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From: *Margaret M. Doane*
Margaret M. Doane, Director, Office of International Programs

Date: October 29, 2007

Subject:

TRIP REPORT: TRAINING ON THE DESIGN AND DESIGN CERTIFICATION OF THE AP 1000 IN CHINA (AUGUST 2007)

Comment:

I am forwarding to you the staff's trip report on the AP 1000 Design and Design Certification Review Training Program which was presented to the Chinese National Nuclear Safety Administration from August 6-7, 2007. NRC staff from the offices of Human Resources (HR), Research (RES), New Reactors (NRO), and International Programs (OIP), presented technical training on the AP 1000 design and the design of its passive safety features. The NRC representatives included: R. Scott Egli (HR), Stephen Bajorek (RES), Scott Moore and John Ramsey (OIP), and Patrick Madden, Joelle Starefos, Jerry Wilson, and Ashok Thadani (NRO).

This training program was the first cooperative activity under the Memorandum of Cooperation (MOC) between the NRC and the NNSA which was signed in May 2007.

Contact: Cindy Rosales-Cooper, 301-415-1168

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D. Ash, DEDIS
L. Trocine, OEDO
V. Ordaz, OEDO
K. Cyr, OGC
T. Rothschild, OGC
M. Weber, NMSS
E. Leeds, NMSS
Y. Chen, NMSS
B. Sheron, RES
D.-M. Perez, RES

M. Cullingford, NRR
R. Zimmerman, NSIR
B. Dean, NSIR
F. Sturz, NSIR
P. Rabldeau, CFO
D. Cool, FSME
C. Miller, FSME
G. Pangburn, FSME
B. Borchardt, NRO
G. Holahan, NRO
D. Williams, NRO
P. Koltay, NRO
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Carolyn ☒
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11-2

September 18, 2007

MEMORANDUM TO: R. W. Borchardt, Director
Office of New Reactors

THROUGH: Patrick M. Madden, Deputy Director /RA/
Division of New Reactor Licensing
Office of New Reactors

FROM: Joelle L. Starefos, Acting Chief /RA/
Organizational Effectiveness and Productivity Branch
Division of New Reactor Licensing
Office of New Reactors

SUBJECT: NRC FOREIGN TRIP REPORT ON THE AP1000 DESIGN AND
DESIGN CERTIFICATION REVIEW TRAINING PROGRAM
PRESENTED IN CHINA FROM AUGUST 6-17, 2007

Enclosed is the trip report which summarizes the AP1000 training program presented by the NRC staff in Beijing and Beidaihe, China from August 6-17, 2007. This training program was the first cooperative activity under the Memorandum of Cooperation (MOC) between the NRC and the National Nuclear Safety Administration (NNSA) of the People's Republic of China signed in May 2007.

NRC staff from the offices of Human Resources (OHR), Research (RES), New Reactors (NRO), and International Programs (OIP) presented technical training on the AP1000 design and the design of its passive safety features. The training also included the plant's response to anticipated and abnormal operational occurrences, and postulated design basis and beyond design basis accident conditions. The following NRC staff members participated in the training: R. Scott Egli (OHR), Stephen Bajorek (RES), Patrick Madden (NRO), Scott Moore (OIP), John (Jack) Ramsey (OIP), Joelle Starefos (NRO), Ashok Thadani (NRO), and Jerry Wilson (NRO). This report also contains information obtained during discussions with our foreign counterparts and the release of this information could interfere with our ability to communicate openly in the future.

Because the MOC agrees to cooperation on the nuclear safety review, the content of this report may be of interest to the Commission and it is recommended that the report be forwarded to the Commission.

Enclosure: NRC Foreign Trip Report
cc w/att: V. Ordaz, AO/EDO

P. Koltay, NRO

M. Doane, OIP

W. Eisenberg, RES

Distribution:

Stephen Bajorek

Scott Egli

ML072560114

K. Gibson, OHR

C. Lui, RES

S. Moore, OIP

ONSIR/INFOSEC

Jerry Wilson

Ashok Thadani

ML072560328 (Enclosure)

C. Rosales-Cooper, OIP

T. Rothschild, OGC

RidsOipMailCenter

RidsNroMailCenter

John (Jack) Ramsey

Scott Moore

ML072560379 (Package)

