LONDON FIRE BRIGADE

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Freedom of Information request reference number: 8855.1

Date of response: 7 August 2024

Request:

I am writing to request information under the Freedom of Information Act 2000 regarding fires at marinas, shipyards, and on-board boats within your service area.

Please provide the following information for the period from 1 January 2014 to present:

1. The total number of fire incidents attended by your service at:
a. Marinas
b. Shipyards
c. On board boats (whether docked or at sea within your jurisdiction)

2. For each category above, please provide an annual breakdown of incidents.

3. For each incident, where possible, please provide:
a. Date and time of the incident
b. Location (marina name, shipyard name, or general location for boats)
c. Type of vessel involved (e.g., pleasure craft, commercial vessel)
d. Cause of fire, if determined
e. Extent of damage (e.g., total loss, partial damage)
f. Any injuries or fatalities

4. Information on any specific challenges faced by your service when dealing with fires in marine environments or on vessels.

Response:

In response to your questions 1-3 of your request. Our Data Team has run a search on the incident data we hold related to fires at 'Marinas' and 'Shipyards' but there were no incidents that contained these words.

They were able to find incidents relating to Boat fires from 1 January 2014 to present, please see the spreadsheet attached with the overall number of fires and the details relating to these fires.

In response to question 4 please see attached the National Operation Guidance related to fires on board vessels by the National Fire Chiefs Council.

I hope you find this information of use. Should you have any further questions please do let me know.

We have dealt with your request under the Freedom of Information Act 2000. For more information about this process please see the guidance we publish about making a request on our website.

Count of Incident Number	Parent Property Type	
Calendar Year	Boats	Grand Total
2014	13	13
2015	7	7
2016	12	12
2017	20	20
2018	12	12
2019	14	14
2020	11	11
2021	12	12
2022	15	15
2023	17	17
2024	7	7
Grand Total	**140**	**140**

DDDateTimeOfCall	DDCalendarYear	PropertyCategory	PropertyType	AtStopDamageSpreadSize	NumFireDeaths	NumAllFireInjuries	PaonDescription	OrganisationName	StreetDescriptor	MainCause	FinalDescription
22/10/2014 18:00	2014	Boat	Barge	Limited to item 1st ignited	0	0	Leadale Wharf		Craven Walk	Other intentional burning, going out of control	RAEBURNER SMOKING ON BOARD
21/10/2014 23:28	2014	Boat	Barge	Limited to room of	0	0	Grand Union Terrace		Haverfield Road	Overheating, unknown cause	FIRE ON HOUSEBOAT POSSIBLY ALL OUT
09/08/2014 10:50	2014	Boat	Other vessel	Limited to item 1st ignited	0	0			Albert Embankment	Accumulation of flammable material	VESSEL ALIGHT ALONGSIDE THE PONTOON
14/07/2014 04:01	2014	Boat	Barge	Whole boat	0	0			Andrews Road	Unsafe use of heat source - due to unsafe disposal	BOAT ALIGHT WATER RESCUE LEVEL 1
11/10/2014 07:58	2014	Boat	Barge	Limited to item 1st ignited	0	0	Albany Boathouse	E M L	Lower Ham Road	Faulty fuel supplies – Petrol product	BARGE ALIGHT-WATER RESCUE LEVEL ONE
14/05/2014 07:29	2014	Boat	Large passenger vessel	Limited to room of origin	0	0		Cottons Centre	Hays Lane	Fault in equipment or appliance	FIRE ON THAMES CLIPPER
23/06/2014 19:38	2014	Boat	Other vessel	Limited to item 1st ignited	0	1			Florence Close	Faulty fuel supplies – Petrol product	JET SKI ALIGHT
23/06/2014 19:02	2014	Boat	Other vessel	Whole boat	0	3			Sudbury Court Road	Unsafe use of equipment or appliance (heat source)	FIRE
19/10/2014 07:21	2014	Boat	Other merchant vessel	Limited to room of origin	0	0		The Cutty Sark	Cutty Sark Gardens	Fault in equipment or appliance	FOUR PUMP FIRE
13/10/2014 13:47	2014	Boat	Large passenger vessel	Limited to item 1st ignited	0	0		Catamaran Cruisers Ltd	Victoria Embankment	Overheating, unknown cause	SMOKE ISSUING FROM VESSEL
15/03/2014 04:09	2014	Boat	Barge	Limited to room of origin	0	0		London Borough of Hackney	Millfields Road	Other intentional burning, going out of control	BOAT ALIGHT
14/04/2014 18:11	2014	Boat	Barge	Limited to item 1st ignited	0	0	Blackfriars Bridge	Doggetts Coat & Badge	Blackfriars Road	Accumulation of flammable material	CRANE BARGE ALIGHT
08/12/2014 02:45	2014	Boat	Barge	Limited to room of origin	0	0		The Navigation Inn	Wharf Road	Combustible articles too close to heat source (or fire)	WATER RESCUE LEVEL ONE
09/12/2015 05:43	2015	Boat	Barge	Limited to item 1st ignited	0	0	SOUTH DOCK MARINA		ROPE STREET	Overheating, unknown cause	SMOKE ISSUING FROM BLUE BARGE (NEAR BOAT YARD)
10/07/2015 22:28	2015	Boat	Motor yacht	Whole boat	0	0		BBC Ariel Sailing Club	Trowlock Way	Heat source and combustibles brought together deliberately	BOAT ALIGHT ON RIVER
01/01/2015 00:44	2015	Boat	Naval vessel	Limited to room of	0	0		H M S President 1918	Victoria Embankment	Bonfire going out of control	SMALL FIRE ABOARD
18/11/2015 19:21	2015	Boat	Barge	Limited to item 1st ignited	0	0		R BLOOMFIELD (BILLINGSGATE) LTD	OLD FORD ROAD	Fault in equipment or appliance	FIRE ON BOAT ON CANAL
01/12/2015 20:25	2015	Boat	Large passenger vessel	Limited to room of origin	0	0	RIVER TAXI PIER		ST GEORGE WHARF	Combustible articles too close to heat source (or fire)	RUNNING CALL TO SMOKE ISSUING FROM THAMES CLIPPER H23Z ATTENDING - NO FURTHER ATTENDANCE REQUIRED
05/05/2015 22:46	2015	Boat	Other vessel	Whole boat	0	0			Reedham Close	Heat source and combustibles brought together deliberately	PERSONS REPORTED BOAT FIRE
09/03/2015 12:41	2015	Boat	Motor yacht	Limited to floor of origin (not whole	0	0		S K D Marina Ltd	St. Katharines Way	Unsafe use of equipment or appliance (heat source)	BOAT ALIGHT WATER LEVEL 2
24/07/2016 16:56	2016	Boat	Barge	Limited to room of origin	0	0	SHELTER 82M FROM KINGS HOUSE SPORTS GROUND, ALEXANDRA GARDENS. 16M FROM THE PROMENADE		THE PROMENADE	Combustible articles too close to heat source (or fire)	BOAT ALIGHT INCIDENT IS AT THAMES GRID 214, THE TERRACE, BARNES, SW13 9QL
18/05/2016 18:24	2016	Boat	Other vessel	Limited to room of origin	0	0	ELECTRICITY SUB STATION 24M FROM 236 OLD FORD ROAD. 9M FROM OLD FORD ROAD		OLD FORD ROAD	Faulty fuel supplies – Electricity	FIRE - BOAT ON FIRE - BRIDGE NUMBER 53 REGENTS
24/02/2016 12:20	2016	Boat	Large passenger vessel	Limited to item 1st ignited	0	0	GREENWICH PIER	TRANSPORT FOR LONDON	CUTTY SARK GARDENS	Combustible articles too close to heat source (or fire)	BOAT ALIGHT - MOORED ACCESS VIA KING WILLIAM WALK
23/07/2016 19:46	2016	Boat	Other vessel	Limited to room of origin	0	0	TOWN END PIER		HIGH STREET	Combustible articles too close to heat source (or fire)	BOAT ALIGHT - WATER RESCUE LEVEL 1
27/03/2016 11:17	2016	Boat	Barge	Limited to room of origin	0	0	CANAL BRIDGE 176A		SPRINGWELL LANE	Unsafe use of equipment or appliance (heat source)	BOAT ALIGHT ON CANAL RICKMANSWORTH PUMP ATTENDING
07/12/2016 14:48	2016	Boat	Other vessel	Whole boat	0	0	CONTAINERVILLE STUDIOS		CORBRIDGE CRESCENT	Overheating, unknown cause	BOAT ALIGHT ON CANAL WATER RESCUE LEVEL ONE IMPLEMENTED
28/02/2016 23:06	2016	Boat	Barge	Whole boat	0	0	SOAPHOUSE CREEK		FERRY LANE	Combustible articles too close to heat source (or fire)	HOUSEBOAT ALIGHT - WATER RESCUE 1 IMPLEMENTED ALL APPLIANCES TO ACCESS VIA BOSTON GARDENS
05/02/2016 15:07	2016	Boat	Other vessel	Limited to item 1st ignited	0	0	TATTERSHALL CASTLE	TATTERSHALL CASTLE	VICTORIA EMBANKMENT	Unsafe use of heat source - due to unsafe disposal	BARGE ALIGHT JUST UP STREAM FROM TATTERSHALL CASTLE NORTH OF HUNGERFORD BRIDGE
11/09/2016 15:45	2016	Boat	Large passenger vessel	Limited to item 1st ignited	0	0	CANARY RIVERSIDE VIRGIN ACTIVE		WESTFERRY CIRCUS	Overheating, unknown cause	BOAT CRASHED INTO PILINGS AND POSSIBLY ALIGHT NR CANARY WHARF PASSENGER PEIR BOAT UNABLE TO
12/07/2016 04:58	2016	Boat	Other vessel	Whole boat	0	0			MASWELL PARK ROAD	Heat source and combustibles brought together deliberately	FIRE BOAT ALIGHT ON DRIVEWAY OF HOUSE OPPOSITE FIU REQUESTED FROM INCIDENT
25/07/2016 14:01	2016	Boat	Barge	Limited to 2 floors (not whole building)	0	0	HERMITAGE MOORINGS		WAPPING HIGH STREET	Combustible articles too close to heat source (or fire)	ELECTRICAL FIRE ON BOARD LEVEL ONE WATER RESCUE IMPLEMENTED
26/11/2016 16:00	2016	Boat	Naval vessel	Limited to item 1st ignited	0	0	RIVER HOUSE		CHELSEA EMBANKMENT	Heat source and combustibles brought together deliberately	POSSIBLY A HOUSE BOAT ON FIRE
08/04/2017 19:11	2017	Boat	Barge	Whole boat	0	0	STREET RECORD		FOOTPATH RUNNING ALONG GRAND UNION CANAL BETWEEN BOROUGH BOUNDARY AND	Unsafe use of heat source - due to unsafe disposal	RUBBISH ALIGHT ON BARGE, LEVEL ONE WATER RESCUE IMPLEMENTED BARGE IS DERELICT - ACCESS ON FOOT
22/03/2017 22:08	2017	Boat	Barge	Whole boat	0	0	L TWR 87M FROM CARGIANT, HYTHE ROAD. 53M FROM UNNAMED ROAD		HYTHE ROAD	Heat source and combustibles brought together deliberately	BOAT ALIGHT ON CANAL - RVP HYTHE ROAD OS CAR GIANT
15/03/2017 16:20	2017	Boat	Motor yacht	Limited to item 1st ignited	0	0	AND UNIT 5 AT 96B		WALLIS ROAD	Accumulation of flammable material	BOAT ALIGHT MOORED ON CANAL
20/12/2017 04:00	2017	Boat	Motor yacht	Limited to room of origin	0	1	STREET RECORD		DANELAND WALK	Unsafe use of heat source - due to knocking over	FIRE ALL OUT IN BOAT - CALLER UNSURE OF ADDRESS AND SUFFERING INJURIES - LAS REQUESTED NEAR

