

Vietnam National Petroleum group

Summary Report

Socialist Republic of Viet Nam

Pilot Survey for Disseminating Small and  
Medium Enterprises Technologies for  
SF Double Shell Tank for Avoiding  
Leakage of Hazardous Objects

February, 2015

Japan International Cooperation Agency

TAMADA INDUSTRIES, INC.

## 1. BACKGROUND

The recent rapid economic growth has led to increasing environmental concerns and disaster prevention techniques in Vietnam. Especially, the environmental issues due to the rapid motorization have been one of the most important development issues.

The underground tank of the service stations (hereinafter referred as SS) in Vietnam uses a single shell tank with the asphalt coating and has risks as following;

- Fire disasters and environmental pollutions (soil / water pollution) due to leak accidents
- Health hazards due to the asphalt coating (contained carcinogen)

The Vietnamese Government strives to achieve both of the economic development and the environmental sustainability.

## 2. OUTLINE OF THE PILOT SURVEY FOR DISSEMINATING SME'S TECHNOLOGIES

### (1) Purpose:

This Survey aimed at preventing oil leaks from the underground tanks at SS and other places through introducing SF Double Shell Tank in Vietnam. By conducting trainings to the counterpart organizations with an aim to transfer the technology of the production, operation and management of SF Double Shell Tank, the Survey aimed to deter oil leak accidents and oil diffusions caused by leakages to a minimum.

In order to accomplish such purpose, a series of seven (7) projects were planned. The 7 projects were structured around four different aspects; namely, Tools (Production Equipment/Product), Technology (Production/Underground Installation/Inspection), System (Law/Regulations), and Awareness. The overview of the projects was shown in the figure below:

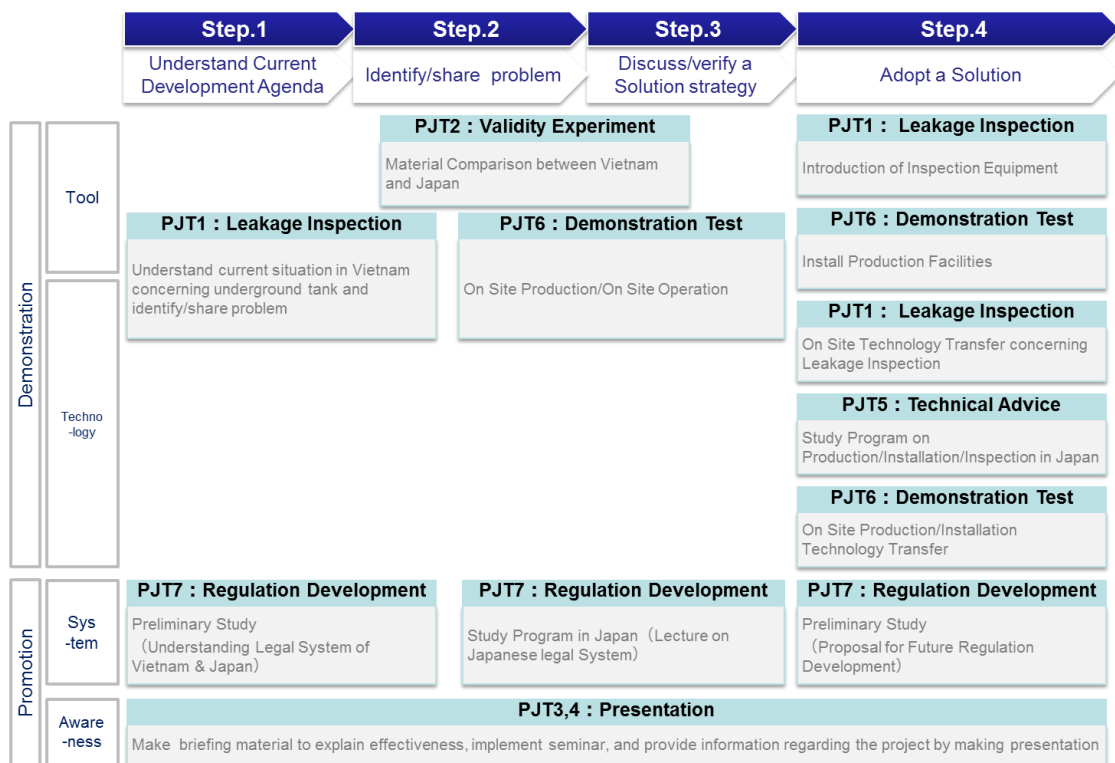


Figure 1: overview of the project

**(2) Activities:**

The purpose and the detail activities of the seven (7) projects were as follows.