OFFICE	ABC:NRO/DNRL	DD:NRO/DNRL
NAME	JLStarefos	PMJ Madden
DATE	9/17/07	9/18/07

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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September 18, 2007

MEMORANDUM TO: R. W. Borchardt, Director
Office of New Reactors

THROUGH: Patrick M. Madden, Deputy Director
Division of New Reactor Licensing
Office of New Reactors

FROM: Joelle L. Starefos, Acting Chief
Organizational Effectiveness and Productivity Branch
Division of New Reactor Licensing
Office of New Reactors

SUBJECT: NRC FOREIGN TRIP REPORT ON THE AP1000 DESIGN AND
DESIGN CERTIFICATION REVIEW TRAINING PROGRAM
PRESENTED IN CHINA FROM AUGUST 6-17, 2007

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NRC staff from the offices of Human Resources (OHR), Research (RES), New Reactors (NRO), and International Programs (OIP) presented technical training on the AP1000 design and the design of its passive safety features. The training also included the plant's response to anticipated and abnormal operational occurrences, and postulated design basis and beyond design basis accident conditions. The following NRC staff members participated in the training: R. Scott Egli (OHR), Stephen Bajorek (RES), Patrick Madden (NRO), Scott Moore (OIP), John (Jack) Ramsey (OIP), Joelle Starefos (NRO), Ashok Thadani (NRO), and Jerry Wilson (NRO). This report also contains information obtained during discussions with our foreign counterparts and the release of this information could interfere with our ability to communicate openly in the future.

Because the MOC agrees to cooperation on the nuclear safety review, the content of this report may be of interest to the Commission and it is recommended that the report be forwarded to the Commission.

Enclosure: NRC Foreign Trip Report

cc w/att: V. Ordaz,
AO/EDO
P. Koltay, NRO
M. Doane, OIP
W. Eisenberg, RES

K. Gibson, OHR
C. Lui, RES
S. Moore, OIP
ONSIR/INFOSEC
C. Rosales-Cooper, OIP

T. Rothschild, OGC
RidsOipMailCenter
RidsNroMailCenter

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NRC FOREIGN TRIP REPORT

Subject

This trip report summarizes the AP1000 training program presented by the NRC staff in Beijing and Beidaihe, China from August 6-17, 2007.

This training program was the first cooperative activity under the Memorandum of Cooperation (MOC) between the NRC and the National Nuclear Safety Administration (NNSA) signed in May 2007. The MOC agrees to cooperation on the nuclear safety review and inspection for the siting, design, manufacturing, construction, commissioning and operation phases of the AP1000.

Dates of Travel and Countries/Organizations Visited

August 3-19, 2007, Beijing and Beidaihe, China

Author, Title, and Agency Affiliation

Joelle Starefos, Acting Chief,
Organizational Effectiveness and Productivity Branch, Office of New Reactors (NRO)

Accompanied by the following NRC managers and staff:

Patrick Madden, Deputy Director, Policy and Infrastructure, NRO;

Scott Moore, Deputy Director, Office of International Programs (OIP);

John (Jack) Ramsey, Senior Nuclear Engineer, OIP;

Dr. Stephen Bajorek, Senior Technical Advisor for Thermal-Hydraulics,
Office of Research (RES);

R. Scott Egli, Reactor Technology Instructor, Office of Human Resources (OHR);

Ashok Thadani, Senior Advisor, NRO; and

Jerry Wilson, Senior Policy Analyst, NRO.

Sensitivity

Official Use Only / Non-Public This report contains information obtained during discussions with our foreign counterparts. Release of this information would jeopardize our ability to receive these frank opinions in the future.

Background/Purpose

The purpose of this trip was to provide initial technical training to the Chinese on the AP1000 design and the NRC's design certification review. This training program was the first cooperative activity under the MOC between the NRC and the NNSA signed in May 2007.

Abstract: Summary of Pertinent Points/Issues

NRC staff from the offices of OHR, RES, and NRO presented 10 days (August 6-17, 2007) of technical training related to AP1000 covering the AP1000 Introduction (R-107P) Course, a description of the vendor's test program and analytical models, a characterization of the

NRC's independent confirmatory testing and analyses, a summary of the NRC's treatment of severe accidents, and a summarization of several policy and technical issues arising from the AP1000 review. The staff also presented portions of the Licensing Reactors under 10 CFR Part 52 Course, and a historical perspective on the evolution of risk-informed regulation. Feedback from the participants on the presentations and technical content was very beneficial to their understanding of the design and its response to varying operational and accident conditions.