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29/08/2017 20:47	2017	Boat	Other vessel	Limited to item 1st ignited	0	0	STREET RECORD		RAYNERS GARDENS	Faulty fuel supplies – Petrol product	JET SKI ALIGHT BY THJE JO DOWN WAY
05/06/2017 18:47	2017	Boat	Fishing boat	Whole boat	0	0			BROMLEY ROAD	Heat source and combustibles brought together deliberately	BOAT ALIGHT RVP 47 BROMLEY ROAD FOR DIRECTIONS
26/11/2017 13:21	2017	Boat	Barge	Limited to room of origin	0	1	PRIVATE SIDINGS		TRANSPORT AVENUE	Combustible articles too close to heat source (or fire)	FIRE ON NARROW BOAT
18/10/2017 02:40	2017	Boat	Other vessel	Limited to item 1st ignited	0	0			MILLSHOTT CLOSE	Heat source and combustibles brought together deliberately	BOAT ALIGHT PARKED ON DRIVEWAY
25/02/2017 21:45	2017	Boat	Barge	Limited to floor of origin (not whole	0	0	CANALSIDE PAVILION		GRANARY SQUARE	Combustible articles too close to heat source (or fire)	CANAL BOAT ALIGHT WATER RESCUE LEVEL ONE IMPLEMENTED BLUE WITH RED TOP
26/11/2017 01:55	2017	Boat	Barge	Whole boat	0	0	STREET RECORD		WALLIS ROAD	Combustible articles too close to heat source (or fire)	CANAL BOAT ALIGHT CYLINDERS REPORTED WATER OPS LEVEL ONE
01/12/2017 17:21	2017	Boat	Other vessel	Limited to floor of origin (not whole	0	0	COWLEY SOUTH TOWPATH		BENBOW WAYE	Unsafe use of equipment or appliance (heat source)	CANAL BOAT ALIGHT WATER OPS LEVEL ONE IMPLEMENTED *RVP BENBOW WAYE*
24/07/2017 17:59	2017	Boat	Barge	Limited to room of origin	0	0	PONTOON DOCK		NORTH WOOLWICH ROAD	Unsafe use of heat source - due to unsafe disposal	FIRE ON BARGE AT JUNCTION OF BARRIER POINT ROAD
20/06/2017 16:13	2017	Boat	Barge	Limited to room of origin	0	0	WILLOW TREE MARINA	LOCK & QUAY WITHIN WILLOWTREE MARINA	WEST QUAY DRIVE	Combustible articles too close to heat source (or fire)	BOAT ALIGHT CREWS WILL BE MET ON ARRIVAL ENTER MARINA VIA SIDE GATE TO THE LEFT OF MAIN GATES
10/05/2017 23:18	2017	Boat	Barge	Limited to item 1st ignited	0	0	GARAGES REAR OF 202-210		HORSENDEN LANE SOUTH	Unsafe use of equipment or appliance (heat source)	FIRE ON NARROW BOAT GRAND UNION CANAL JUNCTION BILTON ROAD TOWPATH OFF OF HORSENDEN
09/04/2017 20:26	2017	Boat	Barge	Whole boat	0	0	FOOTBRIDGE OVER TOW PATH AT GRAND UNION CANAL		RIVERSIDE WAY	Overheating, unknown cause	FIRE ON BOAT - MULTIPLE CALLS RECEIVED - LEVEL ONE WATER RESCUE
01/02/2017 08:36	2017	Boat	Other vessel	Limited to room of origin	0	0	STREET RECORD		SOLEBAY STREET	Combustible articles too close to heat source (or fire)	BOAT ALIGHT PERSONS REPORTED , WATER RESCUE LEVEL ONE NEAR TO BRIDGE
01/05/2017 20:09	2017	Boat	Barge	Whole boat	0	0	NASH HOUSE		OLD OAK LANE	Unable to determine	FOUR PUMP FIRE - LEVEL ONE WATER RESCUE NEAR BRIDGE OVER CANAL
07/03/2017 09:35	2017	Boat	Barge	Limited to room of origin	0	0	GOODRICH HOUSE		SEWARDSTONE ROAD	Combustible articles too close to heat source (or fire)	BOAT ALIGHT
04/01/2017 08:30	2017	Boat	Large passenger vessel	Limited to room of origin	0	0	BUTLERS WHARF WEST		SHAD THAMES	Unsafe use of equipment or appliance (heat source)	RUNNING CALL TO FIRE ALL OUT THE ELIZABETHAN BOAT
05/01/2017 23:11	2017	Boat	Other vessel	Whole boat	0	0	BROOKMARSH TRADING ESTATE	SINSPEED	NORMAN ROAD	Unable to determine	TWELVE PUMP FIRE - PERSONS REPORTED - AERIALS 2 - CYLINDERS PROCEDURE IMPLEMENTED - LINE OPS LEVEL 1
19/08/2018 16:52	2018	Boat	Large passenger vessel	Limited to item 1st ignited	0	0	LONDON BRIDGE CITY PIER		HAYS LANE	Faulty fuel supplies – Petrol product	RUNNING CALL TO VESSEL FIRE FULL ATTENDANCE REQUIRED
08/03/2018 17:30	2018	Boat	Other vessel	Limited to item 1st ignited	0	0	CANAL BRIDGE 190		PACKET BOAT LANE	Faulty fuel supplies – Petrol product	FIRE ON BOAT
06/04/2018 19:51	2018	Boat	Barge	Whole boat	0	0		MOTO LONDON	BASIN APPROACH	Unable to determine	BOAT ALIGHT FIU REQUESTED FROM SCENE BELIEVED TO BE ON LIMEHOUSE CUT WATER OPS LVL 1 IMPLEMENTED **
20/08/2018 13:58	2018	Boat	Other vessel	Limited to item 1st ignited	0	0	CUMBERLAND BASIN		PRINCE ALBERT ROAD	Overheating, unknown cause	BOAT ALIGHT
13/07/2018 23:52	2018	Boat	Other vessel	Limited to room of origin	0	0			GOVERNMENT ROW	Heat source and combustibles brought together deliberately	HOUSEBOAT ALIGHT - WATER RESCUE LEVEL 1 ACCESS VIA GATE ON SMEATON ROAD
01/09/2018 10:38	2018	Boat	Other vessel	Limited to item 1st ignited	0	0	THE MOORINGS		LIGHTERMANS WALK	Combustible articles too close to heat source (or fire)	FIRE ON BOAT - BELIEVED TO BE ALL OUT CALLER WILL MEET YOU ON THE ROAD
12/10/2018 18:22	2018	Boat	Other vessel	Limited to item 1st ignited	0	0	BUCKLANDS WHARF		THAMES SIDE	Combustible articles too close to heat source (or fire)	HOUSE BOAT ALIGHT
22/09/2018 18:55	2018	Boat	Fishing boat	Limited to room of origin	0	0	PLATTS EYOT	PORT HAMPTON ESTATES LTD	LOWER SUNBURY ROAD	Unsafe use of equipment or appliance (heat source)	FIRE ON BOAT BYRON PRIDE SOUTH SIDE OF THE ISLAND CALLER STATES NO VEHICLE ACCESS BUT WILL MEET B
30/07/2018 23:57	2018	Boat	Motor yacht	Limited to room of	0	0	THE GENERAL ELLIOTT		ST JOHN'S ROAD	Faulty fuel supplies – Electricity	BOAT BEHIND PUB ON FIRE - WATER LEVEL ONE
25/10/2018 15:52	2018	Boat	Motor yacht	Limited to room of origin	0	0	CANAL BRIDGE 190B		HIGH ROAD	Heat source and combustibles brought together deliberately	BOAT ALIGHT
09/07/2018 15:01	2018	Boat	Other vessel	Whole boat	0	0	COMMERCIAL PREMISES		STOCKINGSWATER LANE	Playing with fire (or heat source)	BOAT ALIGHT WATER OPS 2 CYL REP
08/05/2018 13:42	2018	Boat	Barge	Whole boat	0	1	WITLEY INDUSTRIAL ESTATE		WITLEY GARDENS	Unable to determine	SIX PUMP FIRE PERSONS REPORTED WATER OPS LEVEL ONE - CANAL BOAT ALIGHT - CYLINDERS CONFIRMED INVOLVE
12/10/2019 00:52	2019	Boat	Barge	Limited to room of origin	0	0	ARGYLL POINT		BURDETT ROAD	Faulty fuel supplies – Electricity	BOAT ALIGHT ON CANAL LIMEHOUSE CUT WATER OPERATIONS LEVEL ONE
08/08/2019 02:54	2019	Boat	Barge	Limited to item 1st ignited	0	0			ST MARK'S CRESCENT	Accumulation of flammable material	BOAT ALIGHT WATER OPERATIONS LEVEL ONE IMPLEMENTED
26/06/2019 10:47	2019	Boat	Large passenger vessel	Limited to item 1st ignited	0	0	GREENWICH PIER	TRANSPORT FOR LONDON	CUTTY SARK GARDENS	Fault in equipment or appliance	FIRE ON VESSEL ACCESSIBLE BY LAND - BASEMENT PROCEDURE IMPLIMENTED VESSEL: MILLENIUM TIME - FIU
12/12/2019 08:47	2019	Boat	Barge	Limited to item 1st ignited	0	0			HELSINKI SQUARE	Faulty fuel supplies – Electricity	BOAT ALIGHT GO DOWN FINLAND STREET ACCESS VIA CAR PARK ON LEFT
30/11/2019 19:46	2019	Boat	Other vessel	Limited to item 1st ignited	0	0	LANDING STAGE KINGSTON ROWING CLUB		CANBURY GARDENS	Heat source and combustibles brought together deliberately	BOAT ON FIRE NEAR THE PUB
18/11/2019 16:26	2019	Boat	Barge	Limited to room of origin	0	1	CANAL COTTAGE		TWYFORD ABBEY ROAD	Combustible articles too close to heat source (or fire)	BOAT ALIGHT
08/07/2019 06:46	2019	Boat	Barge	Limited to item 1st ignited	0	0	CANAL BRIDGE 200C		NORTH HYDE GARDENS	Unsafe use of heat source - due to unsafe disposal	BARGE ALIGHT - WATER LEVEL ONE
11/02/2019 19:00	2019	Boat	Large passenger vessel	Limited to item 1st ignited	0	0	SUNBORN LONDON YACHT		WESTERN GATEWAY	Faulty fuel supplies – Electricity	ELECTRICAL FIRE
19/11/2019 14:45	2019	Boat	Barge	Limited to item 1st ignited	0	0	BRIDGE OVER FRAY'S RIVER		IVER LANE	Overheating, unknown cause	BOAT SMOKING ON CANAL

DDDateTimeOfCall	DDCalendarYear	PropertyCategory	PropertyType	AtStopDamageSpreadSize	NumFireDeaths	NumAllFireInjuries	PaonDescription	OrganisationName	StreetDescriptor	MainCause	FinalDescription
21/09/2019 15:17	2019	Boat	Motor yacht	Whole boat	0	3	HAM LANDING STAGE		HAM STREET	Faulty fuel supplies – Petrol product	BOAT ALIGHT ****RVP HAM HOUSE CARPARK**** WATER OPERATIONS LEVEL TWO NEARBY TO HAM HOUSE A
23/11/2019 16:16	2019	Boat	Other vessel	Limited to item 1st ignited	0	0	GAINSBOROUGH WHARF	GAINSBOROUGH WHARF	WILTSHIRE ROW	Faulty fuel supplies – Petrol product	BOAT ALIGHT
27/11/2019 12:30	2019	Boat	Other vessel	Limited to room of origin	0	0	BELMONT WHARF MOORINGS		SEWARDSTONE ROAD	Cooking – other cooking	HOUSE BOAT ALIGHT - WATER OPERATIONS LEVEL ONE ACCESSIBLE FROM LAND
27/10/2019 20:37	2019	Boat	Other vessel	Limited to room of origin	0	0	STREET RECORD		HATTON ROAD	Combustible articles too close to heat source (or fire)	FIRE ON NARROWBOAT ON CANAL - CALLER WAITING ON ROAD BRIDGE
28/06/2019 14:24	2019	Boat	Large passenger vessel	Limited to item 1st ignited	0	0	FARADAY HOUSE		AURORA GARDENS	Faulty leads to equipment or appliance	BOAT ALIGHT IN ENGINE ROOM SOUTHSIDE BOAT NAMED NEPTUNE
09/11/2020 05:34	2020	Boat	Barge	Limited to item 1st ignited	0	0	HALE WHARF		FERRY LANE	Chimney fire	FIRE IN KITCHEN ON A BOAT LOCK 17 ON THE LEA
23/03/2020 18:16	2020	Boat	Barge	Limited to item 1st ignited	0	0	SITE OF FORMER GAS WORKS		CANAL WAY	Combustible articles too close to heat source (or fire)	BOAT ALIGHT RVP -----SAINSBURYS, CANAL WAY-------
26/02/2020 01:32	2020	Boat	Motor yacht	Whole boat	0	0	STREET RECORD		TEDDINGTON LOCK	Unable to determine	FOUR PUMP FIRE - LEVEL ONE WATER OPERATIONS - MULTIPLE VESSELS ALIGHT ** ADDITIONAL ATTENDANCE
20/02/2020 13:27	2020	Boat	Other vessel	Limited to floor of origin (not whole	0	0	TAMESIS DOCK		ALBERT EMBANKMENT	Cooking – chip pan/deep fat fryer	SMOKE ISSUING COMPLETION OF ATTENDANCE FOR FIRE ON A VESSEL 1 x FIU & 1 X FSO REQUESTED FRO
29/01/2020 15:10	2020	Boat	Barge	Whole boat	0	1	ST PANCRAS YACHT BASIN		CAMLEY STREET	Faulty fuel supplies – Gas	FOUR PUMP FIRE WATER OPS LEVEL 1 IMPLEMENTED
11/09/2020 11:16	2020	Boat	Barge	Limited to room of	0	0	THAMES GRID 197		LOWER HAM ROAD	Faulty fuel supplies – Electricity	HOUSE BOAT ALIGHT WATER OPS LEVEL ONE
24/02/2020 22:27	2020	Boat	Other vessel	Limited to room of origin	0	0	HALE WHARF		FERRY LANE	Heat source and combustibles brought together deliberately	BOAT ALIGHT ON CANAL NEAR LOCK 17 AND LEE VALLEY PARK
22/01/2020 13:00	2020	Boat	Barge	Limited to item 1st ignited	0	0	POINT WHARF		TOWN MEADOW	Faulty fuel supplies – Gas	BOAT ALIGHT
17/12/2020 19:21	2020	Boat	Other vessel	Limited to item 1st ignited	0	0	TELECOMMUNICATION MAST		MARSHGATE LANE	Combustible articles too close to heat source (or fire)	BOAT ALIGHT - WATER OPS LEVEL ONE
28/02/2020 22:53	2020	Boat	Barge	Limited to item 1st ignited	0	0	STREET RECORD		MILL MEAD ROAD	Faulty fuel supplies – Electricity	BOAT ALIGHT ON CANAL - WATER OPERATIONS LEVEL ONE
04/11/2020 23:44	2020	Boat	Barge	Whole boat	0	1	THORPE COURT		BRAMBLE PATH	Other intentional burning, going out of control	FIRE - CANAL BOAT MULTIPLE CALLS WATER OPS LEVEL 1 IMPLEMENTED *** ONCOMING APPLIANCES TO RVP
18/08/2021 23:52	2021	Boat	Motor yacht	Limited to room of origin	0	0	TURKS BOATYARD		THAMES SIDE	Heat source and combustibles brought together deliberately	PERSON THREATENING TO SET LIGHT TO HOUSEBOAT AND THEMSELVES - PREVIOUSLY REPORTED BY POLICE AS A FIR
03/08/2021 07:00	2021	Boat	Other vessel	Whole boat	0	0			CROSS DEEP	Unable to determine	SMOKE ISSUING FROM BOAT - ACCESSIBLE BY LAND CYLINDERS REPORTED WATER OPS LEVEL 1
18/12/2021 21:17	2021	Boat	Other vessel	Limited to room of origin	0	0	THE BOATHOUSE	LEA ROWING CLUB	SPRING HILL	Accumulation of flammable material	SMOKE FROM BOAT ON THE CANAL - PERSONS REPORTED *** RVP SPRING HILL ROAD O/S THEBOAT HOUSE*** OCC
02/10/2021 12:45	2021	Boat	Large passenger vessel	Limited to room of origin	0	0	JUBILEE PIER		TRINITY BUOY WHARF	Fault in equipment or appliance	SIX PUMP FIRE - WATER OPS LEVEL 1 *RVP ORCHARD PLACE ADJACENT TO TRINITY BUOY WHARF*
20/11/2021 23:58	2021	Boat	Other vessel	Whole boat	0	0	LITTLE VENICE ESTATE OFFICE WARWICK COMMUNITY HALL		HARROW ROAD	Overheating, unknown cause	BOAT ON FIRE - ACCESSIBLE BY LAND CLYINDERS INVOLVED ** MULTIPLE CALLS ** RVP JO HARROW ROAD
18/12/2021 13:32	2021	Boat	Motor yacht	Limited to floor of origin (not whole	0	0	PROPOSED BRIDGE AT EASTERN END OF PADDINGTON BASIN		SOUTH WHARF ROAD	Unsafe use of heat source - due to unsafe disposal	WATER OPERATIONS LEVEL 1 INCIDENT - SMOKE ISSUING FROM A HOUSEBOAT
11/10/2021 17:29	2021	Boat	Motor yacht	Limited to item 1st ignited	0	0			WATERMINT QUAY	Heat source and combustibles brought together deliberately	SMOKE ISSUING FROM BOAT MOORED ON RIVER LEA
17/03/2021 12:07	2021	Boat	Other merchant vessel	Limited to room of origin	0	0	HOPPER 293M FROM KNOWHOW, CHURCH MANORWAY 280M FROM UNNAMED ROAD		CROSSNESS SEWAGE TREATMENT WORKS TO WEST STREET FP3	Unable to determine	EMPTY CARGO SHIP ALIGHT - ACCESSABLE BY LAND - FIRE IN ENGINE ROOM CREWS IN BA ATTEMPTING TO PUT FIR
14/03/2021 22:28	2021	Boat	Barge	Limited to item 1st ignited	0	0	STREET RECORD		HA'PENNY BRIDGE	Heat source and combustibles brought together deliberately	BOAT ALIGHT - SEEN FROM MILLER HOUSE HARROW ROAD
25/02/2021 21:17	2021	Boat	Barge	Limited to floor of origin (not whole	0	0	GREENFORD PARK		AURIOL DRIVE	Unsafe use of heat source - due to unsafe disposal	BOAT ALIGHT - GRAND UNION CANAL *** RVP AURIOL DRIVE ***
06/02/2021 00:43	2021	Boat	Barge	Limited to room of origin	0	0	THE WHARF BUILDING		LADBROKE GROVE	Heat source and combustibles brought together deliberately	CANAL BOAT ALIGHT
07/01/2021 17:25	2021	Boat	Barge	Limited to room of origin	0	0	CARRICK COURT		NICHOLSON SQUARE	Combustible articles too close to heat source (or fire)	BARGE ALIGHT ON RIVER LEA LEVEL ONE WATER OPS
05/10/2022 14:37	2022	Boat	Barge	Limited to floor of origin (not whole	0	0	GRAND UNION CANAL		TENTELOW LANE	Heat source and combustibles brought together deliberately	CANAL BOAT ALIGHT CYLINDERS REPORTED MULTIPLE CALLS LEVEL 2 WATER OPS **RVP HAVEALOCK ROAD J/
26/11/2022 00:12	2022	Boat	Barge	Limited to room of origin	0	0	RIVERSIDE COTTAGE		SPRING HILL	Faulty fuel supplies – Electricity	THREE PUMP FIRE WATER OPS LEVEL 1 BOAT ON THE CANAL NEAR TO THE CRICKET GROUND / RIVERSIDE CAF
02/12/2022 09:12	2022	Boat	Large passenger vessel	Limited to item 1st ignited	0	0	TOWER PIER		TOWER HILL	Overheating, unknown cause	FIRE ON VESSEL
30/12/2022 18:16	2022	Boat	Barge	Limited to item 1st ignited	0	0	STREET RECORD		LONDON BRIDGE	Faulty fuel supplies – Electricity	FIRE ALL OUT
23/06/2022 02:05	2022	Boat	Barge	Limited to floor of origin (not whole	0	0	BRENTSIDE EXECUTIVE CENTRE	HILL SPINK	GREAT WEST ROAD	Heat source and combustibles brought together deliberately	BOAT ALIGHT CALLER ADVISES THAT THIS IS BY THE CAR PARK OF THE RIVERSIDE CLINIC
23/07/2022 23:32	2022	Boat	Motor yacht	Whole boat	0	0	THE WILDERNESS		BARGE WALK	Heat source and combustibles brought together deliberately	BOAT ALIGHT WATER OPS 1
20/09/2022 10:09	2022	Boat	Large passenger vessel	Limited to room of origin	0	0	BATTERSEA POWER STATION PIER		CIRCUS ROAD WEST	Vehicle crash or collision	SIX PUMP FIRE - ABOARD THAMES CLIPPER
26/11/2022 17:09	2022	Boat	Barge	Limited to item 1st ignited	0	0	REGENTS CANAL TOWPATH		VINCENT TERRACE	Faulty fuel supplies – Electricity	BOAT ON FIRE IN CANAL WATER OPS LEVEL 1
20/11/2022 15:39	2022	Boat	Motor yacht	Limited to item 1st ignited	0	0	SOUTH DOCK MARINA		ROPE STREET	Overheating, unknown cause	BATTERY SMOKING ON BOAT - ACCESS VIA CALYPSO WAY