Project 1 (PJT1): Leakage Inspection

Leak Inspection was conducted on eighteen (18) tanks at six (6) SS selected by Petrolimex. Two employees from Petrolimex’s affiliate company and two fire department officials attended the inspection instruction trainings carried out by Tamada Industries, Inc.’s staffs. On-site technology transfer was conducted and the assessment of any defect of conventional single tanks was carried out as a part of the inspection.

Project 2 (PJT2): Validity Experiment

Five (5) different tests (1. Tension Test, 2. Stretched Shearing Test, 3.Falling Ball Test, 4. Insulation Test, 5. Water Immersion Test) were conducted to make a comparison of the material efficiency between SF Double Shell Tanks which were coated with FRP and the conventional local tanks which were coated with asphalts. Hanoi University of Science and Technology, the highly reliable institution in Vietnam, was designated to carry out the tests in accordance with the global standard. The results were further analyzed comparing the strength, liquid resistance, and electrical insulation performance of the two materials.

#### Project 3 (PJT3): Effective Briefing Preparation

Briefing materials were prepared as a tool to enhance the awareness of current environmental issues and also to introduce SF Double Shell Tanks as an effective solution to tackle such issues.

#### Project 4 (PJT4): Presentation

Presentation sessions for relevant ministries and oil/SS companies were held in both Hanoi and Ho Chi Minh City in October 2013 and November 2014 respectively. The objective of the sessions was to enlighten the oil leakage prevention measures and to introduce and share the result of this Survey.

#### Project 5 (PJT5): Technical Advice

The purpose of the technical instruction project was to promote the understanding of 1) the current status of Japanese laws and regulations with regard to tanks used for SS and 2) the production techniques of SF Double Shell Tanks of Tamada Industries, Inc. In November 2013, a 7-day technical instruction program was conducted for engineers from Petrolimex, PCC1, and the Ministry of Public Security and Fire Department. The key feature of the program was to visit the actual sites of the production, underground installation and inspection of SF Double Shell Tanks.

#### Project 6 (PJT6): Demonstration Test

In order to build up a smooth operation management system after the implementation of the Survey, PJT 6 aimed to provide technical guidance for the production of SF Double Shell Tank as well as the opportunity to experience the underground installment, leak prevention system and regular inspections. For the actual production of the tanks, necessary equipment was installed in the PCC1's factory and the produced SF Double Shell Tanks were used to demonstrate the underground installment, leak prevention mechanism and leak inspection.

In details, three experiments were carried out for demonstration purposes as follows.

- (1) "Underground Installation Demonstration" with an aim for relevant ministry's officials and oil/SS company's representatives to observe a process of the actual installation of equipment in SS.
- (2) "Leak Prevention Experiment" with an aim for Petrolimex's engineers to observe and to experience the leak accident simulated using a sample leaking tank.
- (3) "Technical Instruction for Regular Inspection" with an aim to provide instructions needed for the inspection process by using an actual SF Double Shell Tank as a sample for Petrolimex's engineers.

### Project 7 (PJT7): Regulations Development

The purpose of PJT 7 was to identify and address the current issues and action steps in order to resolve such issues. The project was organized in two steps. First, an introductory 2-day seminar was carried out in Vietnam for 11 administrative officials from three (3) ministries concerning hazardous substance leakage in July 2014. Followed by the introductory seminar, five (5) administrative officials were invited for 10-day seminar in Japan in September 2014. At the seminar held in Japan, the officials participated in lectures conducted by experts. The lectures were aimed to address the major issues and key points to establish a regulatory framework, such as designing relevant regulations framework and operation of law. Supervised site visits were part of the 10-day seminar as well.