On August 17, 2007, NRC staff was briefed on nuclear and radiation safety in China by managers from the State Environmental Protection Administration (SEPA) and the National Nuclear Safety Administration (NNSA) of the People's Republic of China. SEPA/NNSA presentation materials may be viewed at ADAMS Accession No. ML072320439.

From the insight gained during the interaction with the representatives attending the training, the following are proposed areas of interest where further interaction could provide benefits to both the NRC and the NNSA:

- Construction inspection program
- Sharing review insights for risk important systems
- Vendor/component quality assurance and control programs
- Emergency preparedness
- Human factors
- Digital instrumentation and controls
- Environmental reviews
- Test data from Chinese prototype high-temperature gas-cooled reactor

In addition, NRC representatives from OIP discussed scheduling and coordination of the NRC Chairman's visit to China. The first NRC-NNSA Steering Committee on Nuclear Safety Cooperation is expected to coincide with the Chairman's visit to China.

Discussion

NRC TECHNICAL TRAINING PROGRAM

The following NRC staff members supported the technical training effort in China: R. Scott Egli (OHR), Stephen Bajorek (RES), Patrick Madden (NRO), Scott Moore (OIP), John (Jack) Ramsey (OIP), Joelle Starefos (NRO), Ashok Thadani (NRO), and Jerry Wilson (NRO). During the first week, portions of the team traveled to Beijing, China, to a hotel and conference facility that could accommodate the large number of student attending the technical training. After 4 days of training, the students and NRC staff were transported to Beldaihe, China, approximately 4 hours east of Beijing to the SEPA training facility. With some NRC staff returning home and others arriving in China, the remaining 6 days of training was accomplished at the SEPA facility.

This two-week training included presentations on a breadth of technical and licensing topics related to the AP1000 reactor design. Two NRC technical training courses that are currently being used to train NRC staff entitled "Licensing Reactors Under 10 CFR Part 52 Course" and "AP1000 Introduction (R-107P) Course" were used to support this initial training. The staff removed workload related information and information presented by OGC describing hearing preparation from the Part 52 Course presentation. Consistent with our current training process which allows foreign attendees to return home with NRC course materials,

the staff provided the AP1000 Technology Manual to NNSA for interpretation and reproduction prior to the staff's visit.

Specifically, in support of this training, the staff developed a presentation to discuss the historical perspectives on the evolution of risk-informed regulation – how the NRC developed and is now using probabilistic risk assessment (PRA) tools to influence regulatory decision-making. The staff also presented topics discussed previously in a July 2004 workshop in Beijing, China, including a description of the vendor's test program and analytical models, a characterization of the NRC's independent confirmatory testing and analyses, a summary of the NRC's treatment of severe accidents, and a summarization of several policy and technical issues arising from the AP1000 review. The staff also presented opening remarks, including an overview of the NRC and the new reactor design-centered review approach for combined license application reviews. In response to NNSA's request, the staff developed a 30-question examination, including answers, related to the training seminar curriculum (ML072550275). Closing remarks provided an overview of examination topics and communicated the staff's appreciation for NNSA and SEPA's hospitality during the staff's visit to China.

In addition, the staff provided electronic copies of the following NRC public documents:

- NUREG/BR-0099, NRC Brochure
- NUREG/BR-0164, "NRC – Regulator of Safety" Brochure
- NUREG-1350, 2006-2007 Information Digest
- NUREG/BR-0175, "A Short History of Nuclear Regulation, 1946-1999"
- NUREG/BR-0249, "The Atomic Safety and Licensing Board Panel"
- NUREG-1793, Vols. 1, 2, 3, and Supp. 1, "Final Safety Evaluation Report Related to the Certification of the AP1000 Standard Design"

There were more than 160 Chinese attendees from the following organizations:

