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Book of Abstracts
November 2-5, 1998

Kellie Ann Beall, Editor

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Gaithersburg, Maryland 20899

United States Department of Commerce
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U.S. Department of Commerce
William M. Daley, *Secretary*
Technology Administration
Gary Bachula, *Acting Under Secretary for Technology*
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Crude Oil Full Scale Pool Fire Experiment in Tomakomai in 1998

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Introduction

Japan National Oil Corporation (JNOC), National Research Institute of Fire and Disaster and the University of Tokyo conducted a large crude oil burning experiment at Tomakomai city in January 20-21, 1998. The experiment field was located 5 km south of JNOC's Tomakomai Oil Storage site, on the outskirts of Tomakomai City. We burned from 1 to 20 kl crude oil in pans which were 5 m, 10 m and 20 m in diameter. The ingredients was the same as these in Arabian Light.

The biggest problem in this experiment was the smoke. ALOFT, which was developed by NIST, was a very strong tool for persuading the parties concerned.

The purpose of the experiment is to predict accurate data of crude oil fires for fire- fighting. JNOC needs data involving tanks ranging in size from 82 to 97 m in diameter. However, due to budget constraints, environmental concern and limited techniques, we were able to conduct experiments using 20-m tanks. JNOC will estimate large-diameter tank fires using the data from 5, 10 and 20 m pans.

We could conduct the experiment only when the north wind was blowing because there small residential areas to the north and the experiment field faced the sea to the south. The wind blows constantly from the north only in winter. We selected late January.

Measurements

We measured

a) Burning Rate (Fuel level)
b) External Radiation (See Fig.1 and Fig. 2)
c) IR-Image of flame
d) Image of flame by video camera and high speed video camera
e) Temperatures inside the flame by thermocouple
f) Gas composition inside flame
g) Image inside the flame by video camera
h) Smoke dispersion observation on the ground level and on the air using helicopter
i) Smoke particle size
j) Temperature of side shell
k) Temperature of side shell of small tank at the side of burning pan by thermocouple and IR-Image
l) Ionic current inside flame

m) Flammable gas dispersion observation before burning

n) Smell observation before burning

o) Temperature, humidity, wind direction and wind velocity

We conducted burning two or more times on each size and conducted a total of 10 tests. Most of them could be done in calm weather conditions, especially those involving the 20 m pan.

Result

Any violent boil-over was not observed. But mild water boiling might have occurred because noise and flame changed in the latter half.

Irradiation of down wind side was much larger than that of upwind side. There were much smoke at downwind side and it was seemed that smoke blocked radiation. But still irradiation was higher at down wind side.

Radioactive fraction decreased with an increase in pan diameter. It was about 16% in a 20 m pan fire.

There was clear flame pulsation only when the wind blew very calmly. Intervals of pulsation of 20 m pan were from 3.2 to 3.5 second.

Smoke dissipated quickly. About 60 minutes after ignition(40 minutes after burning was finished) in 20 m pan, we could not detect most of the smoke. Smoke dissipating times were consisted with ALOFT's predictions.

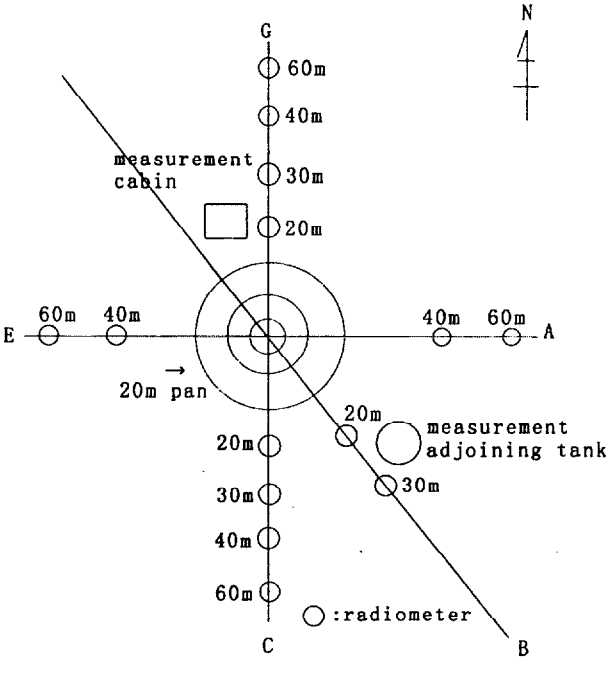

Fig.1 Layout of burning pan and radiometers

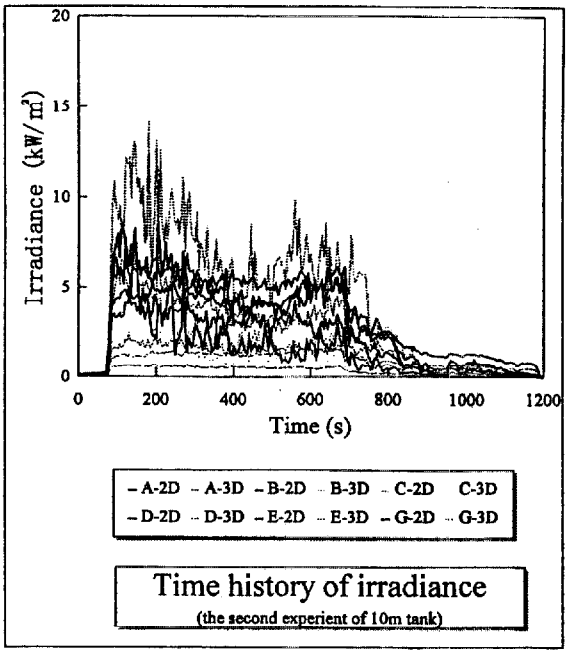

Fig.2 An Example of irradiance time history from 10 m fire