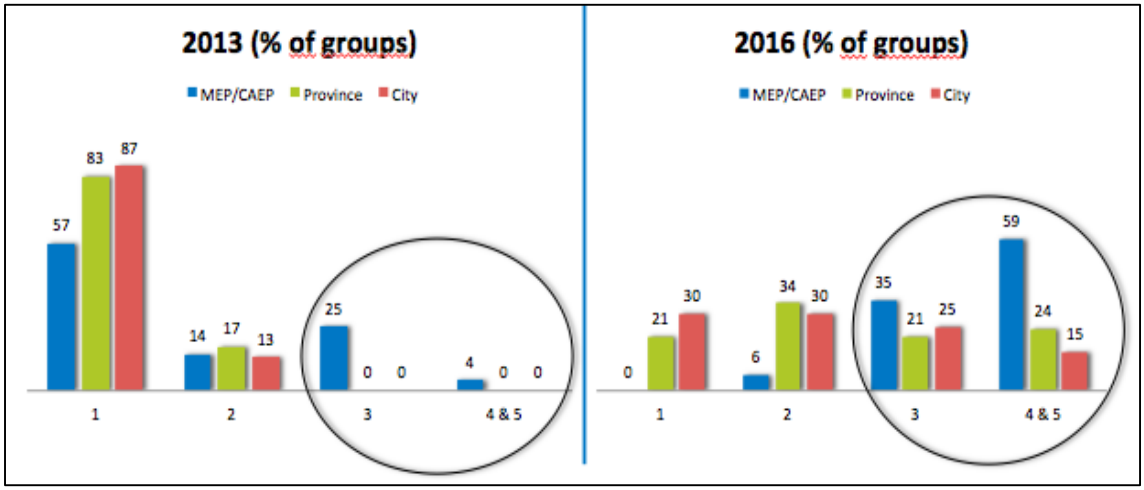


The general picture is that especially the MEP/CAEP staff has benefited from the project – with more than 80% of participants at a knowledge level of 4 or 5 in 2016 (compared with 11% when the project began). This is not surprising, as the MEP/CAEP group also includes 11 staff members that participated in the core project group (see below).

Improvement for provincial and city/local staff is also high, however, with more than 80% of participants at a knowledge level of 3, 4 or 5 in 2016 (compared with +20% at the beginning of the project). It is surprising that the city/local participants score higher than provincial participants (both in 2013 and 2016), as it goes against the general impression that provincial participants have higher skills levels. It may simply be due to different standards for self-reporting, as the difference is not very big – but consistent.

It is worth noting that when conducting the final survey, we received a number of responses (32) from staff at MEP/CAEP who had not participated in the project. They consistently score higher than the target group did in 2013, but significantly lower than the target group participants who had been involved in the whole project. This indicates that during the period of the project there has been a general knowledge increase at MEP/CAEP in the project topics, but that the participants have developed their knowledge even further.

Figure 6: Development in knowledge of GAINS and MSG-6, by main groups (% of group)



The project also had a focus on training related to use of GAINS and MSG-6 methodologies. This training was mainly aimed at CAEP staff, and was not included in the four training sessions held especially for the pilot provinces and cities. Survey results (ref. figure six above), show a signifant increase in knowledge levels at the CAEP/MEP level where more than 90% have reached theoretical level of knowledge (3) or more and 60% have an applicable (4) or expert (5) level of knowledge. Also provinces and cities have clearly benefited from the training related to GAINS and MSG-6, with about 50% at level 3, 4 or 5.

The project has had impact on the practise of government officials

The participants were asked in the final survey whether the training and international experience received through the project had been helpful in their everyday work. They were also asked if the training and international experience received through the project had made them do things differently in their work, and asked to provide an example. 99% responded yes to the first of these questions, and 87% to the other. Only at the provincial level (14%) and the city level (20%) did some respondents note that the project had not made them do things differently.

There is a need to expand on methods and tools to manage environmental risk

In the surveys, we also asked a general question aimed at assessing whether current methods and tools used in work on environmental planning and/or emergency response are considered sufficient. Project participants were asked to reply on a scale from 1-5 (1= “they are not at all sufficient”, 5 = “they fully cover my needs”). The survey showed that 30% in 2013 regarded the sufficiency of current methods and tools somewhat positively (answer of 3, 4 or 5), and that this had increased to 64% in 2016. The rating is similar among the different groups and the survey indicates that there still is a need to improve and possibly expand the portfolio of methods and tools available for public officials working with environmental planning and risk management in China.”

Here the quote of the main parts of the summary of the Vista Analysis report 2016/12 “Final Survey of Target Group: Results and comparison with Baseline Survey” ends.

5. GAINS training (activity 6d)

5.1 Introduction

From the project implementation plan (ref. the internal Inception report, of August 2013)[6]:

A training course on GAINS shall in Q3-Q4 be held in China or Austria for about 10 MEP and CAEP officials, involving Chinese scholars who have visited the IIASA centre in Austria and/or have extensive knowledge of the GAINS model. It is also possible to have one expert in air pollution modelling from CAEP visiting IIASA in Austria for around 10 days.

5.2 GAINS workshop program, December 2013

Table O. GAINS workshop program, December 2013

Dec. 25th, 2013 (Beijing || Tibet Building)		
Time	**Content**	**Speaker**
9:30-11:40	Chair：CAEP, YU Fang, Senior Researcher	
9:30-9:40	Opening Speech	
9:40-11:10	Framework of GAINS and its Applicabilities	Tsinghua University Professor ZHANG Qiang
11:10-11:40	Questions and Discussion	
11:40-13:30	*Lunch and Break*	
13:30-16:40	Chair: CAEP, YU Fang, Deputy Director & Senior Researcher	
13:30-14:30	Application Cases of GAINS model	Energy Research Institute, National Development and Reform Commission Senior Researcher, JIANG Kejun
14:30-15:00	Questions and Discussion	
15:00-15:20	*Tea Break*	
15:20-16:00	Case Studies of the Synergistic Effects on Chinese Air Pollution Prevention	CAEP Researcher, LEI Yu
16:00-16:30	Questions and Discussion	
16:30-16:40	Summary	
Dinner		

[6] The Inception report provided an updated project implementation plan. Quite some time had elapsed from the design of the project in the project proposal to the actual start of the project, and this made it necessary to update and clarify the content of the Project in an inception report.

5.3 Report from GAINS-training in Beijing, 25. December 2013

By CAEP

On December 25, 2013, the Center for Environmental Risk and Damages Assessment (CERDA) under Chinese Academy for Environmental Planning (CAEP) of Ministry of Environmental Protection held “GAINs Model Application Exchange and Training Session” at Beijing Tibet Hotel.

Professor Zhang Qiang from Tsinghua University, researcher Jiang Kejun from Energy Research Institute, National Development and Reform Commission and associate researcher Lei Yu from Chinese Academy for Environmental Planning (CAEP) of Ministry of Environmental Protection were invited to the session to hold seminars respectively as well as training, exchange and discussion on issues such as GAINs model framework and applicability research, application example research and synergistic effect of air pollution control. Other attendees to the session include technical professionals from Emergency Center under Ministry of Environmental Protection, Chinese Academy for Environmental Planning (CAEP) as well as Jiangsu Province, Hubei Province, Yunnan Province and Tongling City of Anhui Province.

Figure 7: Photo from GAINS-seminar in Beijing, 25 Dec. 2013.

The session can be summarized as follows:

1. Professor Zhang Qiang mainly presented the theoretical framework of GAINs model, its applicability, mode of operation, webpage tool uses and application cases, and pointed out that GAINs was a comprehensive integrated model for multi-pollutant and multi-environmental cooperative control effect. By introducing global-scale GAINs-Asia application experiences and regional-scale GAINs-City, his group developed the Excel-based scenario custom tool for convenient policy selection method, thus to build a more friendly policy decision tool.