- Beijing Institute of Nuclear Engineering
- China National Nuclear Corporation
- China Institute of Nuclear Power Operation and Design
- China Power Investment Corporation
- Department of International Cooperation of Nuclear Safety, SEPA
- Department of Nuclear Safety and Radiation Management, SEPA
- Guangdong Regional Office of Nuclear and Radiation Safety
- Northeast Regional Office of Nuclear and Radiation Safety
- Northern Regional Office of Nuclear and Radiation Safety
- Nuclear and Radiation Safety Center
- Nuclear Facility Center, Institute of Mechanics
- Sanmen Nuclear Power Corporation, Ltd
- Shandong Nuclear Power Company, Ltd
- Shanghai Regional Office of Nuclear and Radiation Safety
- Sichuan Regional Office of Nuclear and Radiation Safety
- State Nuclear Power Technical Corporation
- Suzhou Nuclear Safety Center
- Wuhan Institute of Nuclear Power Operation and Research

Feedback from the participants on the presentations and technical content was very beneficial to their understanding of the design and its response to varying operational and accident conditions.

CHINA'S NUCLEAR POWER PROGRAM

On August 17, 2007, Mr. Scott Moore, Deputy Director, OIP, Mr. Patrick Madden, Deputy Director for Policy and Infrastructure, Division of New Reactor Licensing (DNRL), NRO, and Ms. Joelle Starefos, Acting Branch Chief, DNRL, NRO, met with Deputy Director General WANG, NNSA, Mr. JIANG Wei, Director of the Division of Nuclear Safety International Cooperation, and other representatives of NNSA and the Nuclear and Radiation Safety Center (NSC). The purpose of this meeting was to gain an understanding of China's nuclear power program, the regulatory and licensing process, construction inspection oversight, component manufacturing licensing process, and to gain insights into areas of future cooperation.

The Chinese officials provided a briefing describing the following nuclear power plant facilities, programs, and regulatory processes:

- Qinshan site – five units: one unit, 310 MWe PWR Chinese design; two units, 650 MWe PWR Chinese design (similar to Westinghouse two loop design); and two units, 728 MWe CANDU6
- DAYA Bay site – one unit, 984 MWe PWR French design
- Lingao site – two units, 990 MWe PWR French design
- Tianwan site – two units, VVER 1000 (first unit operational in 2006 and second unit expected to be operational in 2007)
- Yang Chiang site – two units, AP1000
- San Mien site – two units, AP1000

By the end of 2005, nuclear power plants supplied a total of 7 GWe in mainland China, representing 1.6% of total capacity of electrical generation. By 2020, the Chinese government plans to reach 40 GWe from nuclear electric facilities. Nuclear supply capacity under construction will reach 18 GWe.

Overview of the Chinese Regulatory and Licensing Process

The reactor licensing process consists of the following plant steps and these steps need to be approved by either the NNSA or the local provincial government before a nuclear power plant utility can proceed to the next step in the process:

- Nuclear reactor siting
- Construction permit
- First fuel load
- Operating license
- Decommissioning
- Operator Licensing

Nuclear Reactor Siting

SEPA total staff for nuclear matters is 31 and the agency is functionally responsible for all environmental regulation in China. The provincial governments are

responsible for implementation of these regulatory requirements. Specifically, the provincial government is responsible for ensuring the environmental assessment performed for the siting of a nuclear power plant meets the regulations. The provincial government is responsible for granting the approval.

Construction Permit

Prior to the issuance of a construction permit, NNSA, with the support of NSC, will perform the necessary engineering review of the preliminary safety analysis report, PRA, emergency preparedness, quality assurance, etc., prior to NNSA's issuance of the construction permit.

NNSA is responsible for all nuclear regulation. Their regulatory responsibility covers nuclear power plants, research reactors, radioactive source materials, fuel cycle, and nuclear component manufacturing. The total staff for NNSA is approximately 80.

The NSC will provide the engineering and consulting services for the AP1000 nuclear power plant design review and related technical matters. The NSC has a staff of approximately 120.

First Fuel Load

Based on the satisfactory results of the inspection oversight and preoperational startup testing, NNSA will authorize fuel load.

The construction inspections will be performed by the appropriate regional office. The Chinese have six regional offices. The total staff for all the regional offices is about 100. Currently, the Chinese are planning to use the Shanghai regional office for the AP1000 construction oversight. Construction inspection guidance for the new facilities has been developed.

Operating License

NNSA issues the license for operation.

