REPORT OF FIRE AT RECENT OIL INSTALLATION, ROYAL EDWARD DOCK, AVONMOUTH, BRISTOL.

Reference No.: 20/03/40/13.

1. DATE AND TIME OF CALL.
   6th September, 1951, Thursday, at 1455 hours.

2. NAME AND ADDRESS OF PREMISES CONCERNED.
   Regent Oil Company, Limited, No.1 Depot, Royal Edward Dock, Avonmouth.

3. TRADE OR BUSINESS CARRIED ON.
   Distributors, Petroleum Products.

4. DESCRIPTION OF PREMISES.
   (a) Situation of the Installation.
   The Regent Oil Installation is part of a large number of similar Oil Installations situated on the banks of the River Severn, just north of the point where the River Avon enters the Severn in the dock area of Avonmouth. The area covered by these installations is 120 acres, and the part occupied by the Regent Oil Company covers approximately 15 acres, of which some 3 acres were affected by the fire.

   (b) Description of Compound.
   The compound measures approximately 300' x 160' and contained eight cylindrical upright tanks and four cylindrical overhead tanks. Two of the smaller upright tanks, together with the four overhead tanks, were separated from the remainder by a low wall 3'3" high, through which product lines passed.

   Tanks were constructed of steel plates, with fixed roofs.
   The plates on the larger tanks were approximately \( \frac{3}{4} \)" in thickness at the base, tapering to \( \frac{3}{16} \)" for the top sections, whilst the smaller tanks were constructed of plates approximately \( \frac{3}{8} \)" in thickness at the base tapering to \( \frac{3}{16} \)" at the top.

   Three or four dip holes were provided in each roof.
   Two pressure and vacuum valves were fitted to each spirit tank, whilst an open vent was installed on the top of each gas oil tank.

   The sizes of the upright tanks within the compound were as follows:
   - Tank A.1 and A.2: 35' high, 95' diameter.
   - Tank A.3: 35' high, 70' diameter.
   - Tank A.4: 35' high, 65' diameter.
   - Tanks A.13 and A.14: 18' high, 20' diameter.
   - Tank A.5: 25' high, 32' diameter.
   - Tank A.6: 25' high, 25' diameter.

   (c) General Access.
   There are three entrances to the Avonmouth Dock area known as West Town Gate, Main Gate and St. Andrews Gate. The main road into Avonmouth from Bristol is a four carriage width road (known as Portway) allowing appliances to have a clear, uninterrupted run into the area. The gate used for entrance into the dock was St. Andrews Gate from which a concrete road some 20 feet in width led to the area occupied by the Regent Oil Company — See Plan No.1.

   (d) Access to the Regent Oil Company, No.1 Compound.
   The compound is approached on the south side by a concrete road approximately 20 feet in width continuing along the west or river side where the main entrance is situated. The east or land side of the compound is bounded by a double railway track which runs the entire length and communicates with the coast road on the west side by an interesting roadway approximately 15 feet in width, which forms the north side of the compound.
The nature of the terrain on the east side prevents its use by vehicular traffic. - See Plan No.2.

(e) Emergency Approach to Compound.

Owing to road congestion an additional access point to the north side from Holesmouth was made during operations at the request of the Fire Brigade, by the Port of Bristol Authority constructing a sleeper road over the railway track. - See Plan No.1.

5. CONTENTS OF TANKS.

<table>
<thead>
<tr>
<th>Tank Marked</th>
<th>Actual Capacity (Galls.)</th>
<th>Actual Contents Involved (Galls.)</th>
<th>Exposed Contents (Galls.)</th>
<th>Product</th>
<th>Owner</th>
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<tr>
<td>R.1</td>
<td>1,469,301</td>
<td>1,262,798</td>
<td></td>
<td>Gas Oil</td>
<td>Regent Oil Co.</td>
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<td>R.2</td>
<td>1,469,304</td>
<td>1,262,181</td>
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<tr>
<td>R.3</td>
<td>814,675</td>
<td>719,832</td>
<td></td>
<td>Motor Spirit</td>
<td></td>
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<tr>
<td>R.4</td>
<td>701,972</td>
<td>417,279</td>
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<td>122,122</td>
<td>95,298</td>
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<td>Aviation Spirit</td>
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<td>(R.5)</td>
<td>74,728</td>
<td>48,903</td>
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<td>Motor Spirit</td>
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</tr>
<tr>
<td>(R.6)</td>
<td>5,814</td>
<td></td>
<td></td>
<td>Motor Spirit</td>
<td></td>
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<tr>
<td>(R.8)</td>
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<td>376</td>
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<td>(R.9)</td>
<td>6,819</td>
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<td>(R.10)</td>
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<tr>
<td>(R.11)</td>
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<td>(R.12)</td>
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</table>

* R.6, R.7 and R.27 - Transfer of product from R.6 to overhead tanks R.7 and R.27 at time of fire.

** R.6, R.9 and R.10 - One horizontal cylindrical tank with three compartments.

*** R.11 and R.12 - One horizontal cylindrical tank with two compartments.

**** R.28 - With R.27 making one horizontal cylindrical tank with two compartments.

6. MAJOR FIRE FIGHTING EQUIPMENT AT OIL INSTALLATIONS.

(a) Available at the Regent Oil Company.