2. Research fellow Jiang Kejun focused on the methodological framework of regional energy environmental model (IPAC/AIM-Local), presented the abutment between energy scenarios and relative technical parameters and GAINs model from the perspective of energy economy and energy environment as well as their roles in the application of the model, pointed out that policy

orientation and industrial restructuring together constitute the optimal result of GAINs targeting coordinated development of environment and economy, and illustrated the effective application of GAINS in practical policy formulation and decision support with vivid examples.

3. Lei Yu, an associated research fellow, summarized the local application of CGE model, LEAP model, emission inventory and other technologies by presenting economic model driven and energy scenario-driven application cases, elaborated the analysis process of synergistic effect of air pollution control, pointed out that GAINs model had achieved integration and optimization of such functions as building development scenario, estimating emission, analyzing environmental quality change and its impact on health and ecology, and recommended that Chinese development of similar analysis tools should highlight localization and scheme optimization.

In the end, deputy director Yu Fang, in combination with formulation of emergency plan of Hengshui city for heavy pollution weather, presented the general idea and practices on formulation of an emergency control program for heavy pollution weather, and assessment of air quality and its impact on health and economy.

Deputy director Mao Jingying from Emergency Center under Ministry of Environmental Protection, deputy director Yu Fang from Chinese Academy for Environmental Planning (CAEP) and chief engineer Guo Zhong from Tongling Municipal Environmental Protection Bureau voiced their own opinions and relevant issues regarding the above content and had a heated discussion with those present at the session.

Table P. Participant list, GAINS training December 2013

No.	Name	Org.
1	Jiang Kejun	Energy Research Institute of NDRC
2	Zhang Qiang	Tsinghua University
3	Lei Yu	Atmospheric Environment Institute of CAEP
4	Li Dan	Guizhou EPB
5	Zhang Shu	Guizhou Environmental Emergency Center
6	Liu Aihua	Hubei EPB
7	Rong Yu	Hubei Research Academy for Environmental Science
8	Meng Ye	Yun Nan EPB
9	Chen Yuanxiang	Yunnan Research Academy for Environmental Science
10	Feng Bin	Jiangsu Research Academy for Environmental Science
11	Li Li	Jiangsu Research Academy for Environmental Science
12	Guo Zhong	Tongling EPB
13	Zhang Jianquan	Tongling EPB
14	Mao Jianying	Environmental Emergency Center of MEP
15	Zhang Long	Environmental Emergency Center of MEP
16	Yang Qian	FECO of MEP
17	Yu Fang	CERDA of CAEP
18	Cao Guozhi	CERDA of CAEP
19	Tian Chao	CERDA of CAEP
20	Dong Jingqi	CERDA of CAEP
21	Jia Qian	CERDA of CAEP
22	Chi Ting	CERDA of CAEP
23	Zhang Yanshen	CERDA of CAEP
24	Niu Kunyu	CERDA of CAEP
25	Qi Ji	CERDA of CAEP
26	Zhou You	CERDA of CAEP
27	Zhao Xuetao	CERDA of CAEP
28	Ma Guoxia	CERDA of CAEP
29	Liu Lancui	CERDA of CAEP
30	Zhou Ying	CERDA of CAEP
31	Chen Xiaojun	Atmospheric Environment Institute of CAEP
32	Jin Ling	Atmospheric Environment Institute of CAEP
33	Wang Lijuan	Atmospheric Environment Institute of CAEP
34	Wang Huili	Atmospheric Environment Institute of CAEP
35	Liu Nairui	Atmospheric Environment Institute of CAEP
36	Yan Zhen	Atmospheric Environment Institute of CAEP
37	Zhang Jing	Policy Simulation Laboratory of CAEP
38	Cheng Xi	Policy Simulation Laboratory of CAEP
39	Liu Shijie	Policy Simulation Laboratory of CAEP
8	Meng Ye	Yun Nan EPB
9	Chen Yuanxiang	Yunnan Research Academy for Environmental Science
10	Feng Bin	Jiangsu Research Academy for Environmental Science
11	Li Li	Jiangsu Research Academy for Environmental Science
12	Guo Zhong	Tongling EPB
13	Zhang Jianquan	Tongling EPB
14	Mao Jianying	Environmental Emergency Center of MEP
15	Zhang Long	Environmental Emergency Center of MEP
16	Yang Qian	FECO of MEP
17	Yu Fang	CERDA of CAEP
18	Cao Guozhi	CERDA of CAEP
19	Tian Chao	CERDA of CAEP
20	Dong Jingqi	CERDA of CAEP
21	Jia Qian	CERDA of CAEP
22	Chi Ting	CERDA of CAEP

5.4 Visit to IIASA by CAEP, 2015

The original plan was that Dr. Cao Guozhi of CAEP should visit IIASA in May 2015 to receive training in GAINS. The visit had to be postponed for various reasons and it was decided to find a replacement for Dr. Cao who could participate in training.

In September 2015, the Head of the Environmental Health Assessment Group in CERDA (Dr. Zhang Yanshen) had been nominated to visit IIASA and receive training in GAINS. Dr. Zhang Yanshen should visit IIASA 23.10-30.10.2015. The training should take place in a small group (3-4) with scientists from other countries.

5.4.1 Participant report of the visit to IIASA, November 2015

By Dr. Zhang: Summary of training session on GAINS model in IIASA, Nov. 2015

1. Basic information

Dr. Zhang Yanshen, member of Chinese Academy for Environmental Planning (CAEP), took part in the training session with respect of the GAINS model from October 22nd to 30th, 2015 at International Institute for Applied Systems Analysis (IIASA) in Vienna of Austria, supported by the project “Planning for Cost-effective Environmental Risk Reduction in China”. Dr. Zig Klimont and his colleagues at IIASA, including Dr. Robert Sander, Dr. Peter Rafaj, Dr. Jens Borken, Dr. Nguyen Thanh Binh, Dr. Gregor Kiesewetter, and Dr. Wolfgang Schoepp, made a detailed introduction on GAINS models in nine days. Dr. Naoko Matsumoto from Japan, and Dr. Savitri Garivait and her research team from Thailand, also took part in the training session together.

2. Training content

Generally speaking, the training session was interactive, informative and not extremely formal. The training session stressed on the interaction with model development allowing new and more advanced users to learn key GAINS features and how the issues encountered during the development of the GAINS model had been resolved.

Dr. Zig Klimont introduced the GAINS principles and its applications in Europe and the workflow to create an emission scenario, and the GAINS operation, including creating new emission scenario, creating new activity pathway, creating new control strategy, assigning pathways and control strategies to the scenario, downloading, modifying and uploading activity data and control strategy and the modifications, and analyzing the effects of changes introduced, et al. Dr. Robert Sander introduced the interface of new GAINS version (GAINS 3) and set up the access to the GAINS with expert mode.

Additionally, the IIASA team gave more detailed information about GAINS elements, including what is a scenario and its main elements in GAINS, principles of emission calculation in GAINS, understanding the data and exchange in GAINS with the model template in energy sector, transport sector, agriculture sector. Dr. Wolfgang Schoepp also introduced methods for the air quality modeling and health impact assessment in GAINS model. Dr. Savitri Garivait introduced her work on developing the activity data, emission, air quality and impact etc. in Thailand with the framework of GAINS.

3. Gains and future application

The training session was very rewarding and improved remarkably my ability in policy analysis. Through the training session at IIASA, I understood the principles of the GAINS model and its framework, and learned how to operate the models to conduct a policy scenario analysis. The most important is that I understood what the GAINS

model can do and its application in different areas with different objectives. Unfortunately, some contents of the training session were very difficult for me to master the detailed elements of the GAINS because of limited amount of time and my knowledge background.

Research team from Tsinghua University has built the GAINS China with support of IIASA and are now developing the GAINS city in China. The GAINS China provides a readily available tool for us to conduct an air pollution control policy impact assessment. We will establish contact with research team from Tsinghua University, and be familiar with the current activity data, scenarios, control measures, efficiencies and application limits of GAINS China and GAINS City.