#### **(3) Information of Product/ Technology Provided:**

The product introduced by this Survey was SF Double Shell Tank and it had following advantages in Japan;

- Easy maintenance
- High tolerance against oil leaks given the dual structure of the tank
- Enables early detection of oils leaks given the embedded leakage detective tubes and the alert system
- Economical because the coating method applied on the tank achieved the least waste ratio of materials
- Enables cost savings of the installation since the construction of underground compartment is not necessary for Double Shell Tanks under the Japanese Regulation

Compared with a single shell tank with the asphalt coating, which was currently in use in most of SS in Vietnam, the initial cost incurred to purchase a SF Double Shell Tank would be higher; however, the cost would be lower in a long run if the potential economic losses caused by an oil leak accident were taken into a consideration.

#### **(4) Counterpart Organization:**

- i. Petrolimex (Vietnam National Petroleum Group)
- ii. PCC1 (Petrolimex Construction Joint-Stock Company No.1, Subsidiary of Petrolimex)
- iii. Relevant ministry organizations involved in the survey were as follows:
  - Ministry of Public Security, Police Department of Fire and Rescue (PCCC)
  - Ministry of Natural Resources and Environment (MONRE), Vietnam Environment Administration (VEA), Department of Pollution Control (PCD)
  - Ministry of Industry and Trade (MOIT), Industrial Safety Techniques and Environment Agency (ISEA)