(1) No.1. Depot

- 400 gallons Foam Compound.
- 100 feet of hose.
- 2 No.2 Foam Making Branchpipes and Knapsack Tanks.
- 2 No.10 Foam Making Branchpipes.
- 1 - 34 gallon Foam Engine.
- 1 Foam Generator - Hopper type, and powder.

Product line fitted with two inlets for base injection.
(ii). No.2, Depot,
- 400 feet of Hose,
- 2 No.10 Foam Making Branchpipes,
- 1 - 34 gallon Foam Engine
- 300 gallons Foam Compound,

(b). Made available by neighbouring oil installations:

(i) - Shell Mex and B.P. Ltd,
- 36 lengths of hose plus 6 lengths borrowed from Port of Bristol Authority,
- 5 Inline Inductors,
- 5 No.10 Foam Making Branchpipes,
- 1,000 gallons of Foam Compound,
- 3 Trailer Pumps,
- 3 Multiple Jet Inductors.

(ii) - Breso Petroleum Co. Ltd,
- Fixed steam fire pump supplying 2,500 g.p.m. into the Port of Bristol Authority's ring main.
- 1,000 gallons Foam Compound,
- 6 lengths hose,
- 2 Major Trailer Pumps.

(iii) - Cleveland Petroleum Company,
- 150 gallons Foam Compound,
- 15 lengths of hose,
- Fixed sprinklers on top of Tanks.

(iv) - Watsons Petroleum Co. Ltd.
- 9 Lengths of Hose.

7. LOCATION AND TIME FIRE ORIGINATED.

(a). Discovery of Fire.

From information given by employees of the Regent Oil Company it is generally agreed that the fire started as a result of an explosion in tank R,15, alleged to contain 26,603 gallons of Gas Oil. The explosion occurred at approximately 1456 hours.

It has been stated by a representative of the Company that prior to, and at the time of the explosion, gas oil believed to be contaminated by motor spirit was being pumped into tank R,15 from the motor vessel "Fort Christina", gross tonnage 10,619, and that two employees of the Company - Mr. Roy Hyett aged 35 years, and Mr. Arthur Baggs aged 40 years - were working in the tank.

A call to Avonmouth Fire Station was made at 1456 hours by Norman Gore of Bristol Fire Brigade who was on duty as a member of the crew of the fireboat "Endymion", which was moored in the Royal Edward Dock, at the same time a call was received by '999' at Brigade Control, Bridewell, which stated - "Fire in tank, Royal Edward Dock, Oil Basin".

(b) Action by Petroleum Installation Employees.

The Deputy Installation Superintendent of the Regent Oil Company was working in his office situated in the yard of No.1 Depot and heard the explosion. He immediately telephoned the ship to cease pumping, and then proceeded to the telephone switchboard where he was informed that a call had already been sent to the Fire Brigade. It is stated that the depot fire organisation was immediately put into effect, the main precaution being the closing of all valves on the site, which was carried out with the exception of the valve at the base of tank R,2. The motor spirit in this tank was being pumped into a barge and the operator in the depot pump house overlooked this particular valve, which remained open during the entire course of the fire.
It was also stated that one foam making branchpiper was brought to bear over the compound wall on the coast road near tank R.4, water being obtained direct from a hydrant on a 2" private main. In the absence of inline inductors foam compound was induced into the water line through a hopper type foam generator. The stock of chemical powder normally used for this type of generator was stated to have deteriorated and to be unfit for use. In addition, cooling jets were brought to bear from the north-east corner on the product lines inside the compound.

Employees of the Cleveland Petroleum Company, on hearing the explosion, immediately took the precaution of turning on the sprinklers fitted above tanks C.4, C.5 and C.6 and stood by to operate the sprinklers on tanks C.1, C.2 and C.3 if the necessity arose.

Employees of Watson's Petroleum Company also took action and provided a cooling jet on each of tanks W.1 and W.3.

As a further precaution employees of Shell Mex and B.P. Limited provided cooling jets on their tanks situated on the "Abadan" site, water being obtained from the 6" steel pipe line into which the fireboat "Endres Gane" was pumping.

5. FIRE FIGHTING OPERATIONS.

(a) Appliances ordered on first call.

On receipt of the call at 1456 hours the first attendance consisting of Pump Escape, in charge of Sub Officer 1, Foam Tender Major in charge of Sub Officer 2, Wireless Car and Fireboat, was completed promptly and all appliances were despatched by 1457 hours.

The Pump Escape and Wireless Car arrived at the fire at 1500 hours, followed by the Foam Tender Major which arrived at 1501 hours. Fireboat "Endres Gane" is normally berthed at the north end of the Eastern Arm, Royal Edward Dock, and was immediately brought into operation.

(b) Action Taken on Arrival.

