

Safety Improvement Initiatives after a Series of Fire Incidents at JXTG Wakayama Refinery

Agenda

1. JXTG Nippon Oil & Energy Corp. Wakayama Refinery overview
2. Large and small incidents that occurred in 2017
3. Safety improvement initiatives
 - I. Improvement of the quality of risk assessment
 - II. Fostering a continuous safety culture to raise safety awareness
 - III. Improvement of pre-fire incident plan for residents
4. Conclusion



1. JXTG Energy Wakayama Refinery

Refinery (11)

Plant (2)



Wakayama Refinery (Established 1941, Current crude capacity 127.5kBD)

- Good product balance of Fuels, Aromatics and Lubricants
- Largest lube oil plant in Japan
- Extensive storage & marine terminal (90% of delivery via marine terminal, including export)

1. JXTG Energy Wakayama Refinery



2. Incidents that occurred in 2017

At the Wakayama refinery, several large and small fires and leaks occurred in the first half of 2017

- **Jan. 18 Fire in crude tank #35**
 - **Jan. 22 Fire at the lube plant**
 - Mar. 24 Oil leak from fuel oil piping
 - Apr. 14 Fire at the chemical plant
 - Apr. 17 Oil leakage from a crude tank to the sea
- } Details on the next slides

2. Causes of major incidents

Fire in crude tank #35 on Jan. 18, 2017

Overview: A fire broke out inside the tank during cleaning work for tank maintenance. Fire continued for 35 hours due to combustion of residual oil

Direct cause : Spontaneous ignition of FeS, iron sulfide, inside the tank

Indirect cause : The tank cleaning procedure mentioned little about the risks and countermeasures for FeS. *Lack of awareness of the dangers of FeS*

2. Causes of major incidents

Fire at the lube plant on Jan. 22, 2017

Overview: Gas leaked and ignited. The fire spread with the transition from an oil fire to a pool fire. It took about 40 hours for the fire to be extinguished. The local government instructed 2,000 nearby residents to evacuate because of potential BLEVE (although low probability)

Direct cause : Ignition of leaked gas from a pipe opening due to corrosion by alkaline sour water corrosion of NH_4HS , ammonium bisulfide

Indirect cause : A risk assessment for NH_4HS corrosion in hydro-treater units was conducted in 2004, but because the risk screening was not appropriate, the hydro-treater of the lube plant was excluded. *The quality of the risk assessment was not adequate*

3. Safety improvement initiatives

- Necessary to improve the refinery's safety related activities
- Safety improvement initiatives
 - I. Improvement of the quality of risk assessment
 - a. Improve training program for process safety
 - b. Strengthen risk assessment implementation system
 - II. Fostering a continuous safety culture to raise safety awareness
 - III. Improvement of pre-fire incident plan for residents

I. Improvement of the quality of risk assessment

a. Improve training program for process safety

- Reviewed the training program for process safety in the refinery
- Divided the people to be trained into four tiers

Tier	Experience
Employee - Juniors	Typical 5 years
Employee - Supervisors	Typical 10 years
Employee - Managers	More than 15 years
Contractor	Supervisor class

I. Improvement of the quality of risk assessment

a. Improve training program for process safety (cont'd)

- Programs were classified into three categories
 - A) Learn about risk assessment system
 - ✓ How to evaluate “probability” and “consequences”
 - ✓ Correct use of Risk Matrix
 - Risk assessment initial training (first time)
 - Risk assessment refresh training (every 3 years)
 - B) Maintain appropriate working environment
 - ✓ Importance of keeping the construction site clean
 - ✓ Stop work when something unexpected happens

I. Improvement of the quality of risk assessment

a. Improve training program for process safety (cont'd)

C) Hazard Identification

- Sour water corrosion
- Dangers of FeS
- Danger experience training

Recently introduced VR system

Experience falls, explosions, etc.