Insights into Areas of Future Cooperation

During the August 17, 2007, meeting, the Chinese suggested the following as their priority for AP1000 areas of cooperation:

- *Priority 1* - Information sharing on NRC review, confirmatory review data, and regulation
- *Priority 2* - Computer codes
- *Priority 3* - NRC technical support to Chinese during their AP1000 technical review
- *Priority 4* - On the job training, exchange of personnel
- *Priority 5* - Inspection of nuclear component manufacturing

Additionally, the NRC suggested the following areas of cooperation where mutual benefits could be realized by both the NRC and the NNSA:

- Construction inspection program
- Sharing review insights for risk important systems

- Vendor/component quality assurance and control programs
- Emergency preparedness
- Human factors
- Digital instrumentation and controls
- Environmental reviews

Pending Actions/Planned Next Steps for NRC

NRC Chairman visit to China.

The NRC-NNSA Steering Committee on Nuclear Safety Cooperation will meet annually to determine future cooperation activities. The first NRC-NNSA Steering Committee on Nuclear Safety Cooperation is expected to coincide with the Chairman's visit to China.

Points for Commission Consideration/Items of Interest

None

Attachments

1. Business Cards
2. List of Training Attendees

References

- Agenda (ML072550330)
- Presentation entitled "Nuclear and Radiation Safety in China," presented by SEPA and NNSA, of the People's Republic of China (ML072320439)
- Examination provided to NNSA--August 2007 (ML072550275)
- Quick Look Report--China Trip--August 2007 (ML072480481)
- Final Thoughts Presentation Speech (ML072560751)
- Training Presentations (ML072070617-PKG)

"On the Margins"

None

National Nuclear Safety Administration
People's Republic of China



Nuclear and Radiation Safety Centre
State Environmental Protection Administration
People's Republic of China

LIU Hua Ph. D., Research Professor
Director General

No. 115 Xizhimennei Nanjiaojie Tel: (8610) 66556343
Beijing China Fax: (b)(6)
Postcode: 100035 E-mail: [redacted]

KANG Yufeng
Deputy Director General, Professor

P.O. Box 1028 Tel: +86-10-82212505
54 Hong Lian Nan Cun, Haidian 62259296 Fax: +86-10-
Beijing 100088, P.R.China 62257804 E-mail:
(b)(6)



American Embassy Beijing
greencl@state.gov

Christopher Green

Karyn Green

Second Secretary

Environment, Science, Technology & Health

3 Xiu Shui Bei Jie
Beijing, China 100600
Tel: 6532-3831 Ext. 6929
E-mail: greenkm@state.gov

PSC 461/BOX 50
FPO AP 96521-0002
Fax: 6532-3297
<http://www.usembassy-china.org.cn>



SHANGHAI NUCLEAR ENGINEERING
RESEARCH AND DESIGN INSTITUTE
IT C&I Group, Dept. of Elec. I & C

Zhang Shuhui
Engineer

NO.29 Hong Cao Road
Shanghai, China 200233

Tel: (021) 64850220-27012
Fax: (021) 64854003
E-mail: (b)(6)
[redacted]
(b)(6)

National Nuclear Safety Administration
People's Republic of China

Wang Zhongtang
Deputy Director General

No. 115 Xizhimennei Nanjiaojie Tel: (010) 66556343
Beijing China Fax: (010) 66126715
Postcode: 100035 E-mail: (b)(6)

TraineeListOfAP1000NuclearReactorTraining

Organization	Number of Participants	Name	TEL (C)	Cell Phone	FAX	EMAIL
Department Of Nuclear Safety and Radiation Management, SEPA	16	WangJun	010-66556343			(b)(6)
		WangZhongtang	010-66556341			
		ZhouShirong	010-66556353			
		LIJigen	010-66556356			
		TianGen	010-66556351			
		JiangFan	010-66556359			
		JiaXiang	010-66556392			
		HouWei				
		GuJianfeng				
		LRUJun				
		ShaoMingchang	010-66556376			
		LITianshu				
		ZhangJiali	010-66556369			
		ShenGang	010-66556394			
		FengYoucai	010-66556348			
		ZhenWei bo				
		TangBo	010-82212504			(b)(6)
		KangYufeng	010-62259298			
		ZhuHong	010-82212511			
		FengYI (F)	010-82212514			
		WangFang (F)	010-82212691			
		LIU (F)	010-82212696			
		ChangMeng	010-82212693			
		ZhengXiangyang	010-82212694			
		ChaiGuohan	010-62258193			
		ZhangChunming				
		WangXiaohai	010-82212572			
		LiChujn	010-82212566			
		Zhouhong (F)	010-82212571			
		ShiJinying (F)				
		YIYan				
		ZhangHailin				
		ZhangQinhua	010-82212573			
		XiaoJun	010-82212567			
		ZhongYimin (F)	010-82212568			