Sub Officer 1, with the Pump Escape crew, followed by the Wireless Car and Foam Tender Major, proceeded up the coast road and into the main entrance to the compound where he observed that the portion of the compound at the rear of the yard was well lit. One incomplete line of hose, which had been laid out by the employees, was ordered to be completed to provide a cooling jet to the overhead tanks, but before this could be effected an explosion occurred involving these tanks, which made the position untenable. He then ordered withdrawal of men and appliances and returned down the coast road to approach the fire from the land side.

Meanwhile, the Wireless Car and one man had been despatched to the Fireboat to order the charging of the 6" pre-laid steel pipe line and to the Port of Bristol Authority's pump house to set into operation the fixed pumps which charge the salt water main.

Instructions were given to Sub Officer 2 to set up a portable pump at an outlet from the 6" steel pipe line which commences at the north end of Eastern Arm and surrounds the Abadan installation. The purpose of this instruction was to enable a trailer pump to supply two No.10 foam making branchpipes through a "G" type inductor. It was necessary in this case to lay hose through the Cleveland Compound and across the railway track to one branch on the eastern side of the fire, and the other on the west.

Sub Officer 1, with the Pump Escape crew, then carried hose up the railway track with the intention of getting to work from hydrants to supply cooling jets to nearby tanks, and to extinguish burning grass on the track.

At 1520 hours a message was received by Police telephone originating from Sub Officer 1 indicating that four tanks were involved, and asking for pumps to be made "A" and additional supplies of foam compound and equipment.
Meanwhile, Divisional Officer Wockey had proceeded in a Wireless Car, followed by a Major Pump from Station No. 1, Bridewell Street, Bristol, and by Assistant Divisional Officer and Station Officer.

(c) Subsequent Initial Action.

On the arrival of the Divisional Officer, he immediately proceeded along the railway track on the east side, where he observed that four tanks (marked R.5, R.6, R.13 and R.14) were well alight, and two others at the rear also appeared to be burning. Later, it transpired that these two were the overhead tanks in the yard. A make-up and informative message was immediately despatched stating - "No pumps or foam tenders. Approximately 6 tanks on fire and well alight. Fire spreading rapidly".

Pumps and equipment had already been despatched in response to the initial make-up message at 1510 hours, and as a further make-up had been anticipated by Brigade Control, additional appliances had been ordered on from Station 1, Bridewell Street, Station 2, Stoke Hill and Station 6, Fishponds, prior to the receipt of the Divisional Officer's message. In order to complete his request one pump was despatched from Station 4, Brislington.

The intensity of the fire at this stage was such that the grass and railway sleepers on the east side were burning fiercely, presenting a severe danger of spread to the Cleveland Petroleum Company's compounds. In addition, product lines which were situated outside the compound, but parallel to the railway track, were exposed to the full heat of the fire. In these circumstances it was essential to make a determined initial attack with water jets, not only to prevent spread to the Cleveland compounds, but also to ensure that this essential approach way should not be made untenable by the fracture of product lines.

Fire fighting and cooling jets were therefore rapidly positioned along the track, and instructions given to increase the number of cooling jets on the exposed sides of the tanks in the Cleveland compound.

Tanks R.13, R.14, R.5 and R.6, with the four overhead tanks, were now burning fiercely and threatening R.16 and R.30, and a rapid assessment revealed the necessity for action to be taken to provide cooling jets for these two tanks. Instructions were therefore given for two lines of hose to be laid up the coast road for this purpose, and for a No.10 foam making branchpipe to be positioned in the entrance yard to attack the fire from the west side. At this time one No.10 foam branch was working on the opposite side over the compound wall.

When the Deputy Chief Officer arrived, the Divisional Officer made his report and the Deputy then took charge of operations, deciding to proceed with and supplement the existing attack by water screening and cooling jets. After making a complete survey of the fireground he realised the immediate necessity for providing additional water supplies to the west side of the compound where existing hydrants were inadequate, as burning oil had entered a ditch near Tank R.13 and was flowing inside the compound parallel to the west wall. Two additional lines of hose were ordered to be laid up the coast road from the fireboat "Endres Gene" to discharge into a portable dam which was set up at the main entrance to the installation on the west side, with the object of getting No.10 foam making branchpipes to work over the compound wall.

It was realised that additional hose and manpower would be required to complete this operation, and accordingly a message was despatched to Brigade Control requesting the attendance of a Hose Laying Lorry and extra men.

(d) Progress of Fire Fighting.

Upon the arrival of the Chief Officer, who was accompanied by H.M. Inspector, Mr. A.V. Thomas, he obtained a brief report from the Deputy Chief Officer, and assumed charge of operations. At this time additional cooling jets had also been brought to bear on tanks C.4, C.5, C.6, R.18 and R.30. It was obvious that to prevent an overwhelming spread of fire
from the damaged tanks, it was of extreme importance initially to concentrate on cooling jets, and at the same time to provide sufficient foam to hold back the burning oil and confine it to the immediate area of its escape. While this action was in progress with the appliances, men and equipment then available, further reinforcements were called for and a plan for a gradual and manageable build-up put into operation.

From this stage onwards the aim was to increase the number of foam branches but at the same time to maintain an adequacy of cooling branches in addition to the reinforcing land appliances, the fireboat "Pyromaniak", normally berthed in the City Docks, was despatched to Avonmouth on the evening tide and commenced pump operation at approximately 23:30 hours.