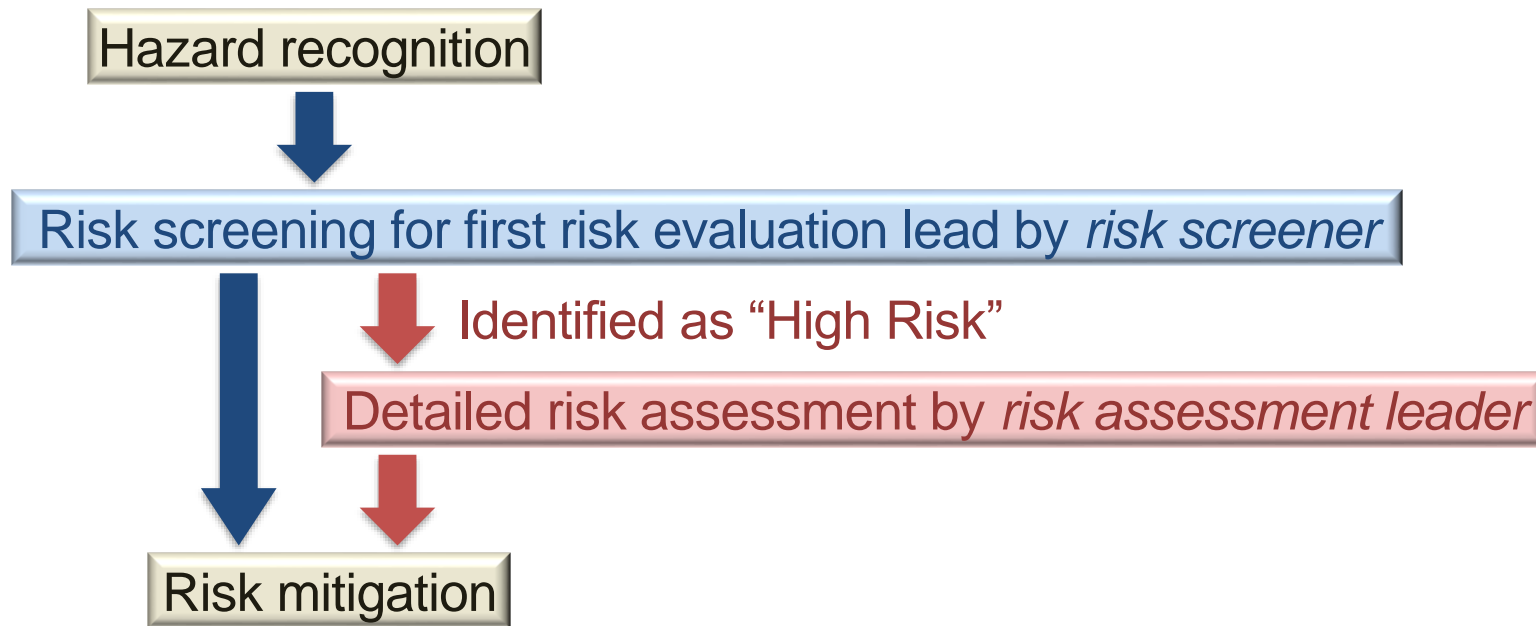
➤ This training is conducted for all four tiers



I. Improvement of the quality of risk assessment

b. Strengthen risk assessment implementation system

➤ Risk assessment steps



I. Improvement of the quality of risk assessment

b. Strengthen risk assessment implementation system (cont'd)

- Only those who have met certain requirements are appointed as *risk screeners* and *risk assessment leaders*
 - More than 10 years experience in refining or chemical plant
 - Completed risk assessment related training
 - Participated in formal risk assessments, etc.
- Appointed chiefs in operation section as *risk screeners* additionally in order to strengthen the system for implementing risk assessment on the front lines of the field
- Of course *these new risk screeners* meet the above requirements

3. Safety improvement initiatives

- Necessary to improve the refinery's safety related activities
- Safety improvement initiatives
 - I. Improvement of the quality of risk assessment
 - II. Fostering a continuous safety culture to raise safety awareness
 - a. Establish a “safety day”
 - b. Issue a safety pocket book
 - III. Improvement of pre-fire incident plan for residents

II. Foster safety culture to raise safety awareness

a. Establish a “safety day”