I will collect the presentation from the training session and absorb the essence, and develop the real or virtual case study that used the GAINS models to carry out air pollution control policy analysis. I will give presentations and share experience in internal communications with my colleagues in CAEP, or at external conference with other research fellow on policy analysis, or policy makers.

We will apply the GAINS model to the policy analysis as much as possible, such as the reachability of air pollution control action plan, impact analysis of air pollution control on air quality or human health. We will establish close cooperation with Tsinghua University and Atmospheric Environment Institute of CAEP, and participate in the formulation of air pollution control policies, and transmit the GAINS model to more research fellows and policymakers.

6. MSG-6 training (activity 6e)

Computable general equilibrium (CGE) models are a class of economic models that use actual economic data to estimate how an economy might react to changes in policy, technology or other external factors. MSG-6 is a model of the Norwegian economy developed at Statistics Norway.[7]

From the implementation plan (ref. the Inception report, of August 2013):

One individual from CAEP will receive in-depth training in the use of the MSG-6 model through a 3-4 month internship at Statistics Norway (Q5 and Q6). After the internship, the CAEP representative will transfer and apply aquired knowledge in China over a period of 6 months with guidance from Norway. After the 6 months, the CAEP representative will again visit Norway (Q9) to discuss practical issues related to applying an MSG-type model in China.

Output: Training in Oslo of CAEP representative in the CGE model MSG-6. Similar model developed/in development at CAEP. Report on training and experience with using CGE models of the MSG-6 type at CAEP.

6.1 CAEP report of CGE model training at Statistics Norway

By Ma Guoxia, May 2015.[8]

Overview of work from first period of stay at SSB (April 1st – July 1st 2014)

During the first period of stay at SSB, I studied the macro balance, the syntax of GAMS, how to construct the simple (2*2*2) economic model, and the SNOW model.

The first month, I studied the syntax of GAMS, and made a presentation about “Green Input-output Model Construction and Simulation in China” to exchange what I did on the input-output model. The second month, I studied to construct the simple (2*2*2) economic model, and supervisor Orvika provided some documents to study the simple model and CES functions. Orvika made some exercises to simulate simple scenarios. The third month, I studied the syntax of MPSGE and the CGE model SNOW constructed by SSB, wrote the SNOW model function and hand book as shown in Supplementary Information 1 and 2. At last, I made a presentation to discuss some thoughts on how to construct the China Environmental CGE model, which were as follows:

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[7] An introduction to the model is available at the Statistics Norway website: http://www.ssb.no/nasjonalregnskap-og-konjunkturer/artikler-og-publikasjoner/macroeconomic-properties-of-the-norwegian-applied-general-equilibrium-model-msg6

[8] This chapter also exists as a separate report in the Vista Analysis project archive. Note that the full report also contains subchapters “The China environmental CGE model”, “Tax on four environmental pollution sectors”, “Subsidy on three environmental tratement sectors”, “A cap on $PM_{2.5}$ emissions”, ”Supplementary information 1: Function of SNOW model” and ”Supplementary Information 2: Handbook of SNOW model”, which have not been included here.

1) We would like to simulate the impact of environmental treatment on GDP. China will invest 5000 billion to control air pollution. So, we want to know if this environmental investment increases economic development and what kind of industries would grow quickly? How much can emissions be reduced with this investment and what kinds of benefits can be achieved? How do we deal with the data of input-output, should we split the environmental investment from the investment firstly?
2) China has implemented the emission reduction of SO_2, NO_X, COD, NH_3 in the twelfth five-year plan, one question we are interested in is how to distribute the reduction target in different industries? The second question is what is the impact of emission reduction to different industries and GDP and other economic indices? Can we simulate these questions?
3) We want to simulate the trend of environmental cost with the economic development, to understand if the relationship between environmental cost and economic development is decoupling or not. Can this be simulated by CGE?
4) Is it difficult to simulate the impact of industrial trade on environmental pollution? As far as I know, virtual water, virtual carbon can be simulated by CGE. Can we simulate virtual pollution by CGE?

Overview of main work in preparation for second period of stay

When I came back to China, I focused on how to construct the China Environmental CGE model. I focused on three parts:

Data accounting

- The environmental input-output table was finished. Two tasks were completed. 1) Splitting the air environmental industry from traditional industries. 2) Splitting the air environmental industry investment from gross capital formation.
- PM2.5 produced and discharged were accounted for. In China, the government did not publish the amount of PM2.5 produced and discharged. I had to investigate how to account it. It is a complicated problem and I asked an expert on air pollution treatment, and found some parameters to account for it.

Data model in GDX format

- Set the domain of rows and columns
- Exchange excel data of XLS format to GAMS data of GDX format.
- Check whether the load data is balanced.
- Set some parameters to GDX
- Check the relationship of parameters if they imply zero-profit and market clearance
- Unload data into GDX-file as the model input.
- Exchange the data of GDX to excel for checking conveniently

China-CGE Model construction

- Load data of GDX
- Set parameters and tax equation.

- Set an equation to account PM2.5 produced and discharged in model.
- Construct the nesting activities structure figures of CGE model.
- Construct the model equations in MPSGE.

What were main challenges for my project?

Although I was able to construct the China Environmental CGE model, there were some difficulties and problems with the model.

- I was initially not able to calibrate the model parameters, and could not run the business as usual scenario.
- Elasticity specification: The elasticities should be specified based on new values in the China Environmental CGE model (sensitivity analysis).
- It was difficult for me to set up the valuable scenarios and get interesting simulated results.
- The literature on CGE models should be studied further and I need to spend more time and guidance on this.

Overview of work from second period of stay (March 1st – March 31st 2015)

With some problems and difficulties, I went to Norway and stayed here for one month. The figure below can explain what happened in this month. The first week, I made a presentation to discuss what I did and what I would do in this month with Orvika and Taran, with Orvika's help. The basic model worked on Monday of the second week. During the second week, I made the second presentation to discuss a paper by Kiuila and Rutherford (2013)[9] and the nest structure of the China Environmental CGE model. During the third week, with the help of Orvika, the China Environmental CGE model worked, but the results of the simulations were not reasonable. During the fourth week, we checked the data and model once more, and revised the model to work. Now, the China Environmental CGE model works and some simulation results seem to be reasonable.

6.2 Statistics Norway's report of the training at SSB

By Tharan Fæhn and Orvika Rosnes, Statistics Norway (SSB), May 2015.[10]

Dr. Ma Guoxia stayed as a visiting researcher at Statistics Norway (SSB), Section for Energy and Environmental Economics in the Research Department, in two periods, April – June 2014 (3 months) and March 2015 (1 month).

Dr. Ma Guoxia worked closely together with Researcher Orvika Rosnes in SSB. In addition, Taran Fæhn (Head of the Section for Energy and Environmental Economics) and Brita Bye (Senior Researcher) participated in the project.

The purpose of Dr. Ma Guoxia's visit was to obtain basic training in CGE-modelling in GAMS/MPSGE, in order to enable her to develop a CGE-model for the Chinese

[9] O. Kiuila, T.F. Rutherford. The cost of reducing CO2 emissions: Integrating abatement technologies into economic modelling. *Ecological Economics*, 87(2013): 62-71

[10] This subchapter also exists as a separate document in the Vista Analysis' Project archive.

economy at the Chinese Academy of Environmental Planning (CAEP) in Beijing, where Ma Gouxia is affiliated.

During the first stay in spring 2014, Dr. Ma Guoxia has:

1. Learned the basics of CGE-modelling in GAMS and MPSGE software, by using simple one-country, 2-sector models. She developed a simple model, calibrated it and carried out simple analyses.
2. Studied the large-scale SNoW model of Statistics Norway and learned about the data and calibration procedures of SNoW.
3. Interpreted MPSGE coding by translating it to algebraic model representation.
4. Outlined the plans for development of a CGE model for Chinese economy.