The fire had now spread and involved tanks marked R.2. and R.3. The major danger point was the pump house in the north-east corner of the compound, as it was stated by the Installation Engineer that if this pump house became involved the resultant damage to the main feed pipes and control valves would cause the fire to spread to the neighbouring compound on the north side of the intersecting road. In order to guard against this possibility the main attack was made from this corner.

Despite the cover given to tank R.4, which by this time was exposed to intense heat from tank R.3, it was not long before fire was seen to be burning around its top edge. However, by 01:05 hours on Friday, the 7th, the situation was such that a reasonable amount of optimism was justified. At 04:55 hours, however, an explosion occurred in tank R.4, which dislodged its roof. This tank contained 417,239 gallons of motor spirit and the resultant terrific and rapid spread of fire forced crews to abandon their positions as fire engulfed the coast road and foreshore. Hose and equipment were destroyed, whilst on the land side of the fire it was necessary to withdraw personnel as a precautious measure. As the appliances supplying water had to be temporarily abandoned some of the Hose from making branchpipes and cooling jets which were being used with good effect on the coast road, were lost.

The danger of burning spirit flooding the coast road and flowing towards other installations immediately became apparent, and consideration had to be given to the building of temporary bunds on the road at each side of the danger area. The possibility that large quantities of sand might be required at some stage of the fire, because of the evident weakening of the compound wall, had been foreseen, and at this stage supplies were rushed to the coast road. One bund was constructed on the north side of the danger area, and a large dump was made on the south side, ready to be used as a bund if necessary.

It was feared that as a result of the explosion some personnel who had been operating in the area were missing. A roll call was taken and all personnel accounted for, with the exception of Fireman Thorne of Exeter Fire Brigade. This fireman was eventually found on the foreshore with back injuries and taken by ambulance to the Bristol Royal Infirmary.

All the ground which had been gained was now lost, and once again priority had to be given to cooling jets on surrounding tanks and pipe lines. As soon as it was possible crews were re-positioned and new hose lines laid to replace those lost. As soon as cooling jets were effectively positioned, foam branches were again brought to bear to cover the vital point around the pump house and the tank in the northwest corner, and other foam branches were placed to prevent the fire spreading southward.
As soon as the Chief Officer was satisfied that the fire was once again held at strategic points, he called together all senior Officers then on the fireground, to direct them in the measures they were to take to put into effect a plan he had formulated for a massed foam attack on the fire. To this end all foam equipment not in use was collected, checked and placed in pre-arranged positions evenly spaced at the north-east and east sides of the compound. Foam compound supplies were built up at each of these points, hose lines laid out with all possible speed, and at approximately 1000 hours on Friday, the 7th, the concentrated attack was put into operation.

The position now was that 26 No. 10 foam branches, supported by 30 cooling jets, were in effective operation.

As a result of this attack, coupled with the determination of every officer and man engaged on the fire, steady progress was made, and despite extremely bad conditions brought about by dense smoke and intense heat, the ground lost at 0435 hours was gradually recovered and the area of fire was reduced until it was confined to tanks R.4 and R.13. The latter, although small, presented great difficulty due to the direction in which it had collapsed at an early stage, the only aperture being very small and facing towards the centre of the compound. A considerable amount of fire persisted in this tank, and the position and angle was such as to make the application of foam a difficult operation.

By midnight on Friday, the 7th, it was felt with a degree of confidence that, apart from some unpredictable event, the fire was now under control.

Tank R.4, continued to burn with intensity for a number of hours. Its position in the centre of the compound and the intense heat with accompanying convection currents, prevented the effective application of foam to the tank with normal equipment. Three 40-foot lengths of 3" steel piping were therefore adapted for use with No. 10 foam making branchpipes to enable foam to be applied at close range.

Re-ignition frequently occurred throughout the compound which called for constant attention, and it is reasonable to assume that the main contributory factor was a leak of spirit from the product line of tank R.2, the valve of which, as previously mentioned, had been inadvertently left open.

The application of foam on the two remaining tanks continued, and at 0450 hours on Saturday, the 8th September, the message 'Stop - Fire out' was given by the Chief Officer to Brigade Control.

(c). Subsequent Operations.

From this time until Thursday, the 20th September, it was necessary to maintain constant fire cover due to the exceptional hazard presented by the concentration of spirit vapour which persisted over the whole area, as a result of leakages from damaged tanks and the quantity of spirit which had escaped into the compound during the fire. Salvage operations were put in hand by the Regent Oil Company, and it is estimated that 1,450,000 gallons of oil and spirit have been reclaimed. Every precaution was taken during this period, and a ban was placed on all road and rail traffic in the vicinity. Two trailer pumps and a fireboat were manned continuously, and foam equipment laid out in readiness to enable an instant attack to be made in event of re-ignition.