DDDateTimeOfCall	DDCalendarYear	PropertyCategory	PropertyType	AtStopDamageSpreadSize	NumFireDeaths	NumAllFireInjuries	PaonDescription	OrganisationName	StreetDescriptor	MainCause	FinalDescription
10/07/2022 16:19	2022	Boat	Large passenger vessel	Limited to item 1st ignited	0	0		ROYAL CHINA	WESTFERRY CIRCUS	Overheating, unknown cause	FIRE ALL OUT
20/10/2022 20:48	2022	Boat	Barge	Limited to room of origin	0	0			BANKSIDE	Combustible articles too close to heat source (or fire)	SMOKE ISSUING FROM BOAT IN CANAL - PERSONS REPORTED
08/05/2022 21:50	2022	Boat	Other vessel	Limited to item 1st ignited	0	0			PALMERS ROAD	Combustible articles too close to heat source (or fire)	BOAT ALIGHT ON VICTORIA WHARF
27/04/2022 23:45	2022	Boat	Other vessel	Limited to floor of origin (not whole	0	0		THE GREYHOUND	SOUTH ORDNANCE ROAD	Faulty fuel supplies – Electricity	BOAT ALIGHT MULTIPLE CALLS
16/01/2022 15:12	2022	Boat	Barge	Limited to item 1st ignited	0	0	GWYNNYTH WINTER MOORINGS		OLD FORD ROAD	Combustible articles too close to heat source (or fire)	HOUSEBOAT ON FIRE WATER OPERATIONS LEVEL ONE
07/12/2022 16:23	2022	Boat	Other vessel	Limited to item 1st ignited	0	0			PALMERS ROAD	Combustible articles too close to heat source (or fire)	CANAL BOAT ALIGHT
28/11/2023 23:16	2023	Boat	Motor yacht	Limited to item 1st ignited	0	0	KING GEORGE V DOCK		WOOLWICH MANOR WAY	Cooking – other cooking	FIRE ALL OUT ON BOAT
10/12/2023 14:10	2023	Boat	Other vessel	Limited to room of origin	0	1	ST PANCRAS YACHT BASIN		CAMLEY STREET	Unsafe use of equipment or appliance (heat source)	PERSON REPORTED - FIRE IN GAS LOCKER ON BOAT - MULTIPLE CALLS - WATER OPS LVL 1 CYLINDER PROCEDURE I
02/06/2023 12:11	2023	Boat	Large passenger vessel	Limited to item 1st ignited	0	0	ST KATHARINES PIER		ST KATHARINES WAY	Overheating, unknown cause	RUNNING CALL TO ENGINE OVERHEATING ON VESSEL - PL REQUESTED FOR BA
01/01/2023 18:46	2023	Boat	Barge	Limited to floor of origin (not whole	0	0			DAUBENEY ROAD	Heat source and combustibles brought together deliberately	HOUSEBOAT ON FIRE - WATER OPS LEVEL 1 IMPLEMENTED 1X FIT REQUESTED FROM SCENE
17/01/2023 20:55	2023	Boat	Other vessel	Limited to room of origin	0	0	SOAPHOUSE CREEK MOORINGS		FERRY LANE	Combustible articles too close to heat source (or fire)	SMOKE ISSUING FROM HOUSEBOAT SOAPHOUSE MOORINGS VIA FERRY LANE
17/01/2023 14:09	2023	Boat	Barge	Limited to item 1st ignited	0	0	STONEBRIDGE LOCK		WATERMEAD WAY	Combustible articles too close to heat source (or fire)	SMOKE ISSUING FROM CANAL BOAT - CONFIRMED WATER OPS LEVEL ONE
15/11/2023 14:00	2023	Boat	Other vessel	Limited to item 1st ignited	0	0			MALLORY CLOSE	Faulty fuel supplies – Electricity	HOUSE BOAT ALIGHT WATER OPERATION LEVEL ONE
05/07/2023 09:26	2023	Boat	Barge	Limited to item 1st ignited	0	0	COPLAND COURT		DURHAM WHARF DRIVE	Cooking – other cooking	SMOKE ISSUING FROM CANAL BOAT - ACCESS BOATERS AVENUE
05/08/2023 22:31	2023	Boat	Barge	Whole boat	0	0	CANAL BRIDGE 190B		HIGH ROAD	Heat source and combustibles brought together deliberately	FOUR PUMP FIRE - WHAT 3 WORDS - MOONS.KEYS.SHUTS - LPP REQUESTED FROM SCENE RVP PACKET BOAT MAR
01/07/2023 16:06	2023	Boat	Other vessel	Limited to item 1st ignited	0	0			MASON CLOSE	Unable to determine	JET SKI ALIGHT IN CAR PARK
02/04/2023 23:15	2023	Boat	Barge	Limited to item 1st ignited	0	0			TAGGS ISLAND	Overheating, unknown cause	SMOKE ISSUING FROM BATTERY IN A BOAT - RVP HAMPTON COURT ROAD POSSIBLY A SMALL BARGE BOAT 2 BIG M
29/04/2023 23:10	2023	Boat	Other vessel	Limited to room of origin	0	0		RIVERSIDE PRESS	WALLIS ROAD	Combustible articles too close to heat source (or fire)	NARROWBOAT ON FIRE ON RIVER LEE
12/03/2023 19:16	2023	Boat	Barge	Limited to item 1st ignited	0	0			CHALK FARM ROAD	Unsafe use of heat source - due to unsafe disposal	FIRE ALL OUT - BIN CUPBOARD AREA - STAFF WILL MEET YOU AT ENTRANCE TO DIRECT
20/04/2023 19:36	2023	Boat	Large passenger vessel	Limited to item 1st ignited	0	0	JUBILEE PIER		TRINITY BUOY WHARF	Faulty fuel supplies – Electricity	RUNNING CALL VIA COASTGUARD TO CLIPPER ALIGHT H23B ATTENDING FULL FIRE ATTENDANCE REQUIRED
01/03/2023 09:58	2023	Boat	Barge	Limited to room of origin	0	0	ALL SAINTS CHURCH		CHURCH STREET	Combustible articles too close to heat source (or fire)	BOAT ALIGHT ON EMBANKMENT ACCESSIBLE BY LAND WATER OPS 1
04/07/2023 00:13	2023	Boat	Barge	Limited to room of origin	0	0	TOWER BRIDGE MOORINGS		MILL STREET	Combustible articles too close to heat source (or fire)	THREE PUMP FIRE - BARGE ALIGHT - ** LEVEL ONE WATER OPS IMPLEMENTED **
12/10/2023 13:34	2023	Boat	Other vessel	Limited to item 1st ignited	0	1	MOORING AND PREMISES AT REGENT'S CANAL TOWPATH KING'S CROSS		TOWPATH BY GRAND UNION CANAL INCLUDING ACCESS PATHS	Cooking – other cooking	FIRE ALL OUT ON HOUSE BOAT
25/01/2024 01:36	2024	Boat	Motor yacht	Limited to item 1st ignited	0	1	STREET RECORD		DAME STREET	Cooking – other cooking	GAS CANISTER EXPLODED - CANAL BOAT ACCESS VIA ABOVE LOCATION - LAS EN ROUTE
20/06/2024 18:41	2024	Boat	Barge	Limited to item 1st ignited	0	0	WESTON COURT		BRINDLEY PLACE	Heat source and combustibles brought together deliberately	BOAT ALIGHT - ACCESSIBLE FROM LAND
07/07/2024 03:18	2024	Boat	Motor yacht	Whole boat	0	0	ANGLESEA LODGE	TWENTY-EIGHT PORTSMOUTH ROAD LTD	PORTSMOUTH ROAD	Heat source and combustibles brought together deliberately	BOAT ALIGHT ACCESSIBLE BY LAND THAMES SAILING CLUB
10/05/2024 16:30	2024	Boat	Other vessel	Limited to item 1st ignited	0	0	JADE APARTMENTS		HOMERTON ROAD	Faulty fuel supplies – Electricity	FIRE - CANAL BOAT - ACCESS FROM TOW PATH OPPOSITE WHARF - BETWEEN MARSHGATE BRIDGE AND HACKNEY
12/07/2024 15:19	2024	Boat	Barge	Whole boat	0	0	LOCKBRIDGE COURT		WOODFIELD ROAD	Faulty fuel supplies – Electricity	BOAT ALIGHT NEAR SITE OF EARLIER FIRE ROCKS.PANEL.GENTLEY BEST ACCESS IS VIA GREAT WESTERN RO
12/07/2024 19:50	2024	Boat	Barge	Whole boat	0	0	PADDINGTON NEW YARD		WESTWAY	Pending Fire Investigation Team findings	INVESTIGATE SMOULDERING AT SCENE OF PREVIOUS BOAT FIRE BEST ACCESS IS VIA GREAT WESTERN ROAD BUS GA
01/04/2024 23:08	2024	Boat	Barge	Limited to item 1st ignited	0	0	WESTBOURNE GREEN CANAL		ROWINGTON CLOSE	Cooking – other cooking	FIRE ON DOCKED VESSEL IN CANAL ACCESS VIA ALDSWORTH CLOSE

National Operational Guidance

Guidance

Fires on board vessels

NFCC National Fire Chiefs Council

Developed and maintained by the NFCC

Contents

Introduction

Incidents involving vessels in the marine and inland waterway environment are not commonplace for fire and rescue personnel; they can be complex to deal with, ranging from incidents involving small vessels to large sea-going vessels, and can include military vessels.

The scope of this guidance refers to fires on board vessels within the statutory responsibility of the fire and rescue service. If a casualty vessel is situated outside of the statutory responsibility (i.e. off-shore, mid-stream, mid-lake, outside 'the area' defined under the Act) it must be recognised it may eventually come alongside and become a statutory duty of the relevant fire authority.

A fire on a vessel is a hazard because of the way vessels are constructed, with difficult access and egress and the possibility of fire spreading beyond the compartment involved through conduction via metal bulkheads and air handling machinery.

To fight any vessel fire effectively, firefighters must be familiar with the basic details of:

- Vessel construction, design and terminology
- On-board fire protection and firefighting media
- General issues such as liaison with other authorities, emergency plans, responsibility for control of operations and safety precautions
- Vessel stability

Within this context, firefighters must have regard to the features of different vessels, and their present condition (e.g. loaded or unloaded) and they may need to adjust their operations accordingly.

This guidance assumes that the affected vessel can be brought alongside for the purposes of firefighting. Fire and rescue services should consider foreseeable risks within their area when planning to respond to incidents involving fires on board vessels.

For the purpose of this guidance a ship is considered to be any vessel over 30 metres in length or over 300 gross tonnes.

Fires on board smaller vessels and craft may also pose further difficulties, arising from, but not exhaustive to:

- Location
- Access
- Water supplies

- Construction
- Fire spread to neighbouring vessels/craft

Because of the specific nature of firefighting on board vessels, this guidance addresses specific hazards, control measures and firefighting techniques that will assist fire and rescue service personnel dealing with these types of fires.

For information regarding working in, on or near water see National Operational Guidance: Water rescue and Geophysical Hazards

The guidance should be read in conjunction with National Operational Guidance: Fires and firefighting, Transport and other associated parts of the framework.

Legislation

Fire and Rescue Services Act 2004 (The Act) [England and Wales]

Fire (Scotland) Act 2005 (The Scotland Act) [Scotland]

Fire and Rescue Services (Northern Ireland) Order 2006 (The NI Order) [Northern Ireland]

Local Government Act 1972

Merchant Shipping Act 1995

Risk management plan

Each fire and rescue authority must develop their strategic direction through their risk management plan. To determine the extent of their firefighting capability, strategic managers will consider their statutory duties and the foreseeable risk within their area.

Work to identify risk and prepare operational plans should consider all stakeholders, including local emergency planning groups and the fire and rescue service risk management plan.

Responsibility of fire and rescue services

Fire and rescue services are responsible, under legislation and regulations, for developing policies and procedures and to provide information, instruction, training and supervision to their personnel about foreseeable hazards and the control measures used to reduce the risks arising from those hazards.

This guidance sets out to provide fire and rescue services with sufficient knowledge about the potential hazards their personnel could encounter when attending incidents. Fire and rescue services should ensure their policies, procedures and training cover all of the hazards and control measures contained within this guidance.

Hazard - Inaccurate situational awareness: On board vessels

Hazard Knowledge

When the incident commander arrives at any vessel they may be required to take over or accept the responsibility for firefighting operations, from the ship's master, captain or devolved nominated representative, the owner, port authorities, a dedicated fire and rescue marine response (FRMR) team officer or a salvor.

On larger vessels, the chief engineer or their officers may also be able to help with expertise in their field. From them, and by examining the vessel plans, the incident commander should obtain details of the incident, the vessel, its cargo, the firefighting measures already implemented or planned and any relevant factors, such as the general state of the vessel's stability.

Information required will include:

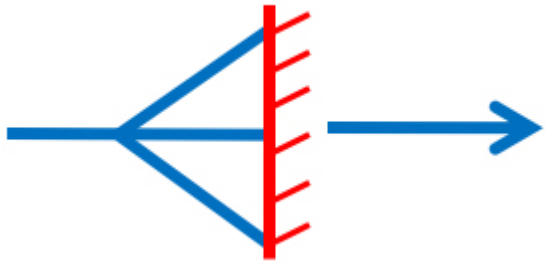
- Whether people are unaccounted for, and where they were last seen
- Where the vessel is berthed
- The stability of the vessel - refer to Transport: Unstable vessel
- The location of the fire
- The nature of the materials involved, for more information regarding construction of vessels see Construction of vessels

- Details of any dangerous goods stowed near the fire (anything likely to explode, react violently or produce toxic gases)
- Boundary starvation
- Access to the fire
- Current and predicted tidal information that may affect firefighting operations, vessel stability, access and egress
- Whether on-board firefighting systems are operating or operable
- Whether the main and auxiliary engines are operable
- Whether mechanical ventilation systems are operating or operable

Ship's plans should be marked up using consistent symbols to promote intraoperability and interoperability between emergency responders, see table below:

Annotation	Symbol
Seat of fire/s	
Smoke-logged areas	
Hot spots on six sides of fire compartment	

Boundary cooling and firefighting jets



Areas searched by fire teams

Primary containment boundary

Secondary containment boundary

The vessel's personnel will usually be able to assist by operating doors, pumps, valves, etc. and by acting as guides. If ventilation equipment is running when the fire and rescue service arrives, the incident commander will need to consult with the vessel's master or their engineer as to whether this should be turned off.

A standard type of abbreviated informative message should also be considered as an early first impression of the incident, such as:

- Type of vessel
- Name of vessel
- Tonnage of vessel
- Location of vessel (e.g. berthing point, jetty number, dry dock)
- Cargo on board
- Location and extent of fire hazard
- Summary of resources in use including ships systems/crews

Some vessels in British territorial waters may have on-board security or anti-piracy measures including small arms.

See National Operational Guidance: Fires and firefighting

See National Operational Guidance: Incident command

Control measure - Responsible person: Fires on board vessels

Control measure knowledge

The master is ultimately responsible for the vessel and all its crew, passengers, cargo, etc. However, in their absence this responsibility can be devolved to a nominated representative. Where possible the incident commander should make contact with the vessel's master on arrival at the incident.

Where there is no obvious responsible person, master or owner, the incident commander must implement operational procedures to save life, protect property and reduce any impact on the environment.