**(5) Target Area:**

Hanoi and Ho Chi Minh City in Socialist Republic of Viet Nam

**(6) Beneficiaries:**

Citizens in Socialist Republic of Viet Nam

**(7) Duration:**

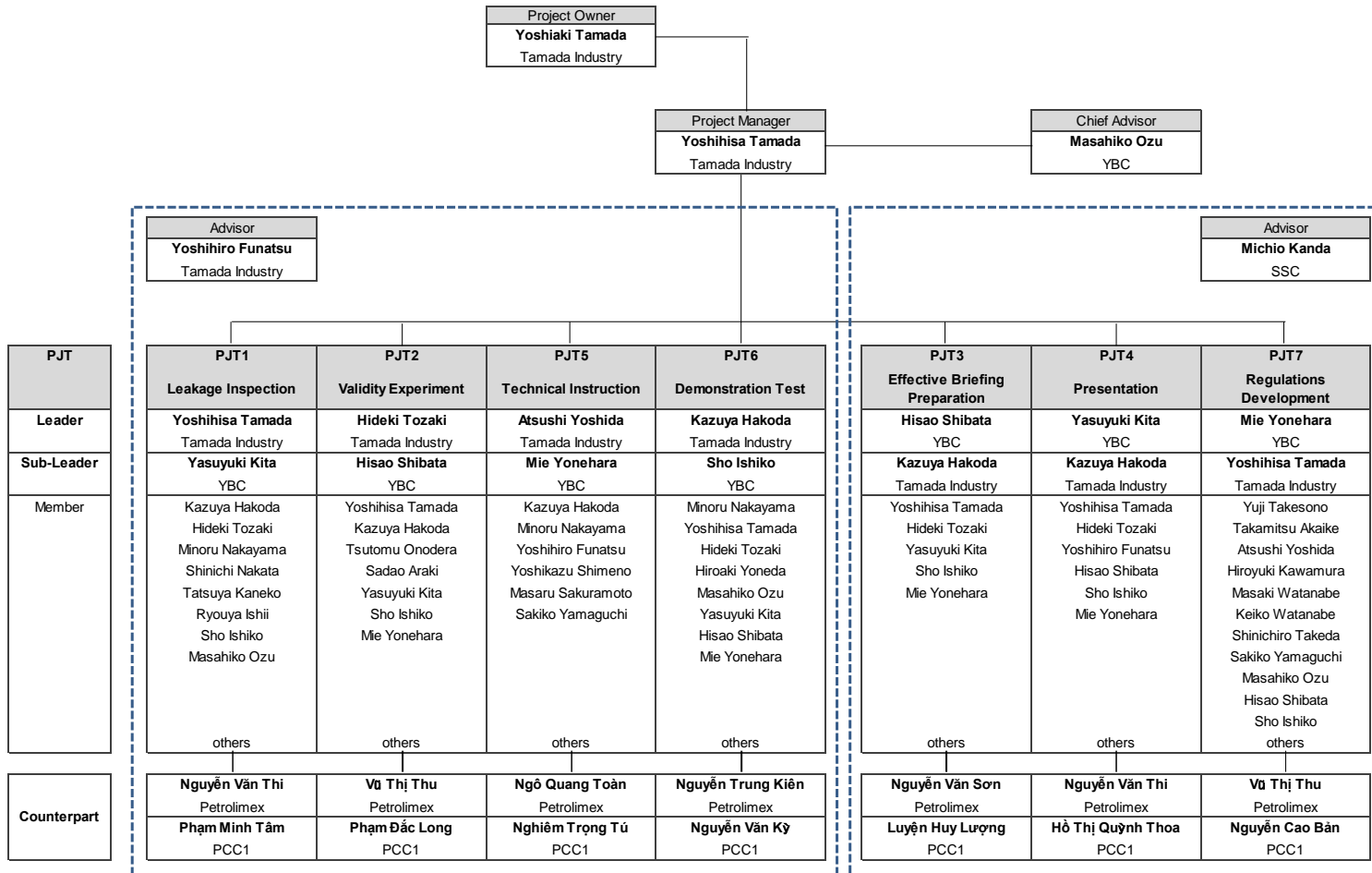
From August 2013 to February 2015







(10) Organization Chart for the Survey Implementation:



### 3. ACHIEVEMENT OF THE SURVEY

#### (1) Outputs and Outcomes of the Survey:

The following section summarized the outputs and outcomes of this survey by each project.

#### Project 1 (PJT1): Leakage Inspection

Three engineers from PCC1 and two engineers from Petrolimex attended the leak inspection. They learned the inspection procedure and usage of the inspection equipment. Also, a demonstration of the leak inspection was conducted with a presence of the representatives of relevant ministries and Petrolimex for an awareness promotion purpose.

Table 1: Summary of the Leak Inspection of existing Single Shell Tanks

	TOTAL						Abnormal Ratio ※2
	INSPECTED					NO INSPEC	
	Abnormal (1)	Re-Insp. Required	Normal	SUB TOTAL (2)			
Tank Pressure	5	4	7	16	1	17	31.3%
Liquid Phase Portion	0	0	1	1	16	17	0.0%
Pipe※1	6	4	4	14	3	17	42.9%
Checker	1	0	14	15	2	17	6.7%
TOTAL SUM	12	8	26	46	22	68	26.1%

※1 Two tanks were assessed with more than one type of inspection

※2 Abnormal Ratio = Abnormal(1) / SUBTOTAL(2)

※3 Leak inspection was conducted on one (1) tank as a part of the seminar of Project 3/4. The result obtained for the tank was excluded from the above analysis; thus, total number of the tank showed in above Table 1 was 17.

Form the Inspection, twelve (12) tanks remarked as “abnormal” because they were not in a good condition. A gap in a man hall or a flange of a tank was observed in several places implying the pressure level was not stable in the inspected tanks. Some gas leaks and rainwater influx were also detected because the tanks were not properly sealed up. These problems can be perfectly solved by conducting a regular inspection and maintenance. Moreover, eight (8) tanks were evaluated as “re-inspection required”. It was due to an unexpected contingency. The temperature was quite high on the day of the inspection, leading to volatilization of gasoline, which further induced the increases in the internal pressure of the tanks.

### Project 2 (PJT2): Validity Experiment

The coating material used for SF Double Shell Tank (hereinafter called “FRP”) was proved to be superior to the coating material used for Single Shell Tank (hereinafter called “Asphalt”) from all the test result except the result obtained from the Test 4: Insulation of the Surface Resistance Value.