9. NUMBER OF PUMPS USED TO EXTINGUISH FIRE.

A total of 60 pumping appliances and 853 Officers and men were in attendance, but it will be appreciated that at any one time there would not be more than about 25% of the total engaged at the fire, due to relieving arrangements. In this connection assistance was rendered by the following Fire Authorities:-
Bath C.B.  Gloucester C.B.  Oxford C.B.
Berkshire.  Glamorgan.  Plymouth C.B.
Cardiff C.B.  London C.C.  Somerset C.B.
Devon County.  Middlesex.  Southampton C.B.

and by the following Services and Organisations:

Esso Petroleum Co. Ltd., Shell Mex and B.P. Ltd.,

Working parties were formed by personnel from the Naval Air Station at Yeovilton, Somerset, and by Army personnel from Horfield Barracks, Bristol.

10. SUSPECTED CAUSE OF FIRE.

An official enquiry into the cause of the initial explosion in tank R.13, where the fire originated, has been held by Dr. H. E. Watts, His Majesty's Chief Inspector of Explosives, and pending publication of the results of the investigation, the cause must be returned as "unknown".

11. FACTORS WHICH AIDED SPREAD OF FIRE.

(a). The twelve tanks involved in fire were, in effect, placed in one compound without inner bunding with the exception of one wall 3'3" high, indicated on Plan 2, which separated tank R.13 from neighbouring tanks R.5 and R.6. This wall had been pierced to permit product lines to pass through and the openings had not been sealed.

In addition to the absence of bund walls between each tank, a common drainage had been installed consisting of two ditches approximately 2'6" in width and 2' in depth, one of which commenced at Tank R.13 and followed a course west and north at a distance of approximately 11 feet from the compound wall. The other had been provided across the compound between tanks R.2 and R.3 and communicated with the first near an interceptor tank which had been installed on the east side at a point opposite tank R.5.

The factors mentioned above undoubtedly contributed to a rapid spread of fire, as it is reasonable to assume that subsequent to the initial explosion in tank R.13, burning gas oil and motor spirit would enter the ditch and fire would be carried to the extreme points at the north west and east sides. Simultaneously, burning oil would pass through the pipe openings in the low wall to affect tanks R,5 and R.6. It will be seen, therefore, that in a relatively short time fire had spread north and south to affect the entire compound.

(b). The spread of fire was undoubtedly assisted by radiation on account of the proximity of certain tanks, for example, R.13 and R.14 were separated by a distance of only 5 feet, R.13 and R.5 by 16 feet, and R.5 and R.6 by 23 feet. Obviously the protection which could have been afforded by the separate compounding of tanks would have been nullified to a great extent by the closeness of these tanks to each other. It is interesting to note that tanks R.2 and R.1, with a distance factor of 40 feet from neighbouring tanks, suffered least damage.

(c). The steel product lines inside the compound were connected to the base of each tank by a short length of flexible armoured piping, with the exception of tank R.1, where flexibility was attained by connecting several short lengths of steel piping by vitallium joints. In the case of tanks R.3 and R.4 the armoured piping was completely destroyed by fire; but the length coupled to tank R.2, the valve at the base of which had been left open, appeared to have been damaged very slightly. It is a reasonable conjecture, however, that the repeated re-ignition occurring in the compound near this tank was due to a leakage of spirit either from the armoured piping or from one of the joints in the product line.

-8-
12. WATER SUPPLIES.

Water supplies available were as follows: (Refer Plan 2).

(a) Five ball hydrants connected to a 6" public water main on the east side of the compound.

(b) Three pillar hydrants with single outlets connected to a 4" public water main in the Cleveland Petroleum Company's compound on the west side.

(c) Three ball hydrants connected to a 10" private salt water main supplied by a steam pump delivering approximately 2,500 g.p.m.

(d) Three pillar type hydrants with double outlets connected to the 10" salt water main referred to in (c) above.

(e) One ball hydrant connected to a 2" public water main in the installation yard on the west side.

(f) One pillar hydrant with double outlet connected to a 2" public water main on the coast road.

(g) Unlimited static water supply from the Eastern Arm of the Royal Edward Dock approximately 2,000' distant.

(h) A 6" pre-laid steel pipe line circumvexing the Ahadon site, with two delivery heads with six outlets on the west side.

In addition to the above, sprinklers were fitted centrally to the roofs of the Cleveland tanks, and were supplied from a 4" public water main.

Water was pumped from the Royal Edward Dock by the Fireboat "Enders Gane" into the 6" pipe line at the commencement of operations and subsequently further deliveries from this appliance, together with deliveries from pumps stationed on the quay wall, supplied water for the portable铛 and cooling jets. Supplies from this source were further increased at 2200 hours on Thursday, 5th September, on the arrival of the fireboat "Pyrosmut".

At the initial onset fire-fighting operations were hindered by the inadequacy of water supplies on the west side, which consisted of two hydrants connected to a 2" main, and it was necessary for a two pump relay to be set into operation from the Royal Edward Dock to provide sufficient quantities of water. A flow of 95 gallons per minute was the maximum output of the hydrant in the entrance yard, with a static pressure of 62-lbs p.s.i.

(3) BRIGADE ORGANISATION.

(a) Mobilising.