During autumn and winter 2014, while at CAEP, Dr. Ma Guoxia collected data and constructed and calibrated the first version of the large-scale CGE model for the Chinese economy.

During her second stay in Norway in March 2015, Dr. Ma Guoxia has:

1. Refined the Chinese CGE model further to include emissions of $PM_{2.5}$ and possibilities to invest in $PM_{2.5}$ treatment.
2. Carried out some policy analyses to test the model.

Dr. Ma Guoxia has made impressive progress during the project and developed a CGE model that can be used and extended for various analyses of the Chinese economy.

7. Study tour to Norway (activity 6f)

From the implementation plan (ref. Inception report, of August 2013):

Exchange visit of CAEP and relevant officials to Norway for studies of environmental planning and risk assessment, and methodologies and experiences in risk control and preventions. Institutions to be visited include, e.g., Statistics Norway, Ministry of Environment, Klif, DSB, Provincial authorities of an industrialized area (possibly Fylkesmannen of Telemark county), academic institutions.

7.1 Discussions and considerations 2013-2014

The topic of the study tour to Norway has been discussed several times at project team meetings. In the first phase of the project (Q1-Q6) it was registered that the political climate between Chinese and Norwegian authorities may make such a visit difficult and it was decided to wait with detailed planning until the situation became clearer. A potential time for such a visit was set to Q10-Q11 (summer 2015).

In the fall of 2014, investigations were made to ascertain the realism of a study-tour to Norway. The full-scale rescue and cooperation exercise in Oslo's main harbor 28-29 April 2015 (HarbourEx15), was considered as one suitable and possible occasion for a visit.

7.2 Final plans 2015

Spring 2015

- During the Spring of 2015 it was established that a Chinese study tour to Norway in the summer of 2015 was not realistic. At the Anshun meeting 21-22 May, it was agreed that CAEP will pursue opportunities to arrange a relevant study tour to Germany and the Czech Republic in the Fall of 2015. CAEP and Vista Analysis will have a workshop on the final day of the tour, to discuss learning input.

Summer 2015

- CAEP planned study tour to Germany and the Czech Republic 19-23 October.

September 2015

- Project team meeting in Beijing 4 Sept.: The study tour must be moved to 7-12 December, due to work load incl. mid-term evaluation of project in October.
- The preliminary program for the study tour is presented in table Q below.

Table Q. Preliminary program for study tour (of September 2015)

Activity	Date	Location	Description
Visiting to Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)	7.12	Bonn	Plant safety and the German Major Accidents Ordinance
Workshop in NRW (Nordrhein-Westphalen)	7.12	Essen	Regulation: Federal Soil Protection Act and Ordinance Risk assessment standards: pathways “soil-human being” and “soil-plants”
BASF (company)	8.12	Ludwigshafen	Environmental monitoring and emergency management in BASF
Monitoring station in Worms	8.12	Worms	Presentations about water policy and about monitoring.
Visit to International Commission for the Protection of the Rhine (ICPR)	9.12	Koblenz	2-hour presentation & discussion / exchange at the ICPR secretariat
Melnik Environmental Protection Bureau	10.12	Melnik	Meeting and discussion
Czech Env. Inspectorate	11.12	Prague	Meeting and discussion
CAEP, Vista Analyse, FECO, Local EPBs	12.12	Prague	Internal workshop

Table R. Participant list for study tour (of September 2015)

Name	Affiliation
Yong Wang	Foreign Economic Cooperation Office (Div. II), Ministry of Environmental Protection
Chen Wen	Foreign Economic Cooperation Office, Ministry of Environmental Protection
Zhigeng Deng	Chinese Academy for Environmental Planning
Fang Yu	Center for Environmental Risk and Damage Assessment, CAEP
Guozhi Cao	Center for Environmental Risk and Damage Assessment, CAEP
Chao Li	Center for Environmental Risk and Damage Assessment, CAEP
Huizhong Wang	Center of Environmental Emergency and Accident Investigation, Department of Environmental Protection of Jiansu Province
Jinshun Bian	Center of Environmental Emergency and Accident Investigation, Department of Envionmental Protection of Guizhouu Province
Songtao Guan	Environmental Protection Bureau of Anshun
Chengkuan Zhu	Environmental Protection Bureau of Tongling

7.3 CAEP report of study tour to Europe including learning points, December 2015

The numbering of tables and figures has in chapter 7.3 been adapted by Vista to the numbering in this report.

To promote and carry out the Sino-Norwegian project entitled Cost-Effective Environmental Risk reduction and follow the project action plan, Yu Fang, Cao Dong,

Cao Guozhi, Li Chao from Chinese Academy for Environmental Planning together with Yang Yuchuan from of Foreign Economy Cooperation Office as well as experts including Guan Songtao from Environmental Protection Bureau of Anshun city of Guizhou province (one of the pilot sites) went on an exchange visit regarding environmental risk prevention and emergency management in Germany and Czech from December 6 to 13. The report on this exchange visit is as follows.

7.3.1 Introduction

From December 6 to 13, the visiting group went to Germany and the Czech Republic for an exchange visit regarding European experience on environmental risk management regulations and risk prevention systems and technology. The group visited some academies and agencies including:

- the Bureau of Industrial Safety and Major Accidents of German Environmental Federal (BUNBR),
- the headquarter of BASF of Germany,
- Water Monitoring Station Worms,
- the International Committee of Protecting the Rhine (ICPR),
- the Environmental Protection Agency of Melnika (Starosta Mesta Melnika),
- Departments of the Ministry of the Environment of the Czech Republic.

There were 6 academic presentations and seminars. The team visited the wastewater treatment system of BASF and the water monitoring system of Worms, and had discussions on environmental emergency management regarding chemical industries, environmental monitoring, standards and processes of environmental risk assessment with experts from academies and management agencies of Germany, Czech Republic and Norway. We also had all-round discussions on laws and regulations, standards, technologies and information management in Germany and Czech.

7.3.2 Advanced Experience from Germany and the Czech Republic

Germany's comprehensive legal framework on environmental risk and emergency management

As a federal nation, Germany has 13 states and 3 city states, each of which has a different regulation on supervision and accountability. However, there is also a federal uniform legal framework which is mainly based on various directives under the EU framework.

According to the EU regulations, the federal government and the state government have different responsibilities. The federal government is responsible for the implementation of EU law and resolving violations of EU rules in accordance with certain procedures. The federal government will ensure the implementation of EU law by legislation, but the EU legislation on urban conservation and development of the external emergency plan is not included. Each state is responsible for the development of EU law on urban conservation and external emergency plans, and also the implementation of the relevant laws are checked on a regular basis. The verification process is mainly carried out by various institutions and experts qualified. Meanwhile, the laws also identify the responsibilities of the agencies. In particular, the laws and regulations cover the fields of hazardous materials, industrial safety, major emergencies, water resources, pipelines, and other aspects of disaster reduction. The guidelines for implementation of the various laws and regulations are provided and supported by associated committees. ((See Table S).)

Table S: Germany's laws and regulations and risk management support system

	Laws and Regulations	Relevant Committees and Guidelines
1	Ordinance on Hazardous Materials	Committee on Hazardous Materials TRGS 400 risk Assessment Guidelines on Dangerous Substances Behavior
2	Regulations on Hazardous Substances in Water	
3	Regulations on Pipelines	Committee of Pipelines TRFL Technical Guidelines for Pipelines
4	Regulations on Industrial Safety	Committee of Safe Operation TRBS 2152 Guidelines on Explosion Danger Assessment
5	Regulations on Major Accident Management	Committee of Safe Production KAS 18 Safety Isolating Distance
6	Disaster Control Act	

German laws and regulations clearly define the responsibilities of institutions and enterprises (See Table T). Enterprises' responsibilities on environmental risk and emergency management includes three processes, namely before, during, and after the emergency. Also, the regulations emphasize the obligations of public participation, information disclosure and report. In addition, the respective responsibilities and liabilities of the relevant agencies in the procedures are also pointed out in the form of clear regulations. Moreover, for all relevant bodies and enterprises, there is a clear division of responsibilities to ensure the smooth progress of environmental risk and emergency management.