Table 2: Summary of Validity Experiment Result

Comparison Test Item		Test Result
1. Tension Test		Asphalt’s tension intensity is measured as 2% of FRP. ※Asphalt test piece was made in Hanoi University of Science and Technology
2. Stretched Shearing Test		Asphalt’s Stretched Shearing Strength is measured as 15% of FRP
3. Falling Ball Test		Asphalt Rupture Strength is measured as 50% of FRP
4. Insulation Test	Surface Resistance Value	Asphalt and FRP are almost the same
	Volume Resistance Value	Asphalt is measured as 0.2 % of FRP ※FRP was tested in Japan
5. Water Immersion Test		Asphalt melted but FRP did not melt

### Project 4 (PJT4): Seminars/Presentations

40 people attended the Orientation Session in Hanoi and 48 people in Ho Chi Minh City in October 2013. In the questionnaire collected after the session, more than 90% of the participants responded that they were “satisfied” with the contents of the session. Subjects that respondents found most useful in the session were Regulations Status, Requirements of Technical Regulations and Management System in Japan. The respondents said they learned in the session that a single shell tank had several problems. The result of the Survey indicated that the Soil Pollution was recognized by the respondents as the one of the important environmental issues following Air Pollution and Water Pollution.

The final presentation was held in November 2014 where 33 people attended in Hanoi and 28 people in Ho Chi Minh City respectively. The result of the questionnaire from the final presentations showed that 95% of the participants said that “It is necessary for Vietnam to strengthen legal regulations for hazardous substances and preventive measures against leak accidents to protect environment.”

Additionally, more than 50% of the participants pointed out the below three (3) mitigating actions as the top priority to be taken against the risk of hazardous substance leakage which arose from underground tanks:

- 1) Implementation of an inspection of quality of the existing underground tanks and a formulation of rules (70%)

- 2) Strengthen quality standards for new underground tanks (54%)
- 3) Implementation of policy to mandate execution of a leak inspection of the existing underground tanks and a formulation of rules (50%)

#### Project 5(PJT5): Technical Advice

Participants of PJT 5 included an engineer from Petrolimex, two engineers from PCC1 and another two executive officers from the Ministry of Public Security, Fire Department. This project offered not only study seminars but also an opportunity to site visit to Tamada Industries, Inc.'s factory where the participants were able to experience practical trainings as well as to observe the factory and SS. Extracting from the questionnaire results, the site visit helped the participants to gain hands on learnings and enhance their understanding of Japanese standards and procedure requirements. Moreover, some participants commented that "Establishment of unified national standards for the underground tanks would be absolutely necessary, but it would take some time, so we would like to give a priority to an internal standard revision first". Likewise, many participants made positive remarks on making the best use of what they learned from the PJT 5.

#### Project 6(PJT6): Demonstration Test

With the cooperation of PCC1, equipment required for SF Double Shell Tank production was installed at PCC1's Hung Yen factory. Total of six 25kl tanks and two 2kl mini-tanks were produced for demonstration purposes.

Underground Installation Demonstration took place on August 28, 2014 in Hanoi and on October 24, 2014 in Ho Chi Minh City respectively. There were over 80 participants including relevant ministry officials, counterparts and the news media. Demonstrations such as the underground installation, the regular inspection procedure and the leak inspection using mini-tanks enabled the participants to understand the procedure of leak preventions as well as the structure of SF Double Shell Tank. The demonstration test attracted a huge attention from the national TV station and newspapers as well.

#### Project 7(PJT7): Regulations Development

The participants of the introductory 2-day seminar totaled to eleven officials (four from PCC1, three from MONRE, four from MOIT). For 10-day seminar in Japan, total of five officials attended (three from PCCC, one from MONRE and one from MOIT). Comparing current Vietnam's regulations system regarding leakages of hazardous substance at SS against that of Japan in the seminar, participants was able to identify the gaps in the two regulation systems and organized the action priorities to bridge the gaps. The participants pointed out the following three subjects as primary area of improvement:

- 1) No existing regulations mandate SF Double Shell Tanks to be used for all tanks in SS
- 2) No obligatory provisions are available for a regular inspection on existing tanks
- 3) No specific regulations concerning countermeasures for soil pollutions due to the leaks

At the end of the seminar, they reached a common understanding that “The best strategy for the leakage of hazardous substances is prevention. We should look into the articles and text of the existing regulations. Also, we would like to work on clarifying the scope of responsibilities of the regulating authority.”