- We established January 22, the same date the lube plant fire accident occurred, as “Wakayama Refinery Safety Day”
- Around January 22 every year, all employees and contractor supervisors gather in the auditorium to hear a message from management regarding safety



II. Foster safety culture to raise safety awareness

a. Establish a “safety day” (cont’d)

- After the message, all participants watch a safety video
- The safety video includes interviews of people who have experienced fire incidents
- They reflect on the incidents and talk about lessons learned
- Watch safety videos once a year to prevent incidents from being forgotten

II. Foster safety culture to raise safety awareness

a. Establish a “safety day” (cont’d)

- Following “Safety Day”, safety meetings are held in each section
- Raise awareness of safety through discussions including lessons & learnt from incidents in 2017



“Question to You”

Please discuss in each section

Ask yourself

What was missing?

What to improve?

Set and execute your own action goals

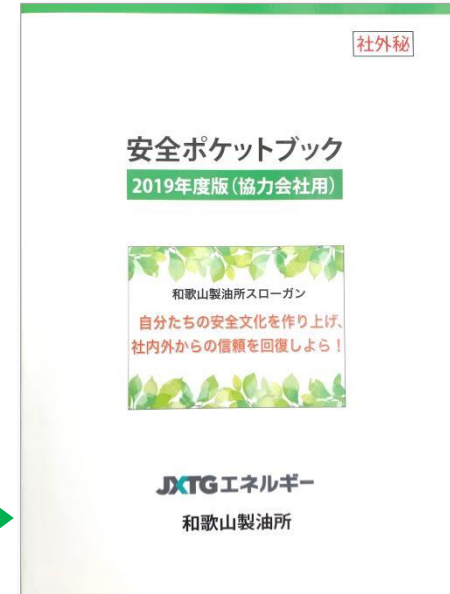
II. Foster safety culture to raise safety awareness

b. Issuance of Safety Pocket Book

- A safety pocket book was issued and distributed to **all employees** and **contractor workers** so that rules for operation and work could be easily referenced in the field



← For employees



For contractors →

II. Foster safety culture to raise safety awareness

b. Issuance of Safety Pocket Book (cont'd)

- Essential and required information gathered from operation, maintenance, technical and SHE groups
- The safety pocket book contains the following
 - ✓ Corporate philosophy / Safety policy
 - ✓ Contacts and procedures for abnormal situations
 - ✓ Environmental regulations
 - ✓ Regulations for personal protective equipment
 - ✓ Probability, consequences and risk matrix for risk assessment, etc.
- The pocket book is revised every year, and includes the latest rules

3. Safety improvement initiatives

- Necessary to improve the refinery's safety related activities
- Safety improvement initiatives
 - I. Improvement of the quality of risk assessment
 - II. Fostering a continuous safety culture to raise safety awareness
 - III. Improvement of pre-fire incident plan for residents

III. Improvement of pre-fire incident plan

- When the lube plant fire occurred in 2017, there was concern about BLEVE if the fire spread, so the city government issued evacuation instructions to 2,000 nearby residents
- Based on our experience from that incident, in order to further improve the pre-fire incident plan, we are engaged in ongoing discussions among the city government, the fire department, the police, and the refinery
- Cooperating in preparing city response manuals covering evacuation methods, evacuation sites, traffic control methods, etc. by sharing information about all possible serious accidents such as BLEVE, VCE, and toxic gas leaks