Table T: Responsibilities of Enterprises and Institutes on Environmental Risk and Emergency Management

	Enterprises' responsibilities	Relevant Institutes' responsibilities
1	Reduce the possibility and impact of major accidents according to related regulations.	Carry out safety audit before official operation.
2	Implement the maintenance, monitoring, training, information and other requirements	Report to the federal ministries in accordance with EU directives.
3	Popularize universal concept of safe production to small enterprises, and require the large and medium-sized enterprises to regularly update security reports to relevant agencies.	Focus on "domino" effect.
4	Ensure the relevant work on emergency preparedness and response	Carry out the verification project.
5	Disclose security and emergency measures to the public.	Accident investigation.
6	Implement the communication and recording mechanism.	

Germany's accurate and pragmatic environmental emergency monitoring and warning technology

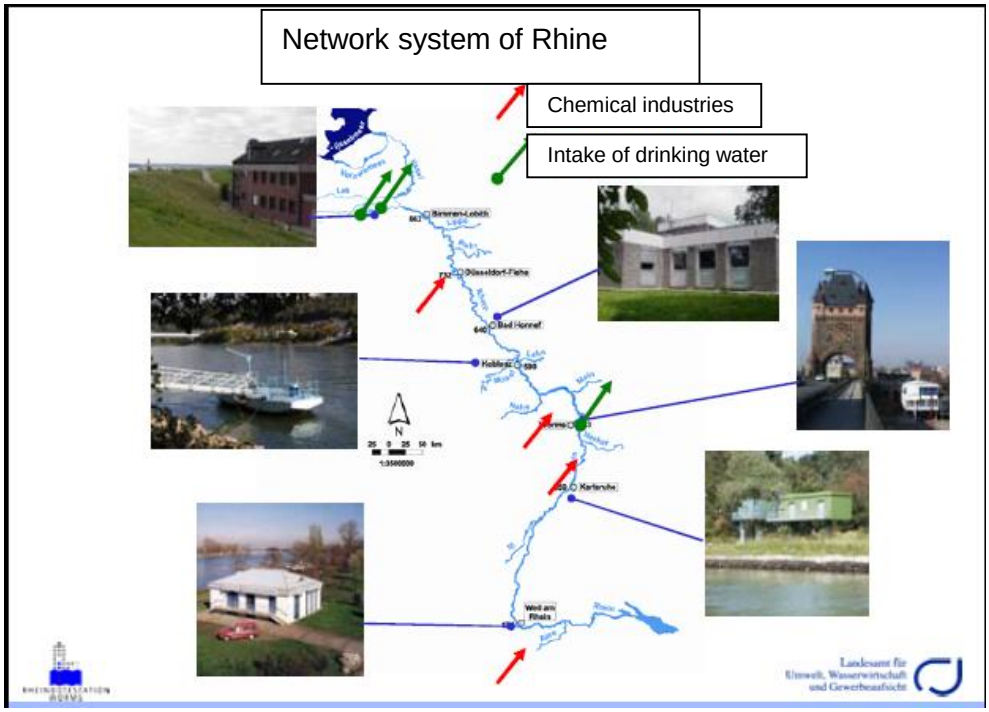
BASF SE is a chemical enterprise in Germany and is also one of the largest chemical enterprises worldwide. BASF has more than 160 joint ventures or wholly owned subsidiaries in 41 countries in Europe, Asia, North and South America. The company is headquartered in Ludwigshafen along the Rhine River and it covers an area of seven square kilometers. There are in total 1750 constructions, 100 km of streets, 200 km of tracks, 2500 km of pipelines and 5 power plants. In addition, the city also has its own

hospital, travel agencies, and train stations. Its form of an integrated site also requires higher and more reliable environmental warning system.

The environmental warning system consists of two parts: decentralized control and centralized control. There is constant data collection with monitoring on quality of air, water and noise. In terms of noise, the sound pressure is detected, collected and data of many years are analyzed. On the air side, they detect sulfur dioxide, nitrogen dioxide, carbon monoxide, wind direction, humidity and other data, through instrumental analysis, which allow them to be ready to get prepared as soon as possible if encountering an explosion or fires and other accidents. Specially trained fire fighters of BASF will guarantee that they will arrive at the accident site within three minutes to ensure no further deterioration will happen. In terms of water, there are two different official pipes responsible respectively for transporting wastewater and cooling water. The waste water will be discharged into the Rhine after treatment. The cooling water enters directly into the Rhine and the process is totally under monitoring. If the cooling water is contaminated, then this section will be turned off until it can be discharged into the Rhine after proper treatment to ensure that contaminated water is not discharged into the Rhine, and this is because the emergency monitoring and early warning technology are pragmatic and accurate.

Dr. Peter Diehl from Worms monitoring station of Rhineland - Palatinate Environment Agency introduced the situation of the Rhine basin as well as the basic mode of operation of the Rhine Valley station warning system.

Figure.8: Network System for Rhine's monitoring and warning system



Worms Rhine water quality monitoring stations are located directly at the drinking water intake whose upstream are surrounded by chemical enterprises like BASF. If accidents like the Sandoz explosion in Switzerland happens, the impact can be incalculable. These reasons contribute to promoting the rapid development of the region's water

quality monitoring and early warning. Specifically, the technical level of the main monitoring stations represent the typical Rhine water quality warning system, including an on-line detection of rapid increase in the concentration of hazardous substances (oxygen content, pH value, temperature), sieve chromatography and mass spectrometry for organic trace substances, continuous bio-tests for concentration of harmful substances. The system can also simulate the source of pollutants generated. (See figure 8)。

Germany's Advanced Environmental Emergency Management System and Emergency Response Capability

Currently, Germany's environmental emergency management system and emergency response capability is very advanced. This is mainly shown in supporting capabilities, early warning capacity, response capacities and so on. Take the emergency prevention and response system in Cologne area as an example, which was introduced by Cologne regional fire inspector Thorsten Ridder of Westphalia regional government, to see in details the status of the German emergency response capacity. Overall, the regional emergency management system consists of two parts, namely, disaster management and related legal systems.

Cologne area emergency management system, also known as "disaster management cycle", is designed to strengthen the emergency management system through capacity building, emergency response and recovery. These include four processes in detail, which are emergency preparedness, emergency response, disaster recovery and impact relief. Emergency preparedness phase includes the implementation of urban conservation law, fire fighting fleet capacity-building, as well as external emergency plans. This has the following characteristics. First, it is guaranteed by Urban Protection Act. All enterprises should follow the relevant city regulations. For example, they should provide relevant information to Local Emergency Management Agency (LEMA), and cooperate with the LEMA to develop internal incident management plan. After the accident, companies should immediately inform the local command agency and carry out other necessary measures. Second, coverage of the fire team is comprehensive. At present, there are 932 fire teams in Germany, widely distributed near airports, chemical plants, power plants and refineries, and can reach the leakage spot or explosion site within five minutes. In addition, the fire agency teams are equipped and staffed similar to ordinary firefighting teams but further with the personnel and equipment for specific environmental emergency events. Third, it has sophisticated external emergency plans, which include a variety of accidents, and every chemical emergency is described in detail. Emergency response plans are also provided. Further details are included as follows.

- Specify the responsible body for coordinating emergency response plans and conducting external emergency plans.
- Describe warning scheme for early substance leakage.
- Action plans of relief organizations.
- Emergency response plan for potential affected areas.
- Action plans of emergency management.
- Information disclosure plans for potential affected populations.