## **(2) Self-reliant and Continual Activities to be Conducted by Counterpart Organization**

### **i. Petrolimex’s continued self-reliant business operation**

PCC1 is expected to independently continue to proceed the production of SF Double Shell Tank alone after completion of PJT6. The PJT 6 assisted the installment of the production equipment for SF Double Shell Tank in PCC1’s Hung Yen factory and provided the technical instruction and procedure for the production. Tamada Industries, Inc. will further provide assistance to PCC1 by supplying FRP materials and extending technical advices for the production of the tanks if needed.

Tamada Industry Inc. will support PCC1 and Petrolimex to build up a sufficient and well-developed supply system for the future dissemination of SF Double Shell Tank in Vietnam.

### **ii. Relevant Ministries’ continued self-reliant activity**

The consciousness and need for the development of regulatory framework seemed to be enhanced internally in relevant ministries as a result of this Survey. For example, at the demonstration of the underground installation of tanks (PJT6), a Fire Department official made remarks to local media saying “The department will start working on a new regulation on SS to adopt SF Double Shell Tank.” In addition, both Ministry of Industry and Trade and Ministry of Natural Resources and Environment showed a positive attitude implying that in order to introduce SF Double Shell Tank from the aspect of legal system, a step by step approach of regulation enforcement would be required. Furthermore, during the seminar conducted in Japan, participated administrative officers presented action plans regarding the development of regulation framework. Besides, at the last presentation of PJT4, many participants stated that continued work was needed to establish the legal framework (60% of respondent indicated as such in the questionnaire).

Taking all the inclination into consideration, it might be quite effective to provide further assistances (for example, specific in-depth assistances by professional supports from a qualified source for regulatory development and subsidization for the implementation of Double Shell Tanks to fill the price gap etc.) to boost the rising enthusiasm to the next level.

#### 4. FUTURE PROSPECTS

##### **(1) Impact and Effect on the Concerned Development Issues through Business**

###### **Development of the Product/ Technology in the Surveyed Country**

Business expansion plans and ideas were developed under the following three contexts as stated below in (a) - (c).

- (a) Directly supplying SF Double Shell Tank from Tamada Industry, Inc.'s factory in Vietnam:  
The product would be manufactured in Tamada Industry, Inc.'s factory in Hai Phong city for Vietnamese market.
- (b) Supplying production materials:  
Production materials for SF Double Shell Tank would be supplied from Tamada Industries, Inc. in Japan to Petrolimex which currently had no access channels for FRP materials.
- (c) Entering license agreements between Tamada Industries, Inc. and Petrolimex group:  
The production technology of SF Double Shell Tank by Tamada Industries, Inc. would be transferred to Petrolimex and affiliated company, PCC-1. The details of the agreement were further to be discussed at another meeting at a later date.

As a first step of the diffusion of SF Double Shell Tank, Tamada Industry, Inc. considers installments of the Tanks in the Petrolimex's new SS are the priority. Petrolimex being the company, which occupied the highest share of the number of SS (47.4% of SS in Vietnam), it could be expected that a considerable reduction of hazardous substance leakage in the country can be achieved by spreading SF Double Shell Tank in collaboration with Petrolimex.

##### **(2) Lessons Learned and Recommendation through the Survey**

According to the survey made through questionnaires, results of interviews obtained from the government offices at each stage of the projects, and comments made to the local media by relevant stakeholders, the local government indicated positive remarks and comments, saying "We want to make it obligatory to implement SF Double Shell Tank with new SS at least in urban areas." "We are considering a development of a new regulation to prevent hazardous substance leakages when developing a lower level cabinet order in line with a legal reform of the Environment Protection Law." "It is quite a shame if this endeavor would stop here, we hope that we would be able to receive your continued support." implying the rise of the awareness of the subject among the local government.

We expect the Vietnamese government to make concrete action plan in cross-sectional cooperation with concerned ministries. With no specific regulation, it is unlikely that each SS replaces the existing Single Shell Tank into SF Double Shell Tank. Thus, it is very important for the government to establish a new system to support the replacement of the tanks. For example, subsidization to introduce SF Double Shell Tank at new SS and implementation of leak inspection for the existing

tanks would support more SS to install SF Double Shell Tanks. Pursuing such effort with urgency, we would propose the government to set up a jurisdictional ministry being in charge to implement the regulatory framework. It is unfortunate that there is no such established organization that would take a lead to tackle the issue in Vietnam while the Fire Department controls the issue in Japan.