III. Improvement of pre-fire incident plan

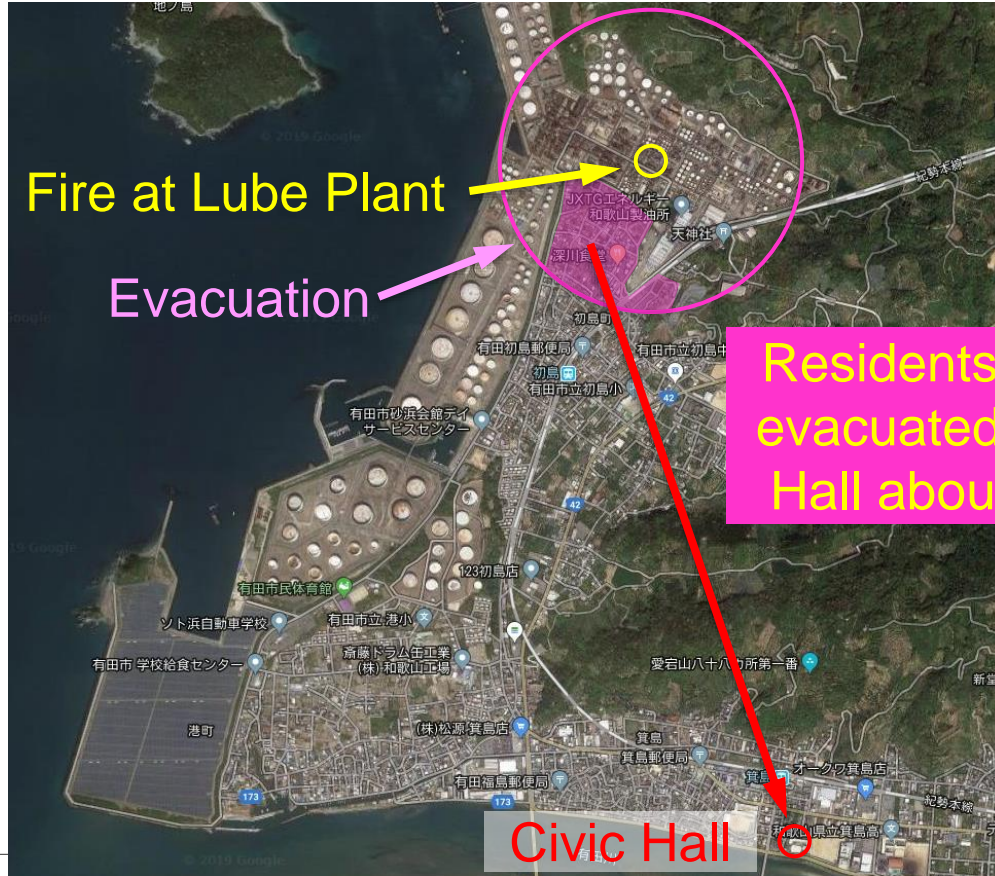
Evacuation of residents in 2017 lube plant fire incident