Emergency response phase includes dispatching emergency command team, business and government emergency teams performing loss reduction, real-time sampling analysis, warning affected people and so on. The characteristics of these processes are as follows. First, the command team enjoys good cooperation. Not only the government will pre-designate an emergency event team, the enterprises will also

set up a team of their own experts based on the actual situation, with regular training and drills. Second, the emergency response fleets are equipped with advanced facilities. The emergency fleet can perform more than ten functions, including extinguishing, acting as a mobile command center, pollution abatement, CRBN detection, serving as first aid stations and so on. The fleets also have appropriate detection equipment and personnel. Third, the pre-warning system is constantly updated. Since the 1990s, Germany's original early population warning systems were constantly knocked out and gradually replaced with a new distribution of new sites near the chemical plants. Today, there are currently four warning tests every year.

In addition to emergency relief fleets provided by the government of the state or the city, enterprises with high risks in Germany also have their own rescue team. Alexander Bentz from Fire Department and Josef Schorr from Environmental Monitoring Department of BASF gave detailed introductions on BASF's pre-warning monitoring and emergency response capacity respectively. In terms of "soft capacity", BASF has set up special Emergency Response and Information Centers, which can integrate and coordinate emergency information centers around the world, and get the most professional and prompt solutions from them. In addition, BASF is still the main base of emergency incident management team around the world. According to the level of incidents and the areas affected, the teams are further categorized into cross-region, cross-nation and cross-factory ones. As for the "hard capacity", BASF headquarter is equipped with an emergency response fleet with more than 100 years of history. The main tasks include fire extinguishing, emergency disposal, routine maintenance and so on. The fleet has more than 200 employees and more than 60 vehicles with the most advanced equipment, and the fleets are required to perform drills frequently.

Germany's on-going environmental spatial risk management and communication mechanism

Currently, the German Safety Committee has 27 members, including federal government agencies, independent expert organizations, corporations, insurance companies, non-governmental organizations and other committees. In accordance with the Critical Incident Management Regulations and Safety Committee, Germany's environmental risk management and control fields has made considerable progress. Prof. Christian Jochum, vice-Chairman of the German Committee on Security Incidents spoke about the environmental spatial risk management and communication mechanism.

Germany's major regulations point out clearly about various environmental risk management and control in the region (see table U).

Table U: Overview of Germany's Critical Incident Management Regulations

Number	Management Regulations	Code of Regulations
1	Flood and snowstorm risk management	TRAS 310e, 320
2	Exothermic chemical reaction risk control	TRAS 410
3	Internal reporting system regulations	KAS-8
4	Enterprise Safety Culture Ordinance	KAS-7e
5	Emergency Planning Ordinance	SFK-GS 45
6	Dust explosion risk control	TAA-GS 33
7	Chemical Industry Park Safety Ordinance	SFK-GS 44e

The term KAS-18 is for safe distance for new plants and existing plants. For new plants, the safety distance can be simulated according to the general accident

scenario; for the existing plant, the safety distance is based on a major accident scenario simulation results.

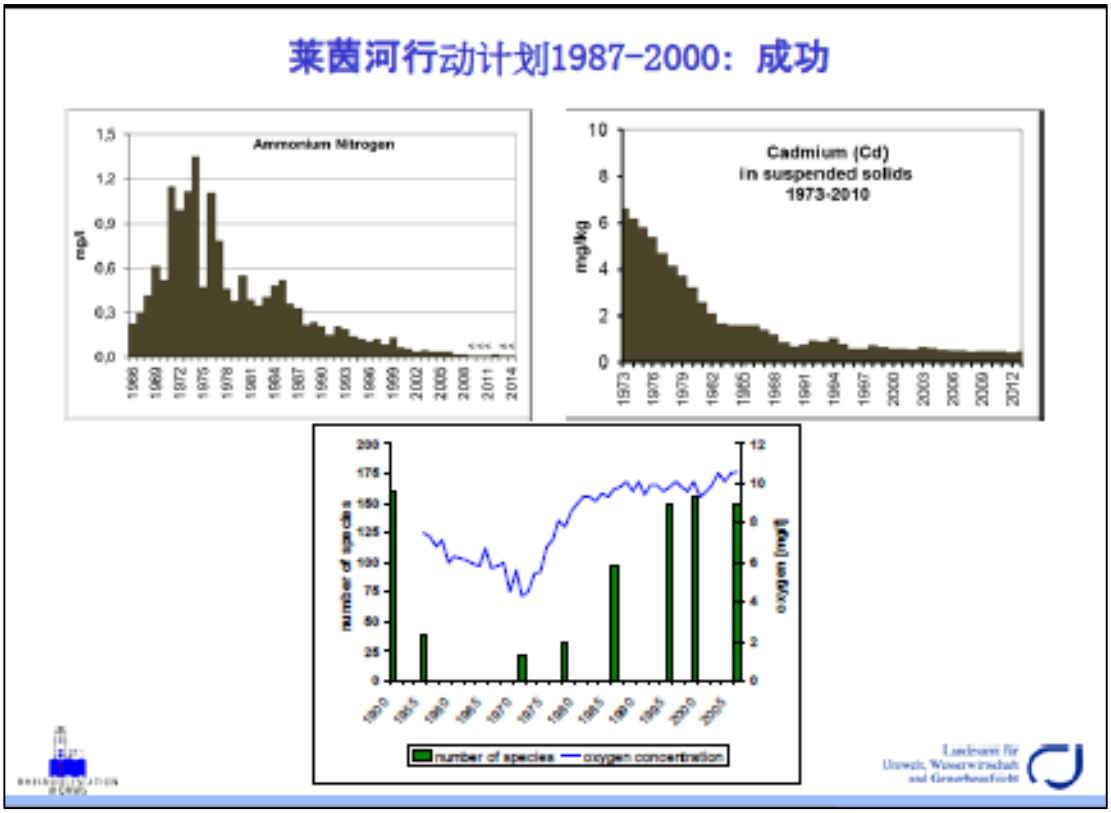
Risk communication mechanism in Germany is based on the EU Seveso directives including 1) the environmental risk assessment in the safety report as the main section; 2) disclose safety report relating to the non-confidential business information to the NGO and the surrounding resident enterprises; 3) surrounding residents and businesses should be informed about the risks and related responses. However, due to the panic after the accident and the media's exaggeration, government and businesses often fall into confidence crisis. In response to such problems, the German government added other risk communication mechanisms on the basis of the Seveso Directive. This includes:

- Invite neutral and prestigious third party experts to assess the enterprise's security management team.
- Interview the employees and workers from the enterprise related to the accident.
- Include the surrounding residents, business representatives, and related organizations in the coordination committee.
- Set up an Email for anonymous reports.
- Release detailed investigation reports on the Internet.
- Strengthen communication and discussions of all sides.

By taking these measures, mutual confidence and communication skills of all stakeholders is greatly enhanced. And because the surrounding residents, businesses have full participation in all aspects of the assessment, it is easier and faster for all parties to reach an agreement on assessment results.

Positive progress on Rhine restoration of the ecological environment

Figure 9: Performance of Rhine Action Plan (1987-2000)



Rhine is the mother river of Europe, but 50% of the chemical enterprises are located in its catchment area. In the 1870s, there was a sharp reduction of the river bifurcation region and bend area, making the Rhine facing problems and seriously affecting the water quality of the Rhine. In the face of these problems, all the states jointly established the International Committee of the Protection of the Rhine which attaches great importance to the economic structure, industrial structure and energy structure adjustment and optimization to prevent and solve the environmental pollution and ecological damage. During 1987-2000, water pollution of the Rhine was under control. Through the "Rhine Action Plan" which involved river course changing, the ammonium nitrogen, suspended solid content of chromium significantly reduced and the oxygen content and the number of species basically reached the level in early 20th century. By "Salmon 2000" program, the number of salmon in the Rhine increased significantly. In terms of the problems brought by dam establishment, a fish ladder was built for salmon to return to Rhine for spawning successfully. The salmon rely highly on water quality and they once disappeared in 1860s. The re-appearance of salmon also marks the re-emergence of good water quality level (see figure 9).