Other relevant stakeholders for liaison may include:

- Category 1 and 2 responders
- Port authorities
- Harbour masters
- Salvors
- Insurance companies
- Owners
- Secretary of State's Representative for Maritime Salvage and Intervention

The incident commander should obtain details of the vessel's fire plan, the incident, the vessel, its cargo and any firefighting measures already implemented, which will include information on the:

- Current firefighting operations being undertaken
- Evacuation, invacuation or disembarkation of passengers and/or crew
- Sections of the vessel enclosed by fire-resisting bulkheads
- Fire detection systems activated
- Status of on-board fire suppression fixed installations
- Availability of fixed and portable fire appliances and firefighting equipment
- Means of access to the various decks and compartments
- Status of ventilation system, including particulars of the master fan controls
- Status of compartment doors and watertight hatches
- Position of dampers
- The location of the international ship-to-shore connection
- Available closed circuit television (CCTV) coverage

Strategic actions

Fire and rescue services should:

- Undertake vessel firefighting training for all personnel who may be exposed to this type of incident

Tactical actions

Incident commanders should:

- Confirm that fire and rescue service assistance is required and ask for permission to board the vessel
- Question the responsible person, other responders and witnesses to understand incident factors and history
- Ensure a thorough brief is obtained from the vessel's master or their nominated representative
- Ascertain any prior and ongoing firefighting actions taken by on board teams

Control measure - Scene survey: Fires on board vessels

Control measure knowledge

A full scene survey of the incident should be carried out at the earliest opportunity; this may require using other vessels or resources to assess the incident.

Available resources may include:

- Port authority vessels (e.g. tugs or pilot vessels)
- Fire and rescue service vessels
- Privately-owned vessels
- Fire and rescue service aerial appliances
- Fire and rescue service resources
- Other services resources (e.g. military or police air assets)
- Unmanned aerial vehicles (UAVs) or drones

The scene survey should also include smoke and thermal scanning. Using thermal imaging equipment for both locating the fire and for assessing the effect of the fire on adjoining compartments will provide vital information. The incident commander should be mindful that insulated bulkheads may result in false temperature readings.

Strategic actions

Fire and rescue services should:

- Consider having a memorandum of understanding with port authorities and other agencies relating to the agreed actions at incidents involving vessels

Tactical actions

Incident commanders should:

- Ensure that a scene survey is carried out at the earliest opportunity
- Ensure that all personnel are fully briefed on the current hazards, risks, control measures and tactical mode
- Identify the location of any available ship to shore connection
- Use ships plan and on-board systems in liaison with the vessel's personnel to confirm the location of the fire

- Identify the presence and effectiveness of any on board or infrastructure fixed installations

Control measure - Thermal imaging or scanning

Control measure knowledge

Thermal imaging cameras (TIC) and other thermal scanning equipment are devices that form an image using emitted infrared radiation as opposed to normal visible radiation. They gather information when normal observation may be inhibited due to smoke or lack of lighting. They also provide the option to search for specific points of interest such as casualties or seats of fire, which may not be obviously visible through the normal spectrum. In some situations, firespread may not be visible to the naked eye, but may be detected using TICs.

The range of thermal image cameras available is wide and they have varying specifications. However, many cameras have a numerical and colour gradient temperature scale, which may assist crews attempting to locate a fire and any casualties or for thermal scanning of a building.

The heat energy radiated from the objects in the form of infrared waves is picked up by the TIC, which is then able to identify the energy differences from the objects being scanned and convert the readings into visual images. The image displayed is therefore based on temperature differential.

Images may be displayed in black and white or in a colour range. The TIC manufacturer's information should be referred to for descriptions of how higher or hotter temperatures will be displayed on their equipment.

TICs are available in different sizes and as an integral part of a number of different resources:

- Hand-held
- Helmet-mounted
- Emergency fire vehicle-mounted
- Self-contained
- Remote-controlled
- Aircraft-mounted (helicopter, drone and aeroplane)

Thermal imaging equipment can offer considerable benefits to incident commanders during the information gathering stage of an incident, including:

- Establishing possible seats of fire
- Establishing the extent of firespread
- Establishing internal fire conditions and assessing the need for defensive or offensive action
- Searching for casualties inside a structure
- Wider search for casualties (during road traffic collisions, aircraft crashes, railway incidents, incidents in the open)
- Improved search capability during low light or low visibility
- Locating the seat of fire in large fuel supplies (for example in landfill or waste management centres)
- Locating hot spots, bullseyes, small areas of combustion or heating
- Establishing heat spread to adjacent hazards and fuel supplies
- Establishing sources of overheating in electrical or mechanical scenarios (for example lighting chokes, vehicle brakes)
- Establishing compromises or weaknesses in fire resistance
- Locating hot spots in cylinders, vessels or pipework
- Recording images and videos, which can assist subsequent investigations or debriefs
- Assisting the incident commander via video link to command and control units

Operators of thermal imaging cameras should be aware that:

- The equipment may not be intrinsically safe, limiting its use in some hazardous environments
- Some surfaces can reflect or absorb infrared radiation, causing images to be misleading to an operator. For example, the devices often depict areas of the same temperature in the same shade or colour. This can obscure some hazards such as pits, surface liquid or unsafe ground which may be dangerous for operators in that area
- Equipment using a different spectrum should not be relied on as a total replacement for normal vision. Standard service procedures for moving in smoke and darkness must be maintained and great care should be taken to ensure that personnel remain safe because battery power may be lost rapidly with little warning
- Images displayed on the devices are computerised images created from the sensor equipment. Allowances should therefore be made for alterations to the actual size and distances involved for the objects on display
- Images may be misleading as sensors may not differentiate between the heat of a fire versus the reflected heat from the sun on surfaces such as glass or polished metal. Well-insulated structures (e.g. sandwich panelled premises) do not readily allow for the passage of infrared radiation. Using a TIC may therefore indicate weaknesses in a structure but may not give any indication as to the conditions within it.

A video developed by Greater Manchester Fire and Rescue Service shows the use of thermal scanning as part of its future firefighting techniques programme.

Strategic actions

Fire and rescue services should:

- Develop tactical guidance and support arrangements for the actions to take, and hazards associated, with the use of thermal image cameras
- Consider using thermal image cameras with video link facilities
- Ensure all personnel receive information, instruction and training in the use and limitations of thermal imaging equipment

Tactical actions

Incident commanders should:

- Consider using a range of thermal imaging resources such as aerial appliances, drones and helicopters
- Consider using thermal imaging equipment for scanning when carrying out a scene survey
- Adopt a systematic approach when using thermal imaging cameras to scan and search an area

Control measure - Locate the fire

Control measure knowledge

The incident commander should consider gathering information gathering from the ship's crew to help identify and locate the fire. Ships crews may also be available to act as wayfinders or guides to lead responding fire and rescue service teams to the appropriate scene of operations.

If the vessel's fire defence systems are still live, examining the fire detectors or fixed installations displays in conjunction with the vessel's plans may give a good indication of the location of the fire.

All available information should be confirmed, collected and analysed before confirming the location of the seat of the fire.

Visible indicators of fire locations may include:

- The presence of flame

- The presence of smoke, its density and temperature, whether it is being discharged from ventilators or other openings
- Heat damage
- Bulkhead or deck head discoloration
- Blistering or burning off paintwork
- Steaming off from application of water spray

On-board systems that may also assist with identifying (but are not restricted to) the location of the fire includes:

- Temperature monitoring equipment
- Bulkhead thermometers
- The vessel's temperature monitoring system
- Fire detection or suppression systems that have activated
- Closed-circuit television (CCTV)

Strategic actions

Fire and rescue services should:

- Where a risk is identified, ensure suitable and sufficient training is provided on locating fires on board vessels

Tactical actions

Incident commanders should:

- Use on-board systems, in liaison with the vessel's personnel, to confirm the location of the fire

Control measure - Identify whether cargo is involved

Control measure knowledge

Details of any cargo carried should be listed and should be available from the vessel's cargo manifest, vessel owners, coastguard, port authorities, agents or insurers. This may include cargo in

static containers, road-going heavy goods vehicles (HGV), bulk carriers and designated cargo holds.

Firefighters must remember that cargoes can be very varied. Some are inherently dangerous, while others may become so when they react to heat or water. Some cargoes, although not chemically dangerous, pose a risk to the safety of the vessel and, indirectly, to life, because they affect the vessel's stability by moving about or by swelling as a result of absorbing water.

Conversely, the inappropriate use of a fire extinguishing medium, or using the wrong medium, can cause unnecessary damage to cargo.

Removing or moving cargo from the vessel or any adjoining compartments as part of the incident plan should form part of any joint decision making process, which may include:

- The ship's master or nominated representative
- Harbour master
- Port authorities
- Local authorities
- Owners
- Insurers

See National Operational Guidance: Hazardous Materials

Strategic actions

Fire and rescue services should:

- Make arrangements with ports that allow responding crews to access cargo manifests

Tactical actions

Incident commanders should:

- Access any available information to identify the cargo (e.g. manifest, crew knowledge)
- Identify whether the incident should be reclassified as a hazardous materials response
- Agree actions relating to the movement of cargo and salvage operations with the ships master
- Identify if the vessel is compliant with the International Maritime Dangerous Goods (IMDG) Code
- Identify presence of hazardous materials on board (e.g. cylinders, illegal activities)

Hazard - Insufficient resources: On board vessels

Hazard Knowledge

Fires on board vessels are likely to require specialist resources and these may take time to assemble. The incident commander will therefore need to prioritise actions and implement the incident plan as and when the correct resources are available at the scene.

Control measure - Specialist resources: Fires on board vessels

Control measure knowledge

Due to the nature of a vessel fire and the unique firefighting actions that may be required, fire and rescue services may need to request specialist advice and equipment, which can come from:

- Marine tactical advisers requested through the Fire and Rescue Services National Co-ordination Centre (NR Fire Control)
- Specialist teams that are available in neighbouring or nearby fire and rescue services, such as declared fire and rescue marine response (FRMR) teams
- Specialist equipment
- Insurers
- Vessel owners
- Salvage companies
- Port or harbour authorities
- Environmental agencies
- His Majesty's (HM) Coastguard

Strategic actions

Fire and rescue services should:

- Ensure that arrangements are in place to request and mobilise specialist resources to incidents involving fires on board vessels

Tactical actions

Incident commanders should:

- Identify the resources currently available to take immediate action and request those likely to be needed to deliver a full incident plan
- Request specialist resources, considering specialist firefighting teams, fire boats, water rescue teams or tugs
- Consider requesting advice from tactical advisers and subject matter experts (e.g. HMCG, SOSREP)
- Establish communication with remote tactical advisers, subject matter experts and specialist resources

Hazard - Working near water or other liquids

Hazard Knowledge

For the purposes of this guidance ‘working near water or other liquids’ is considered to be working within three metres. This distance may be adjusted following a risk assessment.

Working near water, or other liquids, presents a hazard; personnel could accidentally enter the water or liquid, with the risk of:

- Submersion
- Entanglement
- Cold water shock
- Hypothermia
- Contamination
- Drowning

The risk of accidental entry into the water or liquid may depend upon the nature of operational activity being performed, and the necessity to work in the area.

The environment surrounding the water or liquid may increase the risk of accidental entry. The factors that may affect this include:

- Underfoot conditions
- Stability of the surrounding area
- Gradient
- Lack of guarding or barriers
- Weather conditions
- Visibility

For more information on personnel working on or in water, refer to National Operational Guidance: Water rescue and flooding – Working environment: Water rescue and flooding.

For more information on operational activity in the context of docks, harbours, marinas, canals and rivers, refer to National Operational Guidance: Transport

Control measure - Assess the risk of working near water or other liquids

Control measure knowledge

A risk assessment when personnel are working near water or other liquids should take into account:

- The necessity of working near water or other liquids
- The required proximity to the water or other liquids
- The number of personnel required
- The operational activity that will take place
- The likelihood of accidental entry due to:
    - Underfoot conditions
    - Stability of the surrounding area
    - Gradient
    - Lack of guarding or barriers
    - Weather conditions
    - Reduced visibility
- The level of danger presented by the water or other liquids, such as:
    - Depth
    - Temperature
    - Type of liquid, including potential contaminants
    - Speed of flow

Strategic actions

Fire and rescue services should:

- Make risk information regarding the presence of water, or other liquids, available to operational personnel

Tactical actions

Incident commanders should:

- Avoid working near water or other liquids where possible
- Commit the minimum number of personnel to the hazard area when working near water or other liquids
- Assess the risk of accidental entry into water or other liquids

Control measure - Safe system of work: Working near water or other liquids

Control measure knowledge

Where possible the risk of accidentally entering water or other liquids should be mitigated by using:

- Cordons
- Suitable existing or improvised guarding or barriers
- Work restraint systems

Personnel working near water or other liquids should wear personal floatation devices that are compatible with existing personal protective equipment (PPE). The wearing of fire helmets when working near water or other liquids should take into account the operational activity being performed and the risk of accidental entry into water.

For control measures for working on or in water refer to National Operational Guidance: Water rescue and flooding.

For information regarding work restraints refer to National Operational Guidance: Subsurface, height, structures and confined spaces- Unguarded edges.

Strategic actions

Fire and rescue services should:

- Provide suitable PPE and equipment for working near water or other liquids

Tactical actions

Incident commanders should:

- Identify and communicate the presence of water or other liquids to all responders
- Ensure that personnel operate on the safe side of suitable existing or improvised guarding or barriers near water or other liquids
- Assess hydrology and status of water or other liquids - depth, temperature, type of liquid, speed of flow
- Investigate the possibility of rising waters and increased flow from tides, flooding, sluice gates
- Use work restraint or fall arrest systems for personnel working near water or other liquids
- Appoint a safety officer to monitor the hazard presented by water or other liquids
- Ensure that personnel wear suitable PPE and personal flotation devices when working near water or other liquids

Hazard - Restricted access and egress: On board vessels

Hazard Knowledge

Vessel fires often need multi-agency involvement. This, along with the busy environment of a port or harbour, makes ensuring the control of all agencies embarking and disembarking the vessel a key consideration.

Due to the complicated layout of vessels, getting to the location of the fire to carry out firefighting operations may be difficult, due to the type of vessel and its construction.

See National Operational Guidance: Incident command

Control measure - Boarding control procedures

Control measure knowledge

To maintain control of personnel embarking or disembarking the vessel, suitable arrangements should be put in place, under the control of the incident commander, to record the number of all personnel and their whereabouts.

To establish boarding control, in addition to an inner cordon point, a single point of access to the vessel should also be maintained using a system to record times, names, activities and location of those on board.

Anyone passing through this point will have received a safety brief on the evacuation strategy, which will include:

- The evacuation signal
- The whereabouts of an alternative egress or evacuation point, such as:
  - Fire and rescue service ladders
  - Fire and rescue service aerial appliances
  - Vessel's own escape system
  - Accommodation, pilot ladder or platform

- The assembly point for dockside roll call

Strategic actions

Fire and rescue services should:

- Provide a recording system that supports boarding control and emergency evacuation at incidents involving vessels

Tactical actions

Incident commanders should:

- Ensure that inner and outer cordons are established, identified and communicated
- Control access to the inner cordon using methods proportionate to the size and complexity of the incident
- Establish appropriate boarding control procedures for any personnel required to go on board a vessel

Control measure - Safe access and egress: Fires on board vessels

Control measure knowledge

Once on board the vessel, access and egress for firefighting operations are likely to pose significant challenges. Once the location of the fire has been identified, it is important to determine the best route for firefighters, bearing in mind the difficulties of handling hose lines or other equipment in enclosed spaces. Good practice is to have a second point of egress where possible.

The vessel's crew and on-board firefighting teams may be able to advise or guide teams on the most suitable route to a scene of operations. Using the vessel's plan in consultation with the vessel's personnel will also aid decision making on possible access and egress routes. Selecting the most suitable access points to different parts of the vessel is not always straightforward. Crews should take approaching the fire from the deck above and/or below into consideration.

As access for firefighting teams may be complicated, maintaining good access and egress is critically important for the safety of firefighting teams. Firefighters should note that it may be

necessary to wedge heavy doors open to avoid hose lines being cut and retreat avenues being obstructed. Watertight doors need to be managed appropriately, and in conjunction with the vessel's crew, by controlling them locally through hydraulic pumping or operating them remotely, from the vessel's bridge. Wherever possible firefighters should establish manual control of watertight doors locally where personnel are working.

Current and predicted tidal information may affect firefighting access and egress via ladders, gangways, pontoons and craft due to rise and fall of the casualty vessel whilst moored alongside. All access and egress points should be constantly monitored during fire service operations.