Fire at Lube Plant

Evacuation

Residents in this area evacuated to the Civic Hall about 2km away

Civic Hall



III. Improvement of pre-fire incident plan

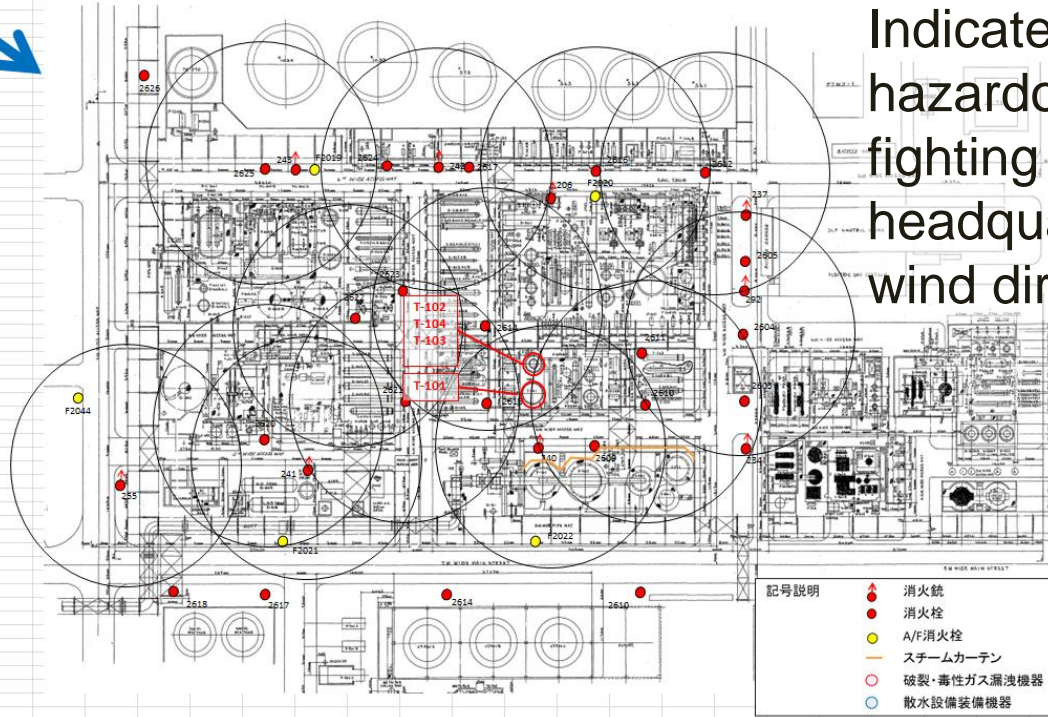
現地防災
本部

消火設備配置図

Pre-fire Incident Plan for lube plant

Indicates plots of large-inventory hazardous material vessels, fire fighting monitors, and command headquarters according to the wind direction

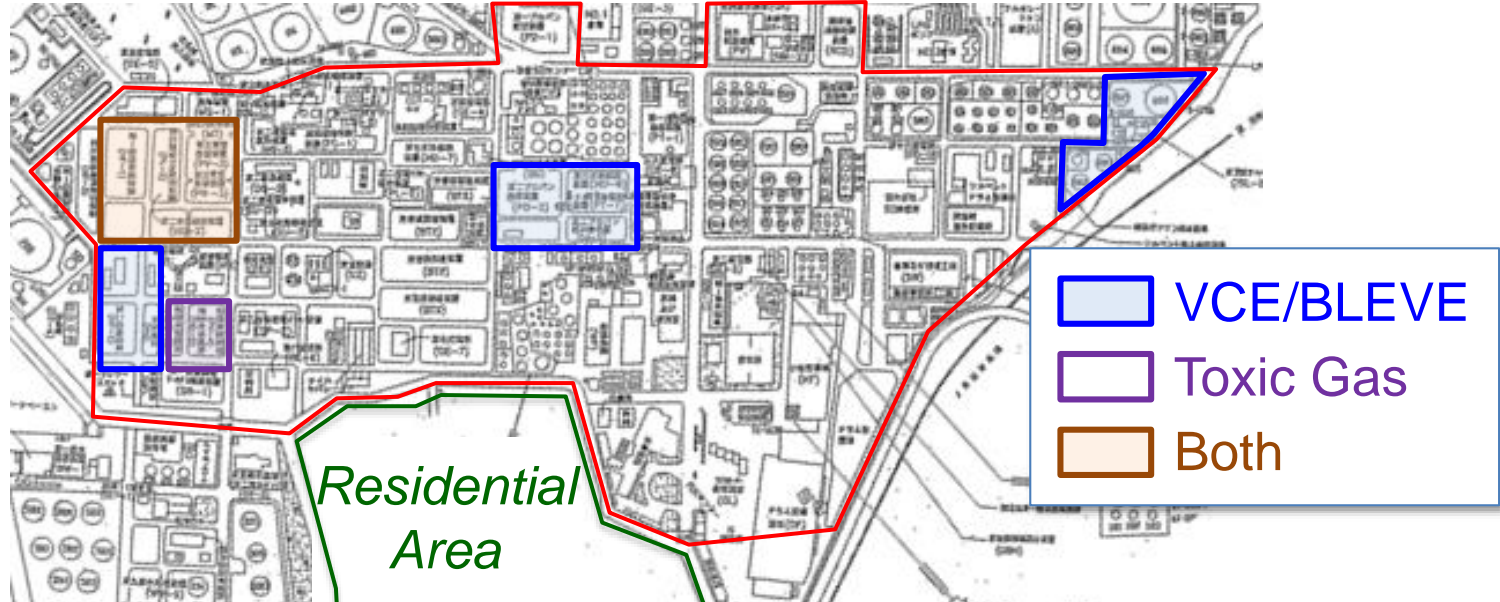
北西風



東風

現地防災
本部

III. Improvement of pre-fire incident plan



- Share information with the city government, the fire department and the police
- The 2017 evacuation took more than 3 hours to complete
- Shortening evacuation time is the first improvement item among the four parties