In view of the seriousness of the fire it was deemed advisable to detail a Brigade Staff Officer to supervise Headquarters Fire Control, which is normally manned by a staff of three. The Control worked efficiently throughout the fire, and met all demands for appliances, men and equipment. It is of interest to note that, during the course of the fire, calls were received to four other occurrences and an immediate response was made with a restricted first attendance.

A fire ground control point was set up and manned in the blockhouse indicated on Plan 2, which was supervised by Officers on temporary relief from the fire-area. In addition to the existing private telephone link between this point and Station No. 3, Avonmouth, a portable radio equipment control was established in conjunction with six portable radio sets, which were being used by Officers at various strategic points on the fire ground. This equipment was supplied by the Home Office Regional Wireless Station, Shepway, Somerset.
Before this equipment was brought into operation an advanced point was set up to control the supplies of water, hose and foam compound which was arriving to meet the demands of the situation.

(b). Catering Arrangements.

On the fire ground hot beverages and sandwiches were supplied from the Brigade Canteen Van which was manned continuously by volunteers from Headquarters Administrative Staff, off-duty whole-time Firewomen, and a number of Auxiliary Firewomen.

A canteen van was also supplied and staffed by the Port of Bristol Authority.

Hot meals for organised parties on temporary relief from the fire ground were provided at the Port of Bristol Authority's Docks Canteen, and at Fire Stations.

(c). Efficiency of Appliances and Equipment.

(1). Pumping Appliances.

The Brigade Transport Officer and workshop staff were continuously in attendance on the fire ground and performed invaluable work in the maintenance of appliances and supplies of oil and petrol. Many minor defects were promptly and efficiently dealt with, and only two pumps had to be withdrawn from operation. The considerable amount of foam compound and foam in the surface water draining into the water being used by a Dennis and Coventry Climax major trailer pump caused a breakdown in the cooling system, with the result that these two pumps burst their cooling tanks. The otherwise complete freedom from serious mechanical breakdown reflects the efficiency of the staff of the Brigade workshop, and to those of the reinforcing Fire Authorities.

(ii). Foam Equipment.

The continuity of foam production was hampered by incessant choking of inline inductors, and undoubtedly the various qualities of foam compound used during the operation, some of which had deteriorated through age, was the main cause. Choking of "W" type inductors and the water bowls of No. 16 foam making branchpipes was also frequently experienced although to a lesser degree.

14. GENERAL DESCRIPTION OF DAMAGE.

| Tank R.1. (Capacity 1,498,904 gallons) | Damaged by fire and heat. |
| Tank R.2. " 1,499,804 " | Severely Damaged. |
| Tank R.15. " 1,222,121 " | Severely Damaged. |

Horizontal cylindrical tank.

| Tanks R.8 (Capacity 11,656 gallons) | Horizontal cylindrical tank with 3 compartments. |
| Tanks R.9 and R.10 | Severely damaged. |
| Tanks R.11 and R.12 | Horizontal cylindrical tank with two compartments. |
| Tanks R.27 and R.28 | Severely damaged. |
The total contents of the above tanks which were involved in fire were as follows:—

<table>
<thead>
<tr>
<th>Product</th>
<th>Gallons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Spirit</td>
<td>2,440,353</td>
</tr>
<tr>
<td>Gas Oil</td>
<td>1,298,963</td>
</tr>
<tr>
<td>Aviation Spirit</td>
<td>101,715</td>
</tr>
<tr>
<td>Benzol</td>
<td>6,188</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>3,855,239</strong></td>
</tr>
</tbody>
</table>

Of this total it is estimated that approximately 2,405,239 gallons have been destroyed.

The walls of the compound were severely damaged and weakened by fire. Two small bunker tanks and one metal barrel, containing a total of approximately 800 gallons of motor spirit were also destroyed. Product lines, the installation pump house and machinery, single storey corrugated iron garage, three small single storey corrugated iron sheds and contents, all suffered varying degrees of damage by fire, heat and water.

The damage to other tanks exposed to the fire as indicated in paragraph 5 was restricted to blistering of paintwork by heat, and loss of an unknown quantity of spirit by vapourisation.

15. **CASUALTIES.**

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthur Baggs</td>
<td>27 Park Hill, Shirehampton</td>
<td>Missing, presumed dead</td>
</tr>
<tr>
<td>Roy Hyett</td>
<td>The Gastons, Lawrence Weston</td>
<td>Missing, presumed dead</td>
</tr>
<tr>
<td>A. Bowles Esq</td>
<td>N.W. Inspector of Fire Brigades</td>
<td>Burns to shoulder</td>
</tr>
<tr>
<td>Fm. Thorne</td>
<td>Exeter Fire Brigade</td>
<td>Back injury</td>
</tr>
<tr>
<td>Fm. Vowels</td>
<td>Middlesex Fire Brigade</td>
<td>Burns to shoulder</td>
</tr>
<tr>
<td>Fm. Kenble</td>
<td>London Fire Brigade</td>
<td>Laceration to hand</td>
</tr>
<tr>
<td>Fm. Jenkins</td>
<td>Bristol Fire Brigade</td>
<td>Collapse, overcome by fumes</td>
</tr>
<tr>
<td>Fm. Mason</td>
<td>Bristol Fire Brigade</td>
<td>Suspected fracture of leg</td>
</tr>
<tr>
<td>Fm. McQuiston</td>
<td>Bristol Fire Brigade</td>
<td>Injury to right ankle</td>
</tr>
</tbody>
</table>

All the above were treated at the Bristol Royal Infirmary, with the exception of Fireman Mason who was conveyed to Southmead Hospital, Bristol.