Advanced experience from the Czech Republic

The city of Melnik has achieved remarkable results in improving environmental quality and preventing environmental risk. Since the 1990s, the city has done a lot of work in pollution prevention and control regarding air and water quality. First, through the adjustment of industrial structure, the city closed a number of large chemical enterprises with heavy pollution and implemented a limitation on plant size of the remaining chemical enterprises. The city also provides municipal subsidies to encourage residents to use special funds to use gas and electric heating (the maximum subsidy percent can be 75%, about 4,000 euros). The city also adopts a

series of measures to control vehicle exhaust pollution. For example, the city prohibits diesel trucks entering the downtown area; the second thing is to control the source of polluted water into the Vlatva river and the Elbe River by source control and separating rain and sewage water; the third measure is to classify different kinds of solid waste and then transport the waste to the disposal center. An efficient garbage incinerator is currently being established in the power plant. The preparation work of the station will take up to six years, and four years are required only for public participation in the evaluation work. The annual design capacity is 450,000 tons (equivalent to that generated by 1.5 million people). The government estimates that by 2023, the garbage recycling (incineration) capacity can reach 100 million tons. It is the determination of the city on improving environmental quality and implementing related policies that helped the city win the Environmental Protection Model City at the UN Summit in Rio.

Data, information management and risk control of the Ecological and Environmental Information Bureau has provided strong support for environmental risk management. According to the European Environment Agency DPSIR framework, Czech has logically organized and selected indicators for the description and display of Czech's atmosphere, water, ecology, solid waste, soil and environmental health and finance situation. According to long-term large amount of data and assessment, Czech has reached an ecological planning (2012-2020) that looks into the future of sustainable energy, air quality and climate, landscape and environmental quality of the land. Czech has also joined the Inspire Project of EU. With other EU member states, Czech has carried out observation by satellite remote sensing to provide basic data for a large number of ecological environment changes. In terms of enterprise discharge permit management, the Environment Information Bureau decides whether to issue a license according to the best available technical guidelines (BAT) provided by the EU by considering the scale and technique of the enterprise. A re-assessment will be carried out three years after the previous assessment. In addition, the Ecological and Environment Information Bureau established the basic database in accordance with EU REACH directive regarding implementing chemicals management.

7.3.3 Enlightenment for China on environmental risk and emergency management

Learning from the advanced experience of Germany, the Czech Republic and EU with consideration of China's actual situation and problems, we summarized enlightenments with the focus on legislation effects, emergency response teams, emergency monitoring and early warning, and risk communication mechanisms.

Improve China's environmental risk and emergency management legal system

Develop specialized law and regulations for environmental risk control and emergency response of major accidents. Learning from the EU SEVESO directive, we can clarify and refine the main responsibility for corporate, and further coordinate the supervision departments of safety, environmental protection, transportation, public security and other governmental authorities to establish a unified, rigorous and efficient emergency response system as well as to provide effective legal protection.

Develop emergency response regulation for environmental accidents. Learning from the EU and the German experiences, legislatively define the liabilities and relationships between different environmental and governmental authorities, enterprises, and the public in environmental emergency process. Coordinate the connection among comprehensive supervision, particular supervision, and graded supervision. Based on this, establish regulations and standards for environmental

emergency plan management, information management, resource management, technology management, team building, training and education, and operation support.

Develop special laws and regulations for environmental management of chemicals. Learning from the EU REACH and based on the source prevention and control before the chemical damage to health and the environment, regulate chemical product in its whole life-cycle, including research and development, production, import, marketing, export, use and disposal. Establish the supporting regulation and legislation system of chemical registration, hazard identification, environmental risk assessment, release and transfer control, eliminating restrictions, control of major source, pollution accountability system and so on.

Establish and train professional team for environmental emergency response

Strengthen the construction of local and regional environmental emergency management institution. From Germany's experience on response agencies construction of region, state and city level, we should holistically plan the scale and major tasks for environmental emergency management agencies at different levels. It is suggested to vigorously promote the construction of local emergency management agency and accelerate the construction of the municipal environmental emergency management agencies as well as the regional environmental protection supervision center capacity building. Thus and so, we can gradually build the sufficient emergency management agencies organizations with high quality.

Strengthen the construction of emergency rescue team. Germany's experience shows that it is feasible to build an emergency response team based on the fire and environmental protection personnel of government and enterprise. Environmental emergency rescue team construction lags behind the present stage. We should gradually establish national, provincial, municipal and other different levels of "multi-skill" and comprehensive emergency rescue teams that are based on fire brigades, large enterprises and other professional emergency rescue teams. Gradually establish an environmental emergency response team system including three kinds of teams of fulltime and government-led teams, special and enterprise-led teams, and market-oriented teams. Strengthen training and exercises.

Focus on R & D of environmental emergency monitoring and warning technology

Strengthen the capacity building of environmental emergency monitoring technology research and development. Based on the environmental risk assessment and the characteristics of typical environmental emergencies, we should vigorously promote the environmental emergency monitoring technology and equipment that are portable, efficient and accurate. We should equip the province and the city with necessary portable emergency monitoring instruments and equipment for monitoring heavy metals, volatile organic compounds, oils and so on. In this regard, we can learn from Germany and coordinate environmental protection, fire and other emergency monitoring and response capacity, and strengthen municipal emergency monitoring vehicles with high-performance to have monitoring capability for some specific pollutants.

Vigorously promote the construction of environmental emergency warning system. We should conduct a national plan for the warning system of poisonous gas in chemical industrial parks. It is important to establish a decision-making supporting system regarding poisonous gas by selecting mature atmospheric prediction model and methods with specific focus on typical pollutants as well as large chemical enterprises and industrial parks. Learning from the development experience of water quality warning system of the Rhine River, we can focus on the monitoring and warning

capacity of major river basins, drinking water sources, national rivers and main tributary discharges. Also, we should strengthen the construction of auto-monitoring station and optimize auto-monitoring systems. Furthermore, we should accelerate the promotion of warning systems for heavy metals, volatile phenol, fecal coliform, toxic chemicals, volatile organic compounds and aquatic organisms.

Cultivate a mutual trust communication mechanism of government and the public

Strengthen environmental information disclosure. EU countries including Germany and the Czech Republic give us good experiences on environmental information disclosure mechanism, regulation and effects. Based on "Environmental Protection Law", "Regulations on Environmental Information Disclosure", "Regulations on Enterprises and Institutions Environmental Information Disclosure" and other regulations, we should specify further the contents, procedures, accountabilities of information disclosure, promote mutual trust among government, enterprises and the public.

Establish efficient participation mode in environmental risk management. The diversity and complexity of the environmental risks make cooperation between government agencies and multi-stakeholder more necessary than ever. Germany, as a representative of EU countries, attaches great importance to risk communication. The SEVESO directive and the definition of safety distance by third-party evaluation is a good example. From experiences of Germany and other EU counties, we learn that it is important to establish a risk communication system that is transparent, multi-dimension, and includes information sharing, round-table meeting, and community participation. The system should also cover the governmental authorities, enterprises, the public, community representatives, media, social organizations and other stakeholders. Moreover, we need to build a participation mode for community and the public that includes dialogues and feedbacks of affected community and involves each stakeholder to the process of making environmental management policy, and gather the feedbacks from the stakeholders. Meanwhile, we also should raise the public awareness of risk and the capability of self-rescue in the face of emergencies.

8. Conclusions

Overall conclusions

The training program was carried out according to plan, with some adjustments reflecting project adaptability and hands on management. Cooperation went well and smooth between Vista Analysis, CICERO and CAEP, in spite of the geographical distance between the Norwegian and Chinese team during most of the project implementation period. Possibly the biggest practical challenge when implementing the training program, was the changes of staff in the project and trainers team at CAEP. This was handled by an increased effort towards the end of the project to bring new CAEP project staff up to speed. Below, we sum up performance versus original plan for the six training activities in the training program.