4. Conclusion

- We experienced multiple fires and leaks in 2017
- We thought it necessary to improve the refinery's safety activities in response to this series of accidents
- Making improvements in the following areas
 - Improvement of the quality of risk assessment
 - Fostering a continuous safety culture to raise safety awareness
 - Improvement of pre-fire incident planning

***These efforts are not temporary,
but must be carried out continuously.***

End of presentation



Improvement of the quality of risk assessment

Introduce a system to reevaluate past risk assessment results

- Even if the same work has been carried out in the past, a system has been introduced to carry out a risk assessment again
- Check whether new risks have arisen due to changes in the situation such as workers experience or configuration of the equipment

Improvement of the quality of risk assessment

Introduce a system to reevaluate past risk assessment results

- These are in accordance with the refinery operating guidelines

Basic Guidelines for Safe Work

“Conduct risk assessment before all work and take appropriate actions”

安全作業基本要領	分類番号	和4F033
	頁	16/38
	制定	2000年4月1日
	改訂	2019年4月1日 37版

第3章 作業の心得

(一般注意事項)

第13条 作業に当っては、次の一般注意事項を守らなければならない。なお、運転操作上の心得は「運転に関する安全作業要領」に、保安作業の心得は「保安に関する安全作業要領」に定める。

1. 職場は、常に整理整頓し、衛生を保つこと。特に通路及び非常口、消火設備、配電盤等の前に物を置いてはならない。
2. 全ての作業の前にはリスク評価を行い、適切な対応を取ること。
3. 薬物、アルコールの影響がある状態で作業をしないこと。
4. 周囲の状況を正しく認識し、的確に行動する習慣をつけること。
5. 製油所内においては、非常事態発生時以外は、疾走したり大声をださないこと。
6. 装置エリア（タンクヤードを含む。以下同じ。）に立入る場合は、当該プラント員の許可を得ると共に製油各G保有の装置エリア立入りリストに氏名、所属、時間等必要事項を記入して立入る事。

対象外「プラント員の許可及び装置エリア立入りリストへの記載は不要」

Foster safety culture to raise safety awareness

Hold employee forums

- Based on the premise that *there is no accident that cannot be prevented*, the refinery management review a series of incidents that occurred in 2017 and give a message for raising safety awareness at the employee forums, held twice a year

Measures against indirect causes-1: Improvement of quality of HAZARD Identification

Based on what has been observed so far, improvement objectives are:

- ✓ Eliminate cognitive bias among different levels of personnel
- ✓ Enhance knowledge among different levels of personnel on Hazard Identification and Risk Assessment (HIRA)
- ✓ Maintain sense of responsibility among different levels of personnel on process safety, etc.

Based on the above, improvement of HIRA training system was implemented.

- ✓ Improved HIRA
 - Risk Assessment & Risk Management
 - Process Operation Hazard Identification
- ✓ Grouping of targeted people
 - Junior: Process, Maintenance and Tech. personnel
 - Supervisor: SSV, Process Coordinator, Team Leader, etc.
 - Manager: Refinery Manager, Vice refinery manager, Group Manager, SSI
- ✓ Senior level personnel act as trainers to less experienced personnel

Measures against indirect causes-2: Increase knowledge about ammonium bisulfide corrosion

- To prevent recurrence, the following measures have been taken:
 - Corrosion control system reinforcement in the refinery
 - ⇒ Cross-check by maintenance, process and technical sectors
 - Periodic check for corrosion control appropriateness by cold eyes from outside the refinery
 - ⇒ Incorporation into periodic audit of the refinery operation management system
- Accumulation and update of knowledge about ammonium bisulfide corrosion
 - Findings about ammonium bisulfide corrosion not only for the fuel oil desulfurization unit but also for the lube oil desulfurization unit shall be used as lessons learned internally and externally.