Although this kind of environmental issue tends to remain latent, the momentum for the prevention of hazardous substance leakage and the awareness of the issue was heightened through the execution of this Survey. Taking all the facts into consideration, we believe there is a need for the Japanese government to provide continuous supports and to try enhancing the development of the movement further. For the purpose, some effective measures can be taken such as conducting a survey on current status of leak situation through inspections at SS in wider range of the regions, providing information and support for regulatory formulation via conducting advance study program, nurturing engineers through the technology licensing, or supplying the production equipment to satisfy the expected demand.

Needless to say, we will spare no effort in providing necessary assistances and cooperation to achieve the goal.

ATTACHMENT: OUTLINE OF THE SURVEY

## Pilot Survey for Disseminating SME's Technologies for SF Double Shell Tank (SF-DST) for Avoiding Leakage of Hazardous Objects in Vietnam

### The Corporate & Site Information

- Proposer: Tamada Industries, Inc.
- Address: Ha 61-1 Muryojimachi, Kanazawa city, Ishikawa Prefecture, 920-0332 JAPAN
- Site: Hanoi and Ho Chi Minh City, Vietnam
- Counterpart: Petrolimex (Vietnam National Petroleum Group), PCC1 (Petrolimex Construction Joint-Stock Company No.1), Ministry of Public Security, Police Department Fire Prevention, Fire Fighting and Rescue, Ministry of Natural Resources and Environment, Ministry of Industry and Trade

### Development Issues of Vietnam

- The major policy is "coexistence of Economic & Social Development & Sustainable Environmental Management".
- Environmental & disaster prevention issues arising from drastic motorization due to fast economic development
- The current underground tanks at SS are of single-shell, becoming a risk of outbreak of fire & environmental pollutions.

Match



### The Feature of the Proposer's Technology & Product<SF Double Shell Tank (SF-DST)>

- SF-DST: Excellent performance in environmental prevention and economy as follows:
- 1) The seamless FRP layer of the outer shell allows high performance in leak prevention (safety)
  - 2) The leak inspection device can detect even if the leakage is very small (safety)
  - 3) As no Pit Room necessary, construction time and costs can be saved (economical)
  - 4) Robotized production process and mass production system can suppress costs. (economical)
  - 5) The unique construction method (Spray-Up Method) allows high efficiency in work and material usage. (economical)

### The Preparation of The Proposer

- ① Overseas Activity: set up a representative office in Mumbai, India in 2009 (with no actual track record), was able to sort out key issues in overseas operation.
- ② Preparation for business in Vietnam: set up an office in Hanoi in May 2012, employed an expert of market development in Vietnam with experience of global trading.
- ③ Preparation for the Survey: conducted field research as a part of the 2012 "Feasibility Study with the Private Sector for Utilizing Japanese Technologies in ODA Project". Interviewed local corporations in Vietnam, enabling to develop our understanding of Vietnam's situation.

### The Content of the Dissemination and Pilot Survey proposed by the Private Sector (JICA Project)

1. **Pilot Survey to verify the effectiveness of SF-DST as a measure to the country's development issues**
  - Conduct the leak inspection of the selected existing underground tanks in the country.
  - Assess the advantage of SF-DST by conducting comparison test with asphalt tank.
  - Provide technical instruction trainings for SF-DST in Japan.
  - Leak Prevention demonstration & operation will be made at the local SS
2. **The Dissemination Program for SF Double Shell Tank**
  - Creation of presentation materials for the developmental issues faced in Vietnam and effectiveness of SF-DST to solve such issues.
  - Conduct briefing session on the Survey for government officials and Petrolimex.
  - Support the development of legal framework on soil pollution and on underground gas tanks.
  - Dissemination activity by demonstrating actual installation & inspection of SF-DST at existing SS.

### Overseas Business Development

For the first year, the awareness of SF-DST and potential soil pollution as a serious issues were heightened. For the second year, a local subsidiary and factory will be established to expand the business operation. For the third year, the business is expected to become profitable, thereafter building the foundations for our business expansion overseas.