Organization	Number of Participants	Name	TEL(O)	CellPhone	FAX	EMAIL
Nuclear And Radiation Safety Center	73	Chen Zhaolin (F)	010-82212569			(b)(6)
		Lin Bin	010-82212563			
		Tao Shusheng	010-82212565			
		Liu Yu	010-82212564			
		Sun Zhaozhan	010-82212591			
		Zhang Yue (F)	010-82212596			
		Wang Qing (F)				
		Huang Bingchen				
		Sun Haitao	13520580843			
		Fang Yonggang	13811458318			
		Cui Zaiming				
		Shen Wei				
		Duan Hongwei	010-82212619			
		Lang Aiguo	010-62258395			
		Wang Zhongqiu	010-82212623			
		Mao Congji	010-82212624			
		Mu Qi	010-82212627			
		Ren Lihua (F)	010-82212622			
		Fang Yan (F)	010-82212625			
		Yang Di				
		Zhu Lixin	010-82212760			
		Zhou Limin (F)				
		Zhou Kefei (F)	010-82212584			
		Chen Rui				
		Zhang Chi	010-82212584			
		Sun Guochen	010-82212587			
		Wu Wenguang				
		Li Juan (F)	010-82212588			
		Li Bing (F)	010-82212588			
		Pang Zongzhu	010-82212580			
		Lin Quanyi	010-82212549			
		Fu Qiang	010-82212659			
		Yuan Zhilun				
		Zhao Shangui	010-82212543			
		Zhang Zengqing	010-82212551			

Organization	Number of Participants	Name	TEL(O)	Cell Phone	FAX	EMAIL
		YueHuiguo	010-82212542			(b)(6)
		ChengYingying (F)	13520976481			
		LiuXinhua	010-82212632			
		LiuTianshu	010-82212635			
		YangHaifeng	010-82212634			
		WangPing (F)	010-82212633			
		XuYanchun (F)	010-82212635			
		WuHao	010-82212331			
		SiGuojian				
		ShangZhaorong				
		HouChunlin (F)				
		PanRong (F)	010-82212612			
		FuJianjun (F)				
		LiHongbing				
		MaWei (F)				
		KangLiping (F)				
		BaiBaorong (F)				
		YiHaiyan				
		SangChangming				
Northern Regional Office of Nuclear And Radiation Safety	2	YanTianwen	31199915	(b)(6)	99908	
		ZhaoPengyu	0518-2205157		E-2206025	
Shanghai Regional Office Of Nuclear And Radiation Safety	5	FengJianping	021-64403078		-44403222	
		RenOu	0573-86384292		73-86384292	
		ZhuWeihu	0573-86384292		73-86384292	
		LinWelbo	0573-86934336		73-86934336	
		LiXuefa	0573-86654251		73-86654251	
Guangdong Regional Office Of Nuclear And Radiation Safety	2	LiYongguo	0755-84477149		5-84477147	
		ZhangXiaomin	0755-84477308		5-84477147	
Sichuan Regional Office Of Nuclear And Radiation Safety	2	ZhangZhigang	028-85591177		-85589152	
		FanYumao	028-85587163		-85535120	
Northeast Regional Office Of Nuclear And Radiation Safety	1	WangHalli	0411-82510785		1-82510749	
Nuclear Facility Center, Institute of Mechanics	4	ZhangShujun	010-86301556		-86301550	
		MaJingxian (F)	010-86301557		-86301550	
		ZhangJin (F)	010-86301552		-86301550	
		DuAlling (F)	010-86301578		-86301550	