In addition many minor injuries were sustained and treated on the fireground.

16. **OBSERVATIONS AND CONCLUSIONS.**

(a). As previously stated, the tanks involved in the fire were contained in a communal compound, the retaining walls of which were constructed of reinforced concrete tapering from 7" in thickness at the base to 2" at the top. The attached photographs will indicate that the heat was sufficient to cause disintegration of the concrete to the extent that holes were formed in several places, whilst severe cracking and bulging occurred even at a comparatively early stage of the fire. This gave rise to considerable anxiety during fire fighting operations, both with regard to the possible spread to adjoining compounds, and to the safety of firemen who were operating from the compound walls.

The absence of bund walls around each individual tank, coupled with a common drainage system, resulted in an overwhelming spread of fire throughout the entire compound, with the result that the fire had to be fought from the limits of the compound boundary walls. Thus, owing to the large intervening space between the walls and tanks R.1, R.2, R.3 and R.4, speedy application of foam in sufficient quantities to extinguish the burning tanks became an impossibility.
During the war every oil and petrol storage tank at Avonmouth was fitted with fixed foam pourers to allow an immediate application of foam to the surface in event of fire, but apparently at the end of the war the Petroleum Board decided to dispense with the idea of top application, and to favour the method of base injection. In this instance two inlets, each to take one "threaded" No.10 foam making branch pipe, had been provided for base injection in the product lines at a point outside the depot pump house at the north east corner. The total inadequacy of this measure can be assessed from the fact that two inlets only were available to cover all tanks in the compound. Before foam could be injected into any one tank, numerous valves would have to be operated, and in particular it would be necessary to enter the compound to open the valve at the base of the burning tank. In addition, before this valve could be opened, sufficient pressure would have to be built up in the product line to overcome the head of spirit in the tank, and taking into consideration that the length of piping from the foam inlets to the base of the nearest tank was, in this case, approximately 300', it is not conceivable that foam could be effectively introduced into any of the tanks by this method.

Finally, in this connection, it can be stated that with the number of product lines and valves in the depot pump house yard, if it had been decided to use this equipment, it would have been difficult to identify the two inlets, in the absence of any distinctive marking.

The close spacing of some of the tanks, together with the absence of fixed sprinklers, indicates that no consideration had been given to the hazard of spread of fire by radiation.

Comment must also be made on the inadequacy of fire fighting equipment available at the Regent Oil Company's depot see paragraph 8 (a). The foam powder held in stock was stated to have deteriorated so as to be unfit for use, and liquid foam compound was used by employees in conjunction with a copper type foam generator. Evidently no consideration had been given to the provision of suitable inductors for use with No.10 foam branches, or to the provision of a pump to give the required pressure to enable this equipment to be used with any degree of efficiency.

The complete lack of effective preventative measures at this installation gave rise to an extremely serious situation, which presented insurmountable difficulties during fire fighting operations, and indicates the urgent need for certain standards to be laid down under regulations made by the Secretary of State. In this connection consideration should be given to the following:

(i) Satisfactory construction of compound walls.
(ii) The construction of imperforate inner bunds to surround each tank, which would also serve as fire fighting platforms.
(iii) The provision of fixed pourers at the tops of tanks to allow injection of foam application.
(iv) The installation of sprinklers above tanks supplied from an adequate water supply.
(v) Adequate spacing of tanks according to capacities.
(vi) Independent drainage to be provided for each tank.
(vii) Adequate supplementary fire fighting equipment to be held at each installation.

(b) The east side of the compound was bounded by railway tracks making passage by vehicular traffic impossible. On account of this fact only railcar pumps could be used on this side of the fire, being non-handled into position, whilst stocks of foam compound also had to be carried up the track to the pump, necessitating a large number of men to be detailed as working crews.

At all large oil installations, where similar conditions exist, it would be a decided advantage if railway tracks could be laid with the line sunk to the level of the ground.
(c). It was observed after the fire that tank H,5 had moved from its original position 3'10" nearer to tank H,4, in which the explosion occurred at 0439 hours on the 7th.

(d). The issue of portable radio sets to Officers in charge of sections on the fireground eliminated considerable delay in ordering men, equipment and supplies as the situation changed from time to time. The subsequent installation of a master station in the control room of the blockhouse, with the portable sets positioned at various strategic points, proved of inestimable value in enabling messages to and from the fireground to be transmitted with the minimum of delay. Situation reports were also submitted from time to time by Officers, and a clear overall picture of the progress of fire fighting operations was therefore obtained at this central point, thus facilitating the planning for the extinction of the outbreak.

(e). In order to enable adequate supplies of foam compound and equipment to be readily available for fires of this size, consideration should be given to the concentration of this equipment at all large oil installations throughout the country. Fire Brigades should be notified of the location of these supplies, so that reserve stocks could be called upon without delay.