Training at MEP's annual seminar (activity 6a)

As shown in tables V and W below, Vista Analysis carried out one less training (lecture) at MEP's annual seminar than planned. This was due to convergence of MEP's annual conference with the final training of pilots in November 2015, and core project team (Vista & CAEP) decided to prioritize the final training of pilots. The final training of pilots was especially important, as this was to be led by new trainers at CAEP under guidance and inspection from Vista. We consider that the lack of participation at MEP's annual conference in 2015 has not hampered dissemination of project findings significantly, and was to some extent compensated for by the final conference (ref. appendix).

Table V: Planned timeline for the trainings (Q1= January-March 2013)

Activities	2013			2014				2015			
	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
6a: Training at MEPs annual seminar		x				x				x	
6b: Training of trainers			x		x		x		x		
6c: In-depth training of target group			x		x				x		
6d: GAINS training		x	x								
6e: MSG-6 training				x	x			x			
6f: Study tour Norway					?	?			?		

Table W: Ex-post timeline for the trainings (Q1= January-March 2013)

Activities	2013			2014				2015			
	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
6a: Training at MEPs annual seminar		x				x				0	
6b: Training of Trainers	X			X			X		X	X	X
6c: In-depth training target group					X		X		X		X
6d: GAINS training			X								X
6e: MSG-6 training				0	x			x			
6f: Study tour (Germany & Czech Rep)											X
* Differences from the original plan (ref. table A), are marked with "X" or "0" (did not happen)											

Training of trainers (activity 6b)

As shown in tables V and W above, Vista Analysis carried out two more ToT-sessions than planned, towards the end of the project. This was instigated by changes in staff on

the CAEP side, making it necessary to make an increased effort to bring the new trainers that joined the project in the last year up to speed. As shown in chapter 3, we succeeded in bringing the whole trainers group up to an advanced knowledge level qualifying them to be trainers in their own right after Project end.

In-depth training of target group (activity 6c)

As shown in tables V and W above, Vista and CAEP carried out 4 and not 3 trainings of pilots. The extra training in Anshun in Q8, was carried out to compensate for the low participation in the training held in Q6 in Beijing. As described in chapter 4.11, a comparison of the baseline survey (2013) and the final survey (2016) of knowledge levels in the target group, shows a consistent and substantial positive development between the start and end of the project.

GAINS training and MSG-6 training (activities 6d and 6e)

As shown in tables V and W above, the GAINS and MSG-6 training was carried out as planned - with some adjustments of the timeline. Study tour reports document learning content and an advanced understanding by the participants.

Study tour to Norway (activity 6f)

As shown in tables V and W above and described in chapter 7, the study tour to Norway was delayed and finally carried out as a study tour to Germany and the Czech Republic. The study tour was well-connected to the training program of the Project, as it included visits to institutions and direct experience of best practise internationally that had been presented in lectures during the trainings. The learning outcome was thus not significantly hampered by the change in destination.

9. Appendix: The final conference, March 2016

A final summary and dissemination conference was held in Beijing 17 March, 2016. The aim of the conference was to sum up the results of the conference, and to share findings and recommendations.

Conference Agenda

09:00-17:00, March 17, 2016		
Time	**Content**	**Speaker**
09:00-09:40	Opening and welcome remarks	FECO MOFCOM Norwegian Embassy International Dep., MEP Planning Department, MEP Emergency Center, MEP
09:40-10:20	Introduction of the project implementation and project policy recommendations and follow up possibilities (one presentation)	Yu Fang, CAEP
10:20-10:40	Tea break and group photo	
Session 1: Methodology framework, chaired by Kristin Aunan		
10:40-11:20	Overview of Seven-step framework	Haakon Vennemo, VISTA
11:20-11:50	Acute and accumulated risk assessment at prefecture/city level based on county data	Jia Qian, CAEP
11:50-12:00	Discussion	
12:00-13:30	Lunch break	
Session 2: Pilot experience, chaired by Yu Fang		
13:30-14:00	Introduction of Tongling pilot experience	Guo Zhong, Tongling EPB
14:00-14:30	Introduction of Jiangsu pilot experience	Wang Huizhong, Jiangsu EPB
14:30-15:00	Introduction of Guizhou and Anshun pilot experience	Zhang Shu, Guizhou EPB
15:00-15:10	Tea break	
Session 3:Training, capacity building and the way forward, chaired by Haakon Vennemo		
15:10-15:40	Introduction of the training and capacity building	Rasmus Reinvang, VISTA
15:40-16:00	Training and capacity building as seen by CAEP: Usefulness and potential	Cao Guozhi, CAEP
16:00-16:10	Training and capacity building as experienced by pilots: usefulness and potential	Representatives of Pilots
16:10-16:20	Award ceremony Training of trainers	H. Vennemo & Yu Fang
16:20-16:30	Award ceremony participating organizations	H. Vennemo & Yu Fang
16:30-16:50	The way forward: Discussion	Led by H. Vennemo
16:50-17:00	Conclusion	Led by H. Vennemo

Participant list final conference in Beijing, 17 March 2016

	Organization	Name	Title
1.	Norway Embassy	Jan Wilhelm Grythe	Commercial Counselor
2	Norway Embassy	Tor Skudal	Environmental Counselor
3	Norway Embassy	Liu Yinglang	Official
4	International Department of MEP	Kang Yun	Official
5	Planning and Finance Department MEP	Wang Fei	Division Director
6	Environmental Emergency Center of MEP	Mao Jianying	Director
7	Vista Analysis	Haakon Vennemo	Director
8	Vista Analysis	Rasmus Reinvang	Doctor
9	Vista Analysis	John Skjelvik	Senior ecnomist
10	CICERO	Kristin Aunan	Doctor
11	Beijing Normal University	Liu Renzhi	Professor
12	Academy for Env. Planning Nanjing Univ.	Jiao Tao	Director
13	Academy for Env. Planning Nanjing Univ.	Liu Mengfei	Engineer
14	Jiangsu Env. Emergency Center	Wang Huizhong	Director
15	Jiangsu Env. Emergency Center	Li Cheng	Engineer
16	Jiangsu Env. Emergency Center	Du Hao	Engineer
17	Jiangsu Env. Emergency Center	Chen Fuxiao	Engineer
18	Guizhou Env. Emergency Center	Bian Jinshun	Director
19	Guizhou Env. Emergency Center	Zhang Shu	Section Chief
20	Anshun EPB	Chen Jingyao	Engineer
21	Tongling EPB	Guo Zhong	Chief Engineer
22	Tongling Env. Emergency Center	Cui Zhuanzheng	Director
23	Tongling Env. Emergency Center	Hu Zhengjun	Engineer
24	Foreign Economic Coop. Office, MEP	Wang Yong	Director
25	Foreign Economic Coop. Office, MEP	Wen Chen	Officer
26	Foreign Economic Coop. Office, MEP	Zhu Yawen	Officer
27	Foreign Economic Coop. Office, MEP	He Shan	Officer
28	Chinese Academy For Env. Planning	Yu Fang	Director
29	Chinese Academy For Env. Planning	Cao Guozhi	Section Chief
30	Chinese Academy For Env. Planning	Jia Qian	Engineer
31	Chinese Academy For Env. Planning	Ma Guoxia	Associate Researcher
32	Chinese Academy For Env. Planning	Zhang Yanshen	Associate Researcher
33	Chinese Academy For Env. Planning	Tian Chao	Engineer
34	Chinese Academy For Env. Planning	Zhou You	Engineer
35	Chinese Academy For Env. Planning	Zhou Xiafei	Engineer

Photos from the final conference, Beijing 17 March 2016

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