Organization	Number of Participants	Name	TEL(O)	CellPhone	FAX	EMAIL
		MengLei (F)	010-88301578	(b)(6)	10-88301550	(b)(6)
		HanGuoli	010-88301578		10-88301550	
		ChuQijian	010-88301552		10-88301550	
		SunXingjian	010-88301578		10-88301550	
		LiuXuefeng	010-88301449		10-88301550	
Suzhou Nuclear Safety Center	8	Zhong Yonghui	0512-68602610		512-68282224	
		GaoQuanyuan				
		YuXueliang				
		NaFuli				
		ChenFang				
		WengFangjian				
		ShangGuanZhihong				
		ChenYang				
Beijing Institute of Nuclear Engineering	10	XinTianmin	010-88023178		10-88012892	
		ZhengJunming	010-88022719		10-88012892	
		YangXiaoyan	010-88023723		10-88012892	
		Guoying	010-88022719		10-88012892	
		BaiJinhua	010-88022719		10-88012892	
		ZhaoShufeng	010-88022717		10-88012892	
		LIJingyan	010-88022702		10-88012892	
		JiangHua	010-88022717		10-88012892	
		YuanYidan	010-88022429		10-88012892	
		HuangWelfeng	010-88022719		10-88012892	
State Nuclear Power Technical Corporation	14	YuZushong	010-58387893		10-58387810	
		ShiYadong	010-58387859		10-58387850	
		WangLiang	010-58387988		10-58387800	
		CaoPanjian	021-64850220		21-64851074	
		XuShouli	021-64850220-22191		21-64851074	
		ChenSong	021-64850220-22153		21-64851074	
		WangZhe	021-64850220-20261		21-64851074	
		TaoJin	021-64850220-29241		21-64851074	
		XuJin	021-64850220-28174		21-64851074	
		ZhangShuhui	021-64850220-27012		21-64851074	
		WangXiaowen	021-64850220-24252		21-64851074	
		WangYong	021-60919288		21-60919420	
		HuangQi	021-60919354		21-60919420	
		ZhouChen	021-60919435		21-60919420	
China National Nuclear Corporation	2	GaoMingshi	010-68555509		10-68555494	
		XinFeng	010-68555397		10-68531694	
China Power Investment Corporation	4	WangPing	010-66298768			
		ChenZhigang	010-66298856		10-66298855	
		DingYunfeng	010-66298859		066298855	
		ZhouPingyuan	010-66298860		10-66298855	
Shandong Nuclear Power Company, Ltd.	5	LiHongtao	0535-3687941		535-3687555	
		FanLihong	0535-3687665		535-3687555	
		ZhangYi	0535-3687782		535-3687555	
		HuangWeiJie	0535-3687713		535-3687555	
		QieWeiqing	0535-3687750		535-3687555	
Sanmen Nuclear Power Corporation, Ltd.	6	PengRuihua	0573-86937359		573-86937356	
		TangGang	0573-86937352		573-86937356	
		CaoPanjian	0573-86034691		573-86034703	
		HeQiuliang	0573-86937351		573-86937356	

Organization	Number of Participants	Name	TEL(O)	Cell Phone	FAX	EMAIL
		Wang Rui	0573-86937359	(b)(6)	573-86937356	(b)(6)
		Zheng Kaiyuan	0573-86937531		573-86937356	
China Institute Of Nuclear Power Operation And Design	6	Zhang Kathua	028-85903934		28-85903343	
		Zhong Fajie	028-85908794		28-85908191	
		Wang Jingxin	028-85908049		28-85908191	
		Yu Hongxing	028-86908845		28-85908191	
Wuhan Institute Of Nuclear Power Operation And Research	1	Huangfang	027-87801701-2413		27-87802981	
USANuclear Regulatory Commission	8	Scott Williams Moore				
		John Earl Ramsey				
		Ashok Chaturisingh				
		Thadani				
		Stephen Matthew Bajorek				
		Jerry Mell Wilson				
		Richard Scott Egli				
		Joelle Lyn Staretos				
Environmental And Scientific And Technological Section, USEmbassy	4	Patrick Michael Madden				
		Karyn Green (F)				
Department Of International Cooperation Of Nuclear Safety, SEPA	3	Jiang Wei	010-66556531		10-66556532	
		Amanda Huang (F)	010-66556505		10-66556532	
		Stella Luan (F)	010-66556530		10-66556532	