Strategic actions

Fire and rescue services should:

- Make tidal information available via service control rooms

Tactical actions

Incident commanders should:

- Ensure there are alternative methods of emergency egress to a place of safety (e.g. off the vessel)
- Consult the vessel's plans and liaise with the vessel's crew regarding safe access and egress routes
- Identify and communicate safe, planned routes to the scene of operations
- Ensure there are alternative methods of emergency egress
- Communicate the emergency evacuation signal and muster point arrangements to all personnel
- Consider the effect of rising and falling water level on access and egress arrangements
- Consider the impact of the infrastructure on safe access and egress routes

Hazard - Ineffective communications: Confined space

Hazard Knowledge

In some confined space environments, barriers and distances can be assumed to make normal communications ineffective. Communications may also fail during the course of the operation.

Control measure - Effective communication

Control measure knowledge

The aim at every incident is to integrate communications and decision-making between the incident commander, operational personnel and fire control rooms.

Effective communication is fundamental to achieving successful and safe resolution of incidents. It provides the incident commander with knowledge about the situation and progress of tasks. Obtaining accurate and timely information is crucial to underpin situational awareness and subsequent decision-making. It helps the incident commander perform the role in a confident and determined manner and thereby assert their leadership and authority.

Communication also plays a vital role in co-ordinating activities, completing tasks and handover of command. Sharing accurate and timely information is also critical for helping others to have a common understanding of the situation, what is happening and what needs to happen next. Even the most effective plans will only work if the people putting them into practice understand them.

As well as exchanging information, good communication helps to build relationships between people. These relationships are important so that people are effective when they carry out their tasks to resolve the incident. Incident commanders should be aware that effective communication is essential for good leadership and makes it easier for people to follow instructions, understand briefings and have confidence in what is being stated.

Effective communication should:

- Provide information that is:
    - Clear
    - Relevant and concise
    - Timely
- Be easily understood
- Be delivered confidently
- Include active listening

- Ensure verbal and non-verbal communications are aligned
- Ensure assumptions are questioned

When establishing an effective communication strategy, consideration should be given to the structure that will support it, in terms of technology, equipment and systems. The strategy should take into account:

- The size, type and location of the incident; communication needs to be supported across the whole of the incident ground, including within buildings and structures
- The effectiveness and resilience of the communication structure
- The provision of resilience, such as fallback arrangements, to ensure there is no loss of communication during an incident
- The provision of communication equipment with an appropriate ATEX classification if required

When implementing a communication strategy, key principles should be considered to ensure:

- That information received in support of the incident is accurate, appropriate and timely
- That information is obtained from a reliable and credible source, or if not that it is checked and verified
- That appropriate methods of communicating information are used if there are security implications, or the need to relay sensitive or distressing information
- The appropriate recipients are provided with relevant information, via an appropriate method
- The relevance of the information

A good flow of information is one of the most important assets for an incident. An incident commander should ensure they:

- Gather information, issue orders and receive situation reports
- Issue orders to personnel
- Receive situation reports from all areas, including sector commanders
- Assess and provide for the needs of other agencies, and plan to meet with them
- Carry out a risk assessment and add this to the briefing on arrival
- Brief personnel about the tasks they need to perform and the hazards and risks they face
- Thoroughly brief personnel to share any safety critical information

A structured method, such as using an IIMARCH (Information, Intent, Method, Administration, Risk assessment, Communications and Humanitarian issues) template, may help incident commanders when preparing a brief. Further information on this approach, and a Word version of the IIMARCH template, can be found on the JESIP website. The JESIP Mobile App includes a prompt for use of the IIMARCH briefing tool, with the ability to share.

For multi-agency incidents the M/ETHANE message protocol can be used to exchange information

about the incident with other responders via the fire control room and other agencies' control rooms.

Incident commanders may also hold briefings on the way to an incident. The extent of the briefing will depend on the type and scale of the incident. If personnel have little experience of the incident type, or there is high risk, a comprehensive briefing should be provided.

It will be necessary to organise safety briefings. As the incident develops, or if the risk of injury increases, those briefings may need to be more comprehensive.

Incident commanders should also establish suitable arrangements for communications. This is usually the role of command support under the guidance of the incident commander, and may include:

- Establishing communication links with fire control rooms
- Ensuring they correctly assign radio channels and call signs
- Establishing communications with other agencies
- The use of talk groups
- Requesting the support of a communications tactical adviser
- Establishing communications with sector commanders and other command support functions to receive regular situation reports
- Ensuring sector commanders can communicate between themselves
- Using local systems; some new and complex buildings and structures, including those extending underground, have communication systems installed for use by emergency services

Effective handover

Ensuring there is an effective handover between commanders is a crucial step in the handing over of command. It is an important stage in the formation of the new commander's situational awareness, which will be partially based on the situational awareness of the current commander and will be further developed from the range of information that will be gathered. Failure to conduct an effective handover can lead to poor situational awareness and can result in inappropriate or ineffective decisions being made.

Handovers should be conducted in a systematic way. There are a range of methods for handing over, which should include:

- Information on the incident
- Information on the risks
- Information on the resources
- The plan, including:
    - Objectives

    - Tactical priorities
    - Operational tactics
- The incident command structure and communication lines
- Key decisions, using the decision controls to articulate for each:
    - What the goals were
    - What they expected to happen
    - How the benefits justified the risks

Further information may be found in Incident command: Knowledge, skills and competence: Interpersonal communication.

Strategic actions

Fire and rescue services should:

- Ensure there is resilience in operational communication strategies and equipment
- Test the compatibility of communications equipment, systems and processes with neighbouring fire and rescue services and other agencies
- Ensure that they have appropriate communications systems in place at incidents
- Have contingency arrangements for reinstating operational communication, in the event of equipment or strategy failure
- Ensure that communication equipment that meets the appropriate ATEX classification is available when required

Tactical actions

Incident commanders should:

- Establish and maintain an incident ground communication plan considering other agencies and remote resources
- Exchange information about the incident with fire control rooms in a timely way
- Provide regular situation updates to all responders

- Establish resilient telecommunications with other responding agencies and consider the use of talk groups
- Ensure the communication structure is capable of meeting the needs of the incident
- Maintain resilience, such as fallback arrangements, in the communication structure to ensure there is no loss of communication during an incident
- Ensure that communication equipment that meets the appropriate ATEX classification is used at incidents if required
- Communicate objectives, priorities and tactics to be adopted in resolving the incident
- Ensure that the location of personnel is accurately reported and recorded
- Deliver clear, concise and timely briefings to crews, command support functions and other agencies
- Provide an effective handover when handing over command
- Receive an effective handover when taking over command
- Maintain an accurate record of information received from the incident ground
- Use the M/ETHANE message protocol to exchange information about the incident with other responders via the fire control room

Hazard - Fire and thermal radiation: On board vessels

Hazard Knowledge

Fires on board vessels present unique challenges to responding fire and rescue service personnel

due to:

- Vessel construction
  - Compartmentation
  - Open plan areas
  - Complicated layouts
  - Confined spaces
- Vessel materials
- Vessel cargoes
- Ventilation systems
- Restricted access and egress
- Travel distances to scene of operations

Before opening any compartment that has been sealed due to firefighting operations, a suitable and sufficient risk assessment should be undertaken and agreed with the ship's master or nominated representative.

The dangers associated with re-opening any compartment cannot be underestimated, due to the possibility of:

- Fire gas explosion
- Backdraught
- Untenable atmospheres created by inert gases, high-expansion foams or products of combustion
- Extreme heat conditions
- Unstable cargo
- General condition of that compartment post incident

Depending on the size of the incident it may be necessary to wait to accumulate sufficient suitable resources before implementing an offensive mode of operation.

For more information regarding construction of vessels see Construction of vessels

See National Operational Guidance: Fires and firefighting.

Control measure - Select an appropriate firefighting method

Control measure knowledge

The fire tetrahedron identifies the four components needed for burning to take place. To extinguish a fire it is largely a matter of depriving the fire of one or more of these factors, so methods of extinguishing fire can be classified in terms of removing these factors.

All fires can be extinguished by cooling, smothering, starving or by interrupting the combustion process to extinguish the fire.

- Cooling: limiting temperature by increasing the rate at which heat is lost from the burning material
- Smothering: limiting oxygen by preventing air from reaching the seat of the fire to allow the combustion process to reduce the oxygen content in the confined atmosphere until it extinguishes itself
- Starving: limiting fuel by removing potential fuel from the vicinity of the fire, removing the fire from the mass of combustible materials or by dividing the burning material into smaller fires that can be extinguished more easily
- Interrupting: inhibiting the chemical chain reaction by applying extinguishing media to the fire that inhibit the chemical chain reaction at the molecular level)

Cooling

One of the most common methods of extinguishing a fire is by cooling with water. This process depends on cooling the fuel to a point where it does not produce sufficient vapour to burn, with the reduction in temperature dependent on the application of an adequate flow of water to establish a negative heat balance. For example, if the rate at which heat is generated by combustion is lower than the rate at which it is lost from the burning material, burning will not continue.

To extinguish a fire by cooling, the rate at which heat energy is lost from the burning material must be increased by removing some of the heat energy. This reduces the temperature of the burning mass, reducing the heat release rate. Eventually, the rate at which heat is lost from the fire may be greater than the rate of heat production and the fire will die away.

When water is applied, it undergoes changes as it absorbs heat from the fire:

- Its temperature will rise
- It may evaporate (boil)
- It may react chemically with the burning material

To achieve maximum effect, the quantity of heat energy absorbed should be as great as possible. The properties of a good cooling agent are therefore:

- High specific heat capacity (thermal capacity)
- High latent heat of vaporisation
- High heat of decomposition

Water is a good cooling agent because of its high thermal capacity and latent heat of vaporisation. This, combined with the fact it is available in large quantities, makes it by far the most widely useful fire extinguishing agent.

The role of decomposition is insignificant in the case of water but very relevant with certain substances, such as carbon dioxide, that absorb heat in this way.

Smothering

If the oxygen supply to the burning material can be sufficiently reduced, burning will cease. The general procedure is to prevent fresh air from reaching the seat of the fire, allowing the combustion to reduce the oxygen content in the confined atmosphere until it extinguishes itself, for example by:

- Snuffing out candles
- Smothering a pan with a fire blanket
- Wrapping a person in a fire blanket
- Applying a blanket of foam over the burning surface, thus separating the fuel from the air

Smothering can also be achieved by removing the oxygen in the atmosphere, thus extinguishing the fire, for example, by:

- Introducing carbon dioxide (CO_2) to the immediate vicinity of the fire
- Introducing an inert gas to the immediate vicinity of the fire, such as through systems installed to protect computer server rooms

Starvation

In some cases, a fire can be extinguished simply by removing the fuel source. This may be accomplished in a number of ways, such as stopping the flow of liquid or gaseous fuel, removing solid fuel in the path of the fire or allowing the fire to burn until all of the fuel is consumed.

Fires can be starved of fuel by removing potential fuel from the vicinity of the fire, for example:

- Back burning forestry fires
- Draining fuel from burning oil tanks
- Removing cargo from a ship's hold
- Creating firebreaks in peat, heathland and forest fires
- Removing vehicles in the proximity of the fire

- Creating firebreaks in thatch roofs
- Removing tyres not affected by the fire from a tyre dump

Interrupting the combustion process

Dry powder, Bromochlorodifluoromethane (BCF) and other halon extinguishers work by releasing atoms that interrupt the chemical chain reaction. They also create an inert gas barrier.

Strategic actions

Fire and rescue services should:

- Develop tactical guidance and support arrangements for the hazards that may be encountered and the actions to be taken when selecting an appropriate firefighting method

Tactical actions

Incident commanders should:

- Select an appropriate firefighting method (i.e. cooling, smothering, starving, interrupting)
- Consider the impact of the extinguishing method on the fire, personnel, property and environment

- Consider the isolation or containment of the fire compartment

Control measure - Select appropriate firefighting media

Control measure knowledge

There are many different types of firefighting media and many different ways in which to apply them, depending on the nature of the incident encountered.

The media chosen for a given type of fire will depend on the nature of the materials involved and the size and intensity of the fire.

When applied to a fire, an extinguishing medium undergoes changes as it absorbs heat from the fire:

- Its temperature will rise
- It may evaporate
- It may chemically decompose
- It may react chemically with the burning material

To achieve maximum effect, the quantity of heat energy absorbed when these changes occur should be as large as possible.

Water

Water is the cheapest, most efficient and readily available way of extinguishing fires of a general nature. With a high latent heat of vaporisation, it takes about six times as much heat to convert a given mass of water at its boiling point into steam as that required to raise the temperature of the same amount of water to boiling point. The most efficient use of water is where as much as possible is converted into steam. The smothering effect of the steam produced at the seat of the fire is thought to play a part in assisting the extinguishing process.

Submerging the burning materials in water can be effective, particularly when considering cooling the remnants of fire. This can be achieved using a variety of container types, sizes and methods, such as buckets, large refuse skips and improvised methods. Consideration will need to be given to containing the resultant contaminated water.

There are occasions when water in any form is not effective and occasions when it is dangerous to use, particularly where there are materials that react unfavourably with water, potentially with explosive effects. Examples include magnesium, aluminium, lithium, potassium, sodium and other combinations of these substances; they are commonly used in manufacturing processes. It is important that specific sites that may store or use these materials are identified and emergency responders are made aware of the associated hazards, control measures and planning arrangements.

Foam

Firefighting foams have been developed primarily to deal with the hazards posed by liquid fuel fires. Although water is used for most incidents, it is generally ineffective against fires involving liquid fuels. This is because the density of water is greater than that of most flammable liquids so when applied it quickly sinks below their surfaces.

Finished foams consist of bubbles produced from a combination of foam concentrate and water that has been mixed with air. These air-filled bubbles form a blanket that floats on the surface of flammable liquids, knocking down and extinguishing fires by:

- Excluding air (oxygen) from the fuel surface
- Separating the flames from the fuel surface

- Restricting the release of flammable vapour from the surface of the fuel
- Forming a radiant heat barrier which can help to reduce heat feedback from flames to the fuel and hence reduce the production of flammable vapour
- Cooling the fuel surface and any metal surfaces as the foam solution drains out of the foam blanket; this process also produces steam which dilutes the oxygen around the fire

A variety of foam concentrates can be categorised into two main groups: protein or synthetic-based, depending on the chemicals used in their production. The characteristics of each concentrate and the finished foam they produce vary, making them suitable for some applications and unsuitable for others.

The main properties of firefighting foams include:

- Expansion: the amount of finished foam produced from a foam solution when it is passed through foam-making equipment
- Stability: the ability of the finished foam to retain its liquid content and to maintain the number, size and shape of its bubbles; in other words, its ability to remain intact
- Fluidity: the ability of the finished foam to be projected onto, and to flow across, the liquid to be extinguished or protected
- Contamination resistance: the ability of the finished foam to resist contamination by the liquid to which it is applied
- Sealing and resealing: the ability of the foam blanket to reseal should breaks occur, and its ability to seal against hot and irregular shaped objects
- Knockdown and extinction: the ability of the finished foam to control and extinguish fires
- Burn-back resistance: the ability of the finished foam, once formed on the fuel, to stay intact when subjected to heat and/or flame

The most common foam in use is in a compressed air foam system, which can be carried in combination with traditional water appliances. The foam attacks all three sides of the fire triangle simultaneously; the foam blankets the fuel, thereby reducing the fuel's capacity to seek out a source of oxygen and adheres to ceilings and walls, more readily aiding rapid reduction in heat. Also, the opaque surface of the foam, as it adheres to walls and ceilings, shields the fuel source from radiant energy.

Compressed air foam systems can deliver a range of useful foam consistencies, labelled from type 1 (very dry) to type 5 (wet), which are controlled by the air-to-solution ratios and, to a lesser extent, by the concentrate-to-water percentage. Types 1 and 2 foams have long drain times, meaning the bubbles do not burst and give up their water quickly. Wet foams, such as types 4 and 5, drain more quickly in the presence of heat.

Compressed air foam systems can produce a wide range of foam qualities or foam types, providing the most appropriate foam response to individual fire situations. This gives the incident

commander the advantage of tailoring the best foam type to the tactical use and fire problem at hand. Generally, the environmental effects of foams are considered in terms of their toxicity and their biodegradability. It is the total volume of the foam concentrate that is released into the environment that is of concern; it does not matter by how much it has been diluted. See National Operational Guidance: Environmental protection for further information.