(f). At this incident it would have been extremely difficult to account for individual men from assisting Brigades, on account of the procedure of reporting as manned appliances, and giving no details of the names of the men forming the crews. The tally system introduced during Nationalisation would overcome this weakness, and should be re-introduced in all cases where reinforcing moves are put into operation.

(g). Although National Fire Service Circular No. 56/1948 requests Fire Brigades to maintain an up-to-date list of special appliances, foam compound in stock, owing to Fire Brigades immediately adjoining their area, there would appear to be a definite necessity to extend the field beyond neighbouring Brigades.

(h). This fire revealed that there is considerable room for improvement in the type of foam making apparatus at present available to Fire Brigades, and there can be no doubt that the Manufacturers of such equipment have not given sufficient thought to the need for the production of large quantities of foam which a fire of this magnitude required.

The frequent choking of inductors and branchpipes which was also experienced, can be attributed to the poor quality of the foam compound, a large quantity of which had deteriorated on account of age, and experiments should be carried out by the Department of Scientific and Industrial Research with a view to the production of foam compound which is not affected by age.

As these two factors are outside the control of a Fire Brigade, it is recommended that the Home Office should be asked to initiate action for the production of better foam equipment and foam compound.

(i). Equipment was collected from the fireground and taken to a central point for cleaning and identification, and the task of sorting was hampered by the fact that in a number of cases, equipment had not been marked in any way. It would be advantageous if direction could be given to all Fire Brigades, requesting that all items should be clearly marked.

17. GENERAL.

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of Foam compound</td>
<td>Approximately 47,192 gallons.</td>
</tr>
<tr>
<td>used</td>
<td></td>
</tr>
<tr>
<td>Quantity of petrol used</td>
<td>2,599 gallons.</td>
</tr>
<tr>
<td>Quantity of diesel oil used</td>
<td>200 gallons.</td>
</tr>
<tr>
<td>Quantity of lubricating oil</td>
<td>40 gallons.</td>
</tr>
<tr>
<td>used</td>
<td></td>
</tr>
<tr>
<td>Quantity of hose used</td>
<td>100,000 feet.</td>
</tr>
</tbody>
</table>
18. APPENDICES ATTACHED.

(a). Form X.433
(b). Photographs.
(c). Press Cuttings.
(d). Plan 1 showing layout of Avonmouth and Royal Edward Docks.
(e). Plan 2 showing layout of Regent Oil Company’s Installation and neighbouring installations.
FIRE AT REGENT OIL INSTALLATION
ROYAL EDWARD DOCK, AYLSMOUTH.
6TH, 7TH & 8TH SEPT. 1951

HORIZONTAL TANKS
R.7, R.8, 9 & 10, R.11 & 12
R.27 & 28

BRISTOL FIRE BRIGADE
REF. 9/CO/40/15
On 6 September 1951, while a cargo of oil was being pumped ashore from the MV Fort Christina into a storage tank at the Regent Oil Company's compound at Avonmouth Docks, there was an explosion followed by a fire in the tank. Bristol Fire Brigade, alerted shortly before 3 p.m., initially sent a pump escape, foam tender and wireless car from Station 3, Avonmouth, and the fireboat Endres Gane. (Avon Fire & Rescue Service)

Senior officers soon realised that Bristol Fire Brigade could not contain the fire and instructed control room staff to seek outside help. Crews from other brigades were called in and by 9 p.m. 150 firemen with thirty pumps were at the fire. Among the reinforcements was a crew from Station A9 Keynsham of Somerset Fire Brigade with their 1940 Leyland limousine pump EYD 586, seen here. Note the discarded empty foam canisters on the right. (Avon Fire & Rescue Service)

That night, when flames rose hundreds of feet into the air, the sky was lit up as if by a huge torch. There were now enough firemen in attendance to give some of the Bristol crews a break, and progress was made in containing the fire. Then at 4.35 a.m. the roof blew off another tank and flames spreading from it sent firemen running for their lives. Much hose and other pieces of equipment were destroyed. (Avon Fire & Rescue Service)
By daybreak the fire was national news and London newspapers hired light aircraft to fly reporters and cameramen, at some risk, low over the scene. Dramatic pictures and reports appeared on front pages. This view gives a good indication of the size of the fire and the surrounding risks. Eventually twenty-six No.10 foam-making branches supported by thirty cooling jets were used.

Right: A major obstacle to the firefighters was the railway alongside the burning tanks. Pumps and hose-laying lorries could not be driven here and all hoses had to be run out by hand. Almost twenty miles of hose were used altogether and some of it was destroyed in the night-time explosion. (Avon Fire & Rescue Service)

Below: Altogether 853 firefighters from twenty-four brigades with sixty pumps and other appliances attended and the firefighters worked in relays of 200 or so at a time. It took thirty-eight hours to finally extinguish the fire. Armed forces personnel also provided back up, fetching and carrying equipment. More than 50,000 gallons of foam-making compound was brought in, much of it in 2-gallon cans. Here naval ratings take a well-earned break. (Bristol Evening Post and Press)