Fire and rescue services also use foam for other purposes in addition to firefighting. See National Operational Guidance: Hazardous materials

Dry chemical powders

The basis of most dry powder extinguishers is sodium bicarbonate. With the addition of a metallic stearate as a waterproofing agent, it is widely used as an extinguishing agent in portable extinguishers and for larger application. Dry powder is very effective at extinguishing flame (rapid knockdown), and is particularly valuable in tackling a fire involving an incident in which clothes have been soaked in flammable liquid and ignited.

Dry chemical powders are expelled from containers by gas pressure and directed at the fire in a concentrated cloud through specially designed nozzles. Dry chemical powders are also tested for their compatibility with foam because early powders tended to break down foam. The two can complement each other at fires where foam is the standard extinguishing agent.

Ternary eutectic chloride powders have been developed for some metal fires. This type of foam melts, and then flows to form a crust over the burning metal, effectively sealing it from the surrounding atmosphere and isolating the fire.

Some burning materials, such as metals that cannot be extinguished by water, may be dealt with by using dry earth, dry sand, soda ash or limestone, all of which act as smothering agents.

Carbon dioxide, vaporising liquids and inert gases

Halons (halogenated hydrocarbons) vaporise rapidly when released from their pressurised container. The vapours are heavier than air, but when drawn into the flames, they inhibit the chain reactions and suppress flaming. Halons have now been largely replaced with inert gases or fine water mists because of environmental concerns.

At normal temperatures, Carbon dioxide (CO_2) is a gas 1.5 times as dense as air. It is easily liquefied and bottled in a portable cylinder where it is contained under approximately 51 bars pressure. When discharged, cold CO_2 vapour and some solid CO_2 are expelled from the horn, which rapidly cools in the process. The solid quickly turns to gas, and some of the liquid CO_2 evaporates to maintain the pressure in the cylinder. The gas, however, extinguishes by smothering, effectively reducing the oxygen content of the air. About 20 to 30% is necessary to cause complete extinction, depending on the nature of the burning material.

Carbon dioxide is quick and clean, electrically non-conductive, non-toxic and non-corrosive. It is however an asphyxiate at the concentrations necessary to extinguish a fire. The operation of total flooding CO_2 systems requires prior evacuation of all personnel.

Another fire extinguishing method is blanketing, which deprives the fire of oxygen. This is especially useful if someone's clothes are burning. For dealing with fires such as cooking fat fryers, the best method is to smother the fire with a fire resisting blanket.

Small fires in textile materials may often be extinguished by beating them out, or by rolling and screwing up the material tightly to exclude the air. Beating is also the method normally employed to extinguish heath, crop and similar fires in rural areas when water is not readily available.

See also National Operational Guidance: Environmental Protection - Fire water run-off

Strategic actions

Fire and rescue services should:

- Develop tactical guidance and support arrangements for the hazards that may be encountered and actions to be taken when selecting appropriate firefighting media
- Identify specific firefighting media from site-specific risk information (SSRI)
- Ensure sufficient stocks and/or supplies of firefighting media are made available at incidents within the area of the fire and rescue service
- Where necessary, make contingency arrangements with neighbouring services regarding using bulk media supplies for firefighting purposes

Tactical actions

Incident commanders should:

- Select appropriate firefighting media (e.g. water, foam, dry powder, CO_2)
- Monitor the effect of the media on the fire to ensure that the anticipated outcome is achieved
- Consider the potential for running fuel fires and deploy appropriate firefighting resources
- Put in place covering and/or safety jets according to identified risks

Control measure - Select the appropriate

firefighting technique: Fires on board vessels

Control measure knowledge

To uphold the importance of firefighter safety it is important to ensure information is gathered from all available sources before deciding on the tactics for firefighting. Depending on the location, type, size and severity of a fire on board a vessel, several tactics are available to the incident commander.

Ship firefighting and incident planning considerations should consider that any single compartment, multiple compartments or primary containment boundary should be assessed from all six sides of the cube where physically possible.

This may also include any preplanning for Site-Specific Risk Information incident plans where there is a foreseeable risk from cargo operations, roll-on-roll-off-passenger (RoPax) ship and ferry operations, cruise terminals, etc. Where such plans exist, the incident commander should take appropriate time to re-evaluate the assumptions and tactics within the plan to ensure they are fit for the incident they are dealing with.

If a dedicated UK fire and rescue marine response (FRMR) team are handing this incident to a shore-side fire and rescue service, then the following terms may be used to describe the strategy and tactics employed:

Contained

The fire is extinguished or held within an area or compartment (on all six sides) by elements of construction (preferably fire-resisting), preventing immediate spread or endangerment of the vessel

Maintained

The fire is 'contained' and resources are sufficient to 'maintain' that containment through firefighting actions (cooling, starvation, vertical ventilation or flooding)

Uncontained

The fire has breached fire resistant construction or is burning freely, but has the potential to be 'contained', by additional fire resistant structures, firefighting action, boundary cooling, ventilation or fire protection systems

Uncontainable

The fire has developed to a stage where it is not possible to hold heat and products of combustion within a fire-resistant compartment with the resources available and uncontrolled spread will inevitably threaten vessel safety

Firefighting options

- Using the vessel's fixed installations
- Boundary cooling
- Boundary starvation
- Compartment flooding
- Temperature monitoring strategy
- Compartment smothering via lock down/starvation

Consideration should be given to the effects of sealing the compartment and monitoring the adjacent bulkheads/decks and deck heads.

- Committing fire and rescue service personnel equipped with conventional hose lines, branches and breathing apparatus to a compartment involved in the fire
- Foam application

For further information on firefighting methods refer to National Operational Guidance: Fires and firefighting - Select the correct firefighting technique

Strategic actions

Fire and rescue services should:

- Have policies and procedures for dealing with fires involving vessels, where there is an anticipated risk

Tactical actions

Incident commanders should:

- Liaise with the vessel's personnel regarding the availability of fixed installations and suppression systems
- Develop an intervention strategy appropriate to current situational awareness and predicted fire development
- Consider compartment boundary cooling, starvation or flooding as a strategy

- Manage the vessel's ventilation systems in conjunction with the vessel's personnel
- Carry out an analytical risk assessment to support the decision to re-open sealed fire compartments

Control measure - Select appropriate firefighting equipment: Fires on board vessels

Control measure knowledge

The vessel's personnel may have on-board firefighting systems available or in operation, such as foam monitors and water spray systems.

Specialist vessel firefighting equipment could include:

- On-board fixed installations
  - Carbon dioxide
  - Inert gas
  - Foam
  - Water mist
  - Dry powder
  - Steam
- International ship-to-shore connection
- A selection of firefighting couplings and controllable breechings
- A selection of hoses and branches
- Flat fan sprays and other flow-controlled branches
- Cutting extinguisher firefighting equipment

Strategic actions

Fire and rescue services should:

- Make arrangements to provide appropriate firefighting equipment to support vessel firefighting operations, where there is an anticipated risk

Tactical actions

Incident commanders should:

- Liaise with the vessel's personnel regarding the available on-board firefighting facilities and teams
- Choose the appropriate firefighting equipment available and brief crews on its use

Hazard - Flashover, backdraught and fire gas ignition

Hazard Knowledge

Firefighters need an adequate understanding of the development of fires in ventilated and fuel controlled states, so they can recognise any potential fire development conditions. Tactics such as venting and indirect and direct application of water can then be used more effectively and safely.

A flashover is the stage where the total thermal radiation from the fire plume, hot gases and hot compartment boundaries causes all exposed combustible surfaces to pyrolyse (release flammable gases) and ignite when there is adequate ventilation. This sudden and sustained transition of a growing fire to a fully developed fire is known as a flashover.

All firefighters should be aware of the phenomenon termed backdraught. A backdraught is sudden and fierce and may occur at any stage during enclosed firefighting operations. Tragically, this type of event has killed firefighters in the past.

A backdraught is where limited ventilation can lead to a fire in a compartment producing fire gases containing significant proportions of partial combustion products and unburnt pyrolysis products (pyrolysates). If these accumulate, the admission of air when an opening is made to the compartment can lead to a sudden deflagration. This deflagration moving through the compartment and out of the opening is a backdraught. The force of a backdraught has the potential to damage building elements resulting in an unstable structure.

Fire gas ignitions occur when gases from a compartment fire have leaked into an adjacent compartment and mixed with the air within this additional area. This mixture may then fall within the appropriate flammable limits that, if ignited, will create an increase in pressure either with or without explosive force. Where this process occurs it is not necessary for an opening to be opened for such ignition to take place. If an explosive force is experienced, this is commonly termed a

'smoke explosion'. Where an ignition occurs with much less pressure, the term 'flash fire' is more appropriate.

Fire and rescue service personnel should be aware that the above phenomena are not mutually exclusive and all could be present at the same incident.

Control measure - Understand signs and symptoms of flashover

Control measure knowledge

The previous section provides a scientific description of events that firefighters may encounter but most importantly firefighters should be able recognise and understand the following signs.

Signs of room flashover include:

- High heat conditions or flaming combustion overhead
- The existence of ghosting tongues of flame
- A lack of water droplets falling back to the floor following a short burst fog pattern being directed at the ceiling
- A sudden lowering of the smoke layer (previously referred to as the neutral plane)
- The sound of breaking glass as windows or glazing begin to fail from exposure to heat, possibly causing a visible rise in the smoke layer (previously referred to as the neutral plane)
- A change in smoke issuing from a window (seen from the exterior), with increasing velocity, as if issuing under pressure, and a darkening of smoke colour towards black
- The sudden appearance of light-coloured smoke (pyrolysis) from low-level items being subjected to high heat flux from the hot gas layer

This video demonstrates the phenomenon of flashover.

Where it is necessary to use a combination of direct and indirect firefighting techniques and gas cooling, firefighters should take care at all times to ensure that direct firefighting jets/sprays do not impact negatively on the conditions or on firefighting teams as they move through a structure when deployed for internal firefighting operations.

Summary of key fire behaviour indicators

	Fire behaviour indicator	Hazard information
1	Slow-moving light-coloured smoke issuing from an opening	Early-stage fire development or smoke issuing some distance from the fire compartment
2	Fast-moving darkening smoke issuing from an opening	Impending flashover
3	Heavily darkened or heat-crazed windows	Under-ventilated fire conditions threatening backdraught or smoke explosion
4	Pulsing (in and out) darkened smoke movements around closed doors and windows	Fire development heading towards backdraught
5	Very hot doors or windows (feel with back of the hand)	Under-ventilated fire conditions threatening backdraught, smoke explosion or thermal runaway (flashover)
6	Sudden reversal of smoke issuing from an opening, causing smoke to head back into the compartment/building	The fire is rapidly developing and in need of more oxygen (impending flashover or backdraught), or a gusting wind-driven fire event is occurring
7	A rapid lowering of the smoke layer (previously referred to as the neutral plane)	Impending flashover
8	A rising of the smoke layer (previously referred to as the neutral plane)	A vent opening may have occurred at another location in the compartment/building
9	Turbulence or rising and falling (bouncing) in the smoke layer (previously referred to as the neutral plane)	Rapid fire development may be occurring
10	Heat radiating down from the smoke layer (previously referred to as the neutral plane)	Impending flashover

11	Detached 'ghosting' tongues of flame moving around the fire compartment	Impending flashover
12	Flaming combustion seen near the ceiling or at the smoke interface	Impending flashover
13	Smoke seen issuing from closed windows, doors or roof eaves, as if under pressure	Under-ventilated fire and impending backdraught

Strategic actions

Fire and rescue services should:

- Provide information, instruction and training to ensure all personnel are aware of the indications, safety measures and actions to take for potential flashover events
- Develop tactical guidance and support arrangements to ensure the safety of personnel when dealing with potential flashover events
- Maintain systems and processes to acquire and act on operational information on the occurrence of flashover events at operational incidents
- Share operational information and organisational learning on flashover events with relevant stakeholders

Tactical actions

Incident commanders should:

- Where flashover conditions are suspected, consider direct firefighting techniques
- Consider employing a combination of direct firefighting and gas cooling to control conditions
- Brief crews to carry out self-protection, door entry and compartment firefighting techniques

Control measure - Understand signs and symptoms of backdraught

Control measure knowledge

All firefighters need an adequate understanding of the development of fires in ventilation-controlled and under-ventilated states, so they can recognise potential backdraught conditions. Tactics such as venting and/or the indirect and direct application of water can then be used more effectively and safely.

Signs of backdraught include:

- Fires in tightly closed compartments, especially in energy efficient buildings
- Dark oily deposits and condensation running down the inside of windows
- Windows, doors and door handles that are hot to touch (back of the hand)
- Rattling sounds or smoke pulsating around openings
- Smoke being drawn back into openings and large air movements (draughts) seen heading into openings as the fire searches for more oxygen
- Ghosting tongues of flame seen in the compartment
- Turbulence in the smoke layer (previously referred to as the neutral plane), sometimes seen to 'bounce' up and down
- Whistling and roaring sounds, sometimes denoting high-velocity air flowing in or gases burning off in the compartment, preceding a backdraught event
- A change in fire conditions, with fast-moving smoke seen from the exterior to exit at high velocity, as if under pressure, and a steady darkening of smoke colour

This video demonstrates the phenomenon of backdraught

Strategic actions

Fire and rescue services should:

- Ensure all personnel receive information, instruction and training in the indications, safety measures and actions to take for potential backdraught events
- Develop tactical guidance and support arrangements to ensure the safety of personnel when dealing with potential backdraught events
- Maintain systems and processes to acquire and act on operational information on the occurrence of backdraught events at operational incidents
- Share operational information and organisational learning on backdraught events with relevant stakeholders

Tactical actions

Incident commanders should:

- Where backdraught conditions are suspected, apply media and ventilate before interior deployment

Control measure - Gas cooling

Control measure knowledge

Gas cooling is the approach of directing variable bursts or 'sweeps' of water-fog into the hot gas layer

Essentially, this involves the distribution of finely divided water droplets into the hot gas layer using a short 'burst and pause' (or pulsing) action at the branch nozzle as a means of reducing the temperature in the fire gases to a point where the threat of an impending flashover is limited or avoided. This technique can also be used where the hot gas layer is igniting and threatening to develop into a full compartmental flashover.

In either situation, an adequate flow rate (litres per minute) and an optimum spray pattern must be available at the branch.

It is extremely important to understand that gas cooling is predominantly a means of reducing the likelihood of flashover and should not be considered as a technique for dealing with either a fast developing or post-flashover fire. In such cases a solid stream (jet) directed at the fuel base becomes the dominant technique for fire suppression.

To fully understand the effects of gas cooling, it is essential to understand what the intervention is trying to control. Once it is understood that combustion can take place within the fire gases and how and why it occurs, firefighters are more prepared to intervene effectively.

Combustion is a chemical reaction that results in heat and light being produced. The fact that it is a chemical reaction means that new chemical substances are generated. Many chemical reactions generate heat but critically a combustion reaction will also produce light. The elements essential to the initiation of a combustion reaction are sometimes described in terms of the fire triangle; an ignition source or sufficient heat together with fuel and a supporter of combustion all have to be present.

Supporter of combustion

In its simplest form, combustion is a sequence of exothermic oxidation reactions, which means that

energy (heat and light) is generated as the fuel source is broken down and an oxidant is added. This oxidant is the supporter of combustion. Under normal circumstances, the oxidant is most likely to be the oxygen in air.

A number of different factors can have a significant impact on the danger and intensity of a reaction within the fire gases:

- Stoichiometric mixture (ideal mixture)
- Flammable limits
- Flash point
- Fire point
- Auto-ignition temperature
- Ventilation

Intervention

When water evaporates it expands to water vapour (steam); this can be anywhere within the ratio range of 1,700:1 and 3,400:1 depending on the temperature. When restricted to a compartment, this can have significant benefits but it also carries some risks, for example; the expansion can lead to a significant increase in pressure in the compartment.

However, when properly applied, the contraction of the fire gases can be greater than the amount of water vapour formed. The result should be a noticeable rise in the smoke layer (previously referred to as the neutral plane) in the fire compartment. This benefits effective application as the overpressure area will rise with the smoke layer (previously referred to as the neutral plane); firefighters should not be subjected to a wave of hot fire gases and visibility will improve.

Incident commanders should be aware of:

- The most appropriate firefighting media, for example, water and foam
- The most appropriate weight of intervention (litres per minute), for example, firefighting jets and hose reels
- The most appropriate method of firefighting, for example, smothering, starvation and cooling (indirect or direct cooling)
- Contingency plans that are formulated, implemented and communicated to ensure the safety of committed personnel in the risk area, for example, committing a supporting firefighting team

Strategic actions

Fire and rescue services should:

- Provide appropriate equipment and media to enable effective gas cooling tactics to be

implemented
- Develop tactical guidance and support arrangements for the hazards that may be encountered and the actions to be taken when considering gas cooling tactics for fires in buildings

Tactical actions

Incident commanders should:

- Use appropriate gas cooling techniques and equipment for the internal conditions identified

Control measure - Tactical ventilation

Control measure knowledge

Ventilation is one factor that will need to be considered as part of the overall incident plan. When planned and performed correctly, ventilation can save lives, improve firefighting conditions, and reduce damage to property.

Ventilation can be defined as:

'The removal of heated air, smoke or other airborne contaminants from a structure or other location and their replacement with a supply of cooler, cleaner air'

Ventilation is something that will occur naturally as part of the fire development and decay process. It will have an impact on the development of a fire before and after the-arrival of the fire and rescue service. However, ventilation is also a tool that should be considered as part of any overall firefighting strategy.

Ventilation can be performed after the fire has been extinguished or controlled, to clear residual smoke and heat from buildings or structures.

The benefits of controlled and co-ordinated tactical ventilation should be balanced against the hazards associated with accelerated fire growth and the introduction of oxygen into under-ventilated fires in buildings.

If applied and managed correctly, tactical ventilation can provide beneficial effects to any firefighting strategy by:

- Replenishing oxygen and reducing carbon monoxide levels
- Controlling temperature and humidity
- Removing moisture, dust, and other airborne contaminants
- Improving visibility and aiding navigation

Tactical ventilation is a planned intervention that requires co-ordination and control, to open up buildings and structures to release the products of combustion and can be defined as:

'The planned and systematic removal of heat and smoke from the structure on fire and their replacement with a supply of fresher air to allow other firefighting priorities.'

As part of an overall firefighting strategy, incident commanders should always have a clear and informed objective before commencing any form of ventilation activity. This will ensure that the full range of benefits of ventilating can be realised including:

- Improving conditions for the survivability of people in the building
- Improving conditions for personnel to enter and search for or rescue people
- Reducing the potential for rapid fire development, including flashover, backdraught, or fire gas ignition
- Restricting fire and smoke damage to property

In broad terms ventilation can be separated into two types:

Natural ventilation – This is the process of supplying and removing air through a structure or space without using mechanical systems. In firefighting terms, this refers to managing the flow of air (flow path) into and out of a structure or location, using the prevailing atmospheric conditions, such as wind strength, speed, and direction, via structural openings, such as windows, doors, and vents, to clear any smoke or hot fire gases.

Forced ventilation – This is the process of using fans, blowers or other mechanical means or devices to assist in creating, redirecting, and managing the air flow (flow path) into and out of a structure or location, so that heat, smoke and fire gases are forced out.

In both instances, additional factors related to climatic and atmospheric conditions, such as temperature and pressure, will have an impact on the relative success of any ventilation activity.

Type of forced ventilation	Considerations

Positive pressure ventilation (PPV)	This is achieved by forcing air into a building using a fan. Using the fan will increase the pressure inside the building relative to atmospheric pressure. The most appropriate tactic for PPV will depend on whether the inlet vent is also being used for access and egress. If the fan has to be placed further back because of operations at the entrance to a building, the fan may be less effective. The effectiveness of PPV will depend on a range of factors, including the: • Wind direction and strength • Size, type, and number of fans • Proportion of the fan's air that enters the building (fan performance) • Relative sizes of inlet and outlet vents • Size of the room to be cleared • Temperature of the fire gases or smoke in the building Personnel should always be aware of the potential risk of increasing the level of carbon monoxide (CO) in other areas of a building when ventilating, either when directing or forcing fire gases through a building or, in particular, if using petrol-driven PPV fans. Personnel should ensure that fans are positioned to prevent any build-up of CO. Consideration should be given to monitoring the levels of carbon monoxide.
Negative pressure ventilation (NPV)	NPV refers to extracting the hot air and gases from the outlet vent. This will reduce the pressure inside the building relative to atmospheric pressure. This can be achieved by using fans or water sprays.
Heating, ventilation and air conditioning (HVAC) and fire-engineered systems	HVAC systems are often engineered into buildings so that, in the event of a fire, they can be operated to ventilate public areas and support safe evacuation, as well as improve conditions for personnel. These systems are normally automatic but can also be operated by a manual override.

Powered smoke and heat exhaust systems	These systems are generally operated automatically and are likely to be operating before the arrival of the fire and rescue service. They can also be operated manually but this will need careful consideration by incident commanders as part of the firefighting and ventilation tactical strategy.

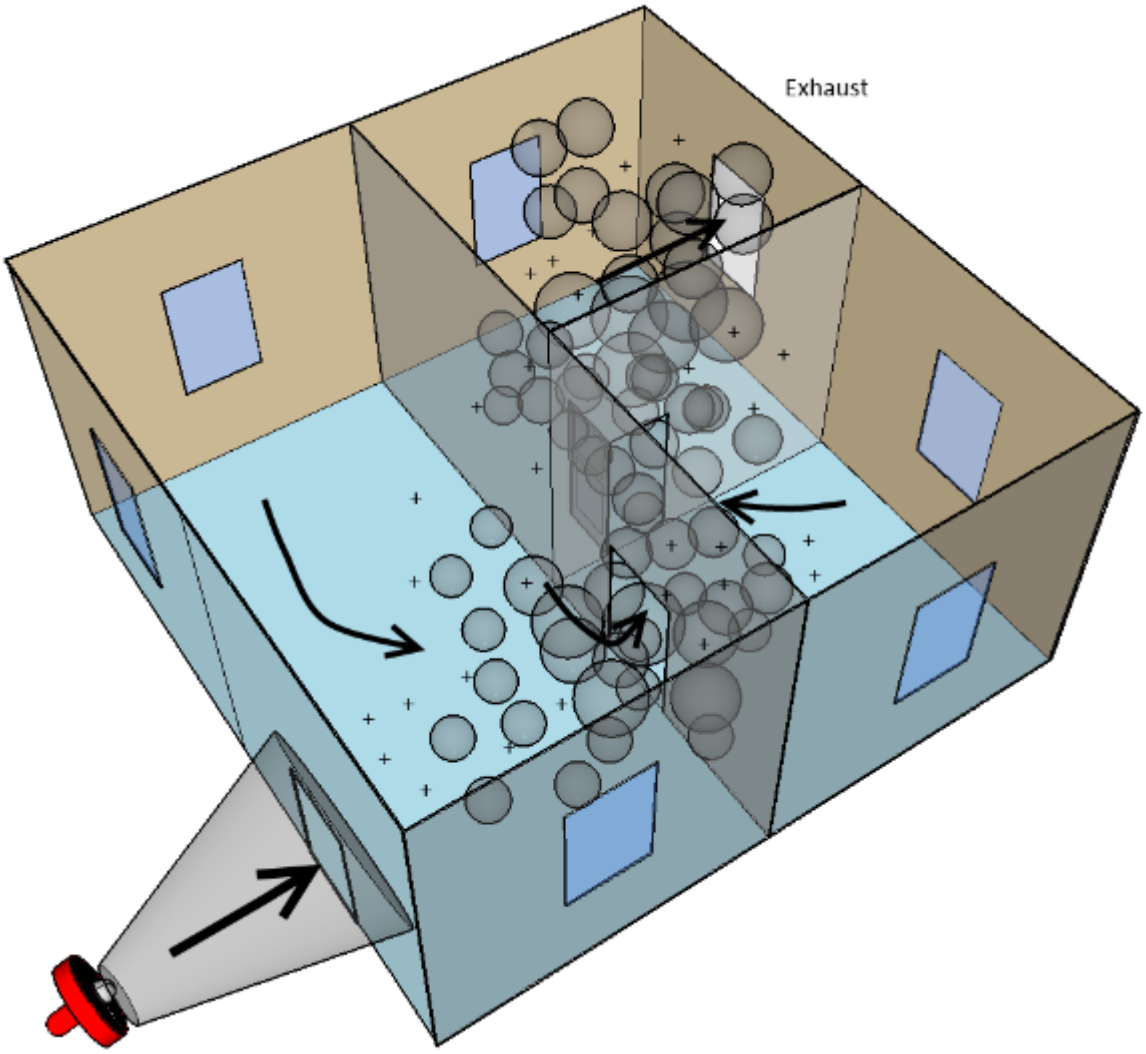


Figure 7: Positive pressure ventilation

Source: Building Research Establishment

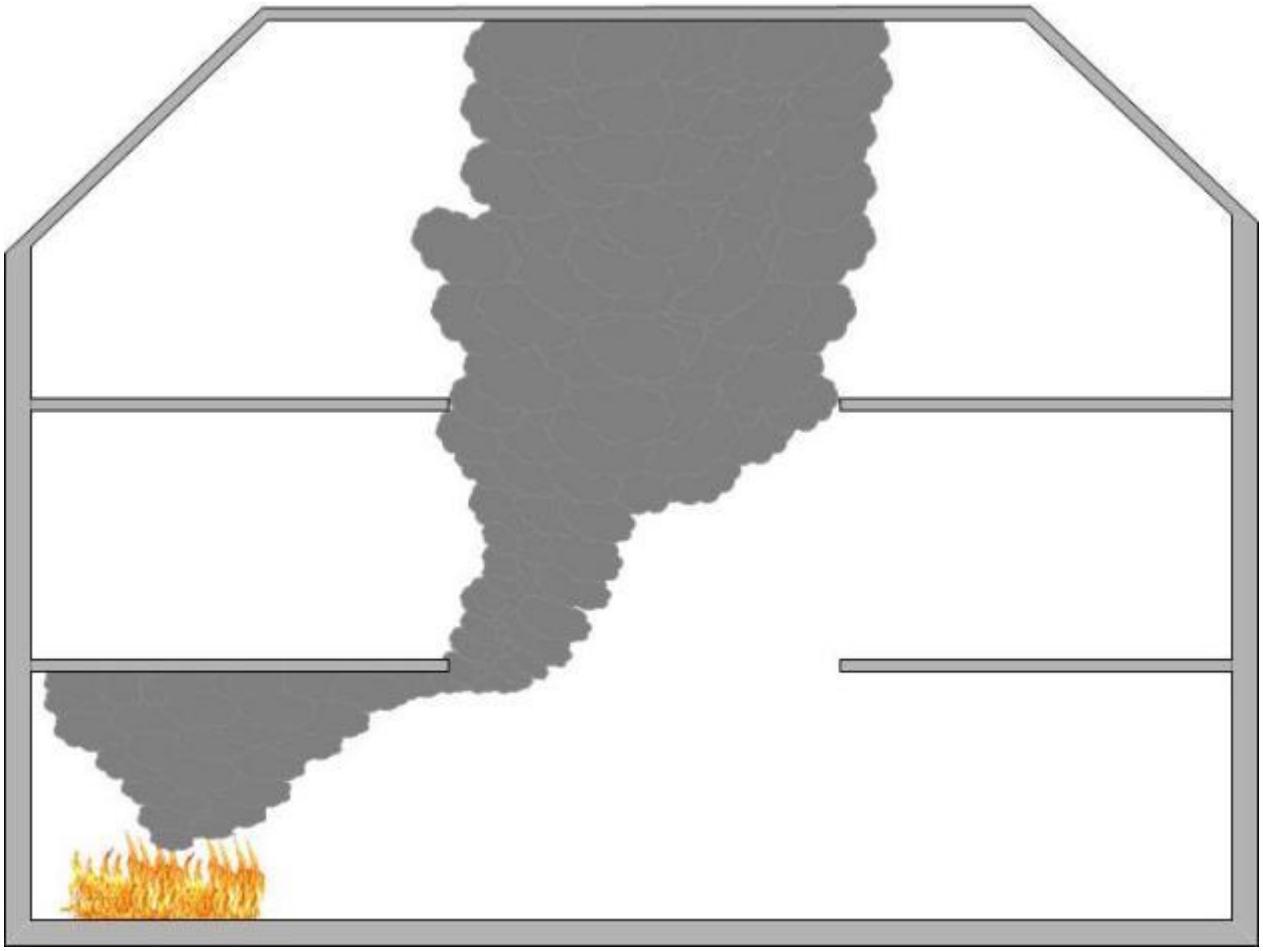


Figure 8: Heating, ventilation and air conditioning system in an atrium

Source: Building Research Establishment

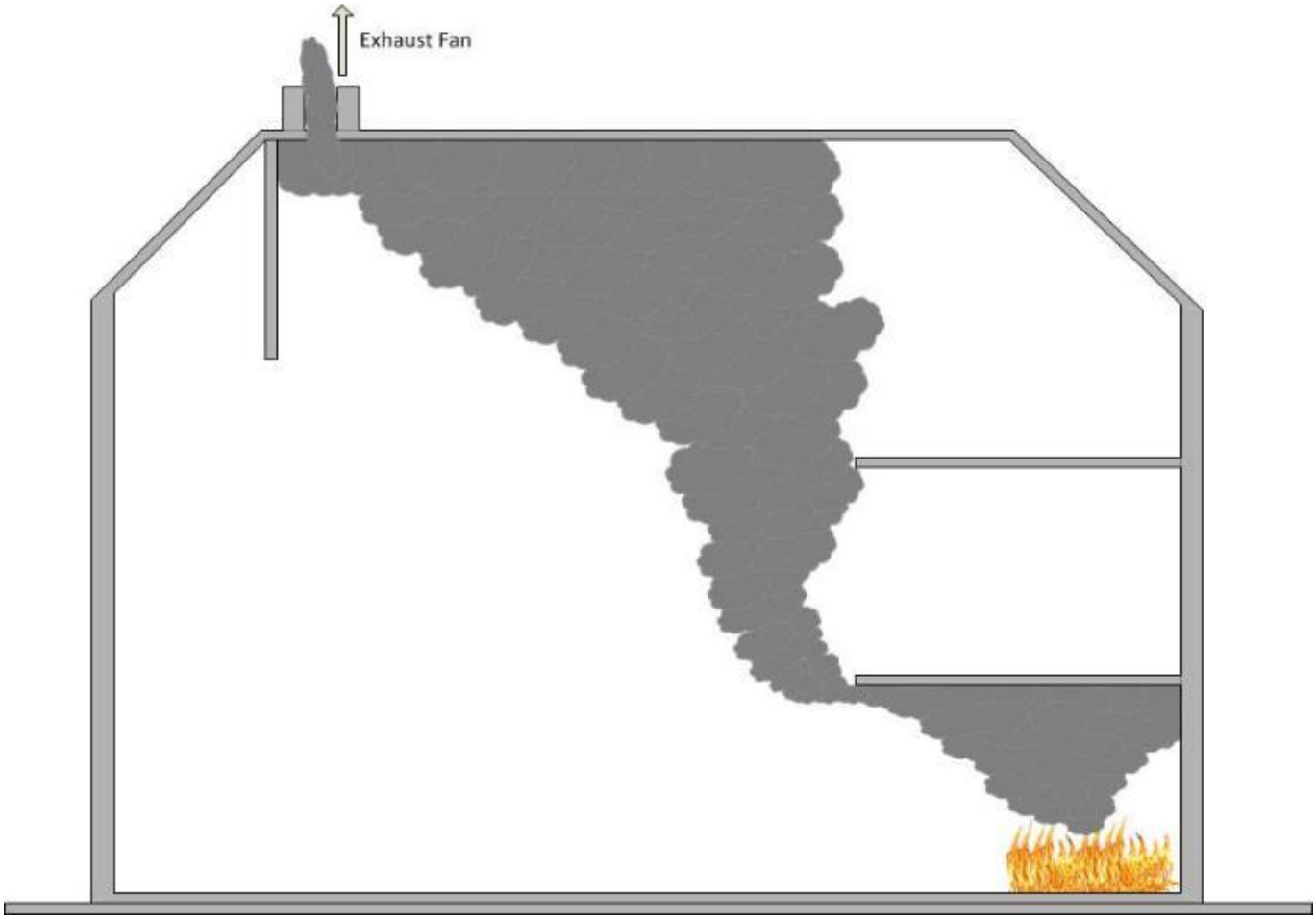


Figure 9: Heating, ventilation and air conditioning system

Source: Building Research Establishment

The success of any ventilation plan or strategy will to a greater degree depend on the techniques employed to effectively plan and manage:

- Where air will enter a building, structure, or location (inlet vent)
- Where hot gases and smoke will leave a building, structure, or location (outlet vent)
- The route that they will take (flow path)

Personnel should be aware that creating a vent in a previously under-ventilated area can increase the risk of creating a backdraught.

In broad terms, two techniques may be considered, which present both barriers and enablers to the ventilation process:

- Vertical (or top) ventilation: Making an opening at high level to take advantage of the natural characteristics of hot gases and smoke, for example, buoyancy, allowing them to escape
- Horizontal (or cross) ventilation: Making openings in external walls, using doors and windows

to aid the removal of hot fire gases and smoke

Both techniques can be employed using natural or forced methods of ventilation.

Locating the fire

Locating a fire is critical in formulating a robust, safe, and effective ventilation strategy. The following factors should be considered:

- The location of the fire may be evident on arrival, but it is possible that the fire has developed in hidden areas or not be visible at all. It is vital to identify any routes of potential fire development and any flow paths that may be created, considering the impact on firefighting operations and their potential to create or intensify undetected fire development.
- In the majority of incidents, ventilation should only be used when a fire has been located and the likely impact of ventilation has been assessed. If the seat of fire is difficult to locate, tactical ventilation can be used to clear adjacent rooms, corridors, or staircases to:
    - Help identify the seat of fire
    - Maintain safe access and egress routes to and from a hazard area
    - Reduce the potential of phenomena, such as fire gas ignition
- Monitoring systems, such as automatic fire detection systems or closed-circuit television (CCTV), can be used to identify the seat of fire
- Thermal scanning and thermal imaging equipment may help to identify the seat of the fire

Ventilation strategy

The ventilation strategy implemented at any fire will be affected by a range of factors but in broad terms, the strategy should initially be based around either one or a combination of the following:

- Offensive ventilation: Close to the fire to have a direct effect on the fire itself, to limit firespread and to make conditions safer for personnel
- Defensive ventilation: Away from the fire, or after the fire, to remove heat and smoke, particularly to improve access and escape routes and to control flow paths to areas of the building unaffected by the fire
- Control flow paths and anti-ventilation: Planned and co-ordinated confinement of fire gases and reduction of air flows into the fire, to prevent the fire and smoke from spreading, protecting access and egress, and limiting oxygen to reduce fire development

When planning and developing any ventilation strategy, it is vital that due consideration be given to the impact that any unplanned or poorly considered ventilation can have. The safety of personnel and people in the building is vital when forming a ventilation strategy. The impact and effects of ventilation and fire conditions should be constantly monitored and reassessed and, if appropriate, tactics should be adjusted.

The benefits and effects of any planned ventilation should be considered together with the:

- Location of the fire
- Location of people and protection of escape routes
- Access and egress of personnel
- Internal and external layout and design; including any fire-engineered solutions
- Likely fire dynamics and development
- Presence of natural ventilation, including local topography that may affect wind effects and pressure differentials
- Effect of heating, ventilation, and air conditioning (HVAC) systems incorporating smoke control, sprinklers, and design features, such as atriums and smoke curtains
- Impact of natural fire phenomena on fire development, for example Coandă, stack, trench or piston effects or wind-driven fire
- Potential for a dust explosion

Ventilation strategies should be reassessed continuously to ensure that safety is maintained and that any planned ventilation activities are supporting the overall incident plan, considering relevant factors including:

- Wind direction and strength
- Whether ventilation is appropriate and the correct ventilation tactics
- Whether personnel should be withdrawn while ventilation takes place
- Location of outlet vents, which should ideally be downwind and at a high level
- Whether external covering jets are in place
- Whether an inlet vent is created and kept clear, ideally as soon as possible following creation of the outlet vent
- The requirement to constantly monitor the effects of ventilation

Post-fire considerations

Consider:

- Using ventilation post-fire to assist in clearing any smoke and other airborne particles as part of the salvage activities
- Ensuring that bullseyes (hot spots) are identified and fully extinguished before the fire scene is handed over; turning over and damping down will assist in identifying such areas
- Advising the fire investigation officer or other agencies of any ventilation activities undertaken during firefighting operations, as this may have some relevance to the subsequent fire investigation in respect of fire development and post-fire indications; for more information refer to Operations – Preserve evidence for investigations

Strategic actions

Fire and rescue services should:

- Consider providing means of controlling ventilation at incidents
- Consider arrangements for providing forced ventilation at incidents
- Ensure any equipment provided for forced ventilation is maintained and used according to the instructions of the manufacturer

Tactical actions

Incident commanders should:

- Ensure covering jets are in place before creating exhaust vents
- Consider the effect of firefighting tactics and the flow path of smoke on access and egress
- Consider limiting ventilation to control fire development
- Develop, implement, and maintain a ventilation strategy
- Monitor the effects of the ventilation strategy and adjust if necessary
- Consider using tactical ventilation to improve conditions and maintain access and egress routes
- Ensure any fire and rescue service equipment deployed for forced ventilation is used appropriately
- Consider gas monitoring, including the levels of carbon monoxide, when using positive pressure ventilation

Control measure - Personal protective equipment (PPE): Fires and firefighting

Control measure knowledge

Personal protective equipment (PPE) for firefighting purposes is a key requirement for fire and rescue services. Services should provide PPE for firefighting that conforms to BS EN 469:2005 Protective clothing for firefighters — Performance requirements for protective clothing for firefighting.

Fire service personnel should be aware that in the event of flashover, structural firefighting PPE on its own is unlikely to provide adequate protection to the wearer.

Strategic actions

Fire and rescue services should:

- Ensure that the types of personal protective equipment (PPE) used comply with relevant standards and meet the requirements of their risk assessment for fires and firefighting

Tactical actions

Incident commanders should:

- Ensure that Firefighting PPE is worn in accordance with service risk assessment, procedures and training
- Consider the need for additional PPE where compatible with firefighting PPE (e.g. high visibility, eye protection)

Control measure - Respiratory protective equipment

Control measure knowledge

Respiratory protective equipment (RPE) is a type of personal protective equipment designed to protect the wearer from breathing in harmful substances, or from oxygen-deficient atmospheres, when other controls are either not possible or are insufficient on their own.

The use of RPE allows efficient, effective and safe working practices to be adopted at incidents of all sizes and type where an irrespirable atmosphere presents a hazard to personnel. There are two main types of RPE; respirators and breathing apparatus (BA).

Further information about the use of RPE can be found in the British Standards Institution (BSI) publication, ISO/TS 16975-1:2016 Respiratory protective devices – Selection, use and maintenance: Establishing and implementing a respiratory protective device programme.

Respirators

Respirators are filtering devices that remove contaminants from the air being breathed in; non-powered respirators rely on the wearer breathing to draw air through the filter. Respirators are not suitable for use in oxygen-deficient atmospheres.

Breathing apparatus

Breathing apparatus (BA) requires a supply of breathing-quality air from an independent source such as an air cylinder. Breathing apparatus (BA) enables firefighters to breathe safely in otherwise irrespirable atmospheres. The use of BA as a control measures is likely to be applied as part of the incident plan for any incident involving:

- Smoke and fire gases
- Working in confined spaces
- Hazardous materials including:
    - Asphyxiants
    - Dusts
    - Toxic, flammable or explosive substances

Airlines

Airline equipment supplies air to the wearer from a cylinder that is located remotely from them. The technical procedures for the specific airline equipment in use should be followed. Airline equipment should only be used by trained and competent personnel. It be appropriately used and maintained, to avoid the air supply to BA wearers being compromised.

Following an appropriate risk assessment, it may be decided to use airline equipment to provide breathing apparatus capability. Its use may be appropriate:

- If an extended air supply to self-contained BA wearers is required
- If use of self-contained BA is unsuitable
- At incidents in the open, where airlines are used to provide a breathable atmosphere without the weight of a self-contained BA set
- For specialist operations that involve restricted access

Although the use of airline equipment reduces the overall weight carried by a BA wearer and can provide a limitless supply of air, the physiological limitations of the BA wearer should be considered when airline equipment is used.

Face mask fit testing

If RPE is used, it must be able to provide adequate protection for individual wearers; RPE cannot protect the wearer if it leaks.

Face mask fit testing is a method of checking that a tight-fitting face piece matches the wearer's facial features and seals adequately to their face. A face mask fit test should be carried out as part of the initial selection of the RPE and it is good practice to ensure testing is repeated on a regular basis. Further detail on face mask fit testing is provided in the Breathing apparatus foundation material.

Further information is contained in the Health and Safety Executive's publications:

- Respiratory protective equipment at work: A practical guide (HSG53)
- Guidance on respiratory protective equipment (RPE) fit testing (INDG479)

Maintenance

Maintenance is a requirement for all RPE, except for disposable (single use) RPE, and should be carried out by properly trained personnel. Thorough maintenance, examination and tests should be carried out at regular intervals in accordance with the manufacturer's instructions.

Breathing apparatus foundation material

The breathing apparatus foundation material provides the procedures underpinning the planning, use, and command and control of BA. It should also assist fire and rescue services with:

- Developing safe systems of work when deploying BA
- Managing BA operations
- Testing and maintenance of BA equipment
- Defining roles and responsibilities for BA
- Developing BA training
- Readiness of BA wearers
- Pre-planning for intraoperability and interoperability

For more information refer to The Foundation for breathing apparatus.

Strategic actions

Fire and rescue services must:

- Provide personnel with suitable and appropriate RPE that fits and protects the wearer
- Ensure that personal RPE worn simultaneously is compatible and does not negatively impact other safety measures

Fire and rescue services should:

- Specify the type of RPE required for hazards identified through risk assessments and communicate this information to personnel
- Have suitable arrangements for the provision, testing and maintenance of respiratory protective equipment
- Ensure personnel regularly undertake face mask fit testing of RPE

Tactical actions

Incident commanders should:

- Carry out a risk assessment before deploying personnel wearing RPE
- Ensure personnel wear the appropriate type of RPE
- Consider the use of airline equipment

Hazard - Smoke and fire gases

Hazard Knowledge

Smoke is generally a mixture of fine solid particles, droplets of water and other liquids, and gases given off by the materials involved in the fire. The most important toxic product in any fire is carbon monoxide, which is produced by all organic materials when they burn. However, tests have shown that a 'cocktail' of nearly a hundred gases can be detected by specialised equipment. In addition to producing smoke, fire can reduce oxygen levels, either by consuming the oxygen or by displacing it with other gases. Heat is also a respiratory hazard, as superheated gases burn the respiratory tract.

Smoke is made of:

- Particles: unburned, partially burned, and completely burned substances
- Vapours: fog-like droplets of liquid that can poison if inhaled or absorbed through the skin, such as benzene, formaldehyde and other volatile organic compounds
- Toxic gases: carbon monoxide (CO) can be deadly, even in small quantities. Hydrogen cyanide results from burning plastics and interferes with cellular respiration

Regulation 7(5) of the Control of Substances Hazardous to Health Regulations (COSHH) sets out clear requirements for the control of carcinogenic and mutagenic substances, including a requirement that exposure be reduced to as low as is reasonably practicable.

Working in smoke and darkness reduces visibility and the effectiveness of other sensory perceptions, making navigation difficult even in relatively simple environments. When committed to a building there is a strong possibility that firefighters will encounter conditions limiting visibility and affecting their key human senses. For example, when deployed to locate a fire internally in a structure, firefighters wearing breathing apparatus (BA) will often rely on touch and hearing as their primary senses; their sense of smell will be lost and their visual sense impaired when working in smoke and darkness.

Smoke, steam and fire gases can increase the distance electricity can jump and may result in arcing between sources, affecting firefighter safety.

See National Operational Guidance: Utilities and fuel

Control measure - Avoid smoke plumes

Control measure knowledge

Where possible, contact with smoke plumes should be avoided by selecting upwind approach routes and adopting defensive firefighting techniques. Avoiding contact with smoke and fire gases will reduce the need for respiratory protective equipment (RPE) and post-incident decontamination.

See National Operational Guidance: Environmental Protection - Smoke plumes

Strategic actions

Fire and rescue services should:

- Ensure that all crews are aware of the risk to health presented by working in smoke and fire gases

Tactical actions

Incident commanders should:

- Adopt an upwind approach to smoke plumes and fire gases, and to avoid where possible
- Consider the effects of wind and ventilation on smoke and fire gases when positioning firefighting personnel
- Advise relevant agencies if a smoke plume presents a risk to the safety of the public
- Consider the impact of smoke plume on downwind life risk, road users and other transport networks
- Obtain advice from the hazardous materials adviser (HMA) on the size of any downwind protection zone

Control measure - Tactical ventilation

Control measure knowledge

Ventilation is one factor that will need to be considered as part of the overall incident plan. When planned and performed correctly, ventilation can save lives, improve firefighting conditions, and

reduce damage to property.

Ventilation can be defined as:

'The removal of heated air, smoke or other airborne contaminants from a structure or other location and their replacement with a supply of cooler, cleaner air'

Ventilation is something that will occur naturally as part of the fire development and decay process. It will have an impact on the development of a fire before and after the-arrival of the fire and rescue service. However, ventilation is also a tool that should be considered as part of any overall firefighting strategy.

Ventilation can be performed after the fire has been extinguished or controlled, to clear residual smoke and heat from buildings or structures.

The benefits of controlled and co-ordinated tactical ventilation should be balanced against the hazards associated with accelerated fire growth and the introduction of oxygen into under-ventilated fires in buildings.

If applied and managed correctly, tactical ventilation can provide beneficial effects to any firefighting strategy by:

- Replenishing oxygen and reducing carbon monoxide levels
- Controlling temperature and humidity
- Removing moisture, dust, and other airborne contaminants
- Improving visibility and aiding navigation

Tactical ventilation is a planned intervention that requires co-ordination and control, to open up buildings and structures to release the products of combustion and can be defined as:

'The planned and systematic removal of heat and smoke from the structure on fire and their replacement with a supply of fresher air to allow other firefighting priorities.'

As part of an overall firefighting strategy, incident commanders should always have a clear and informed objective before commencing any form of ventilation activity. This will ensure that the full range of benefits of ventilating can be realised including:

- Improving conditions for the survivability of people in the building
- Improving conditions for personnel to enter and search for or rescue people
- Reducing the potential for rapid fire development, including flashover, backdraught, or fire gas ignition
- Restricting fire and smoke damage to property

In broad terms ventilation can be separated into two types:

Natural ventilation – This is the process of supplying and removing air through a structure or space without using mechanical systems. In firefighting terms, this refers to managing the flow of air (flow path) into and out of a structure or location, using the prevailing atmospheric conditions, such as wind strength, speed, and direction, via structural openings, such as windows, doors, and vents, to clear any smoke or hot fire gases.

Forced ventilation – This is the process of using fans, blowers or other mechanical means or devices to assist in creating, redirecting, and managing the air flow (flow path) into and out of a structure or location, so that heat, smoke and fire gases are forced out.

In both instances, additional factors related to climatic and atmospheric conditions, such as temperature and pressure, will have an impact on the relative success of any ventilation activity.

Type of forced ventilation	Considerations
Positive pressure ventilation (PPV)	This is achieved by forcing air into a building using a fan. Using the fan will increase the pressure inside the building relative to atmospheric pressure. The most appropriate tactic for PPV will depend on whether the inlet vent is also being used for access and egress. If the fan has to be placed further back because of operations at the entrance to a building, the fan may be less effective. The effectiveness of PPV will depend on a range of factors, including the: • Wind direction and strength • Size, type, and number of fans • Proportion of the fan's air that enters the building (fan performance) • Relative sizes of inlet and outlet vents • Size of the room to be cleared • Temperature of the fire gases or smoke in the building Personnel should always be aware of the potential risk of increasing the level of carbon monoxide (CO) in other areas of a building when ventilating, either when directing or forcing fire gases through a building or, in particular, if using petrol-driven PPV fans. Personnel should ensure that fans are positioned to prevent any build-up of CO. Consideration should be given to monitoring the levels of carbon monoxide.

Negative pressure ventilation (NPV)	NPV refers to extracting the hot air and gases from the outlet vent. This will reduce the pressure inside the building relative to atmospheric pressure. This can be achieved by using fans or water sprays.
Heating, ventilation and air conditioning (HVAC) and fire-engineered systems	HVAC systems are often engineered into buildings so that, in the event of a fire, they can be operated to ventilate public areas and support safe evacuation, as well as improve conditions for personnel. These systems are normally automatic but can also be operated by a manual override.
Powered smoke and heat exhaust systems	These systems are generally operated automatically and are likely to be operating before the arrival of the fire and rescue service. They can also be operated manually but this will need careful consideration by incident commanders as part of the firefighting and ventilation tactical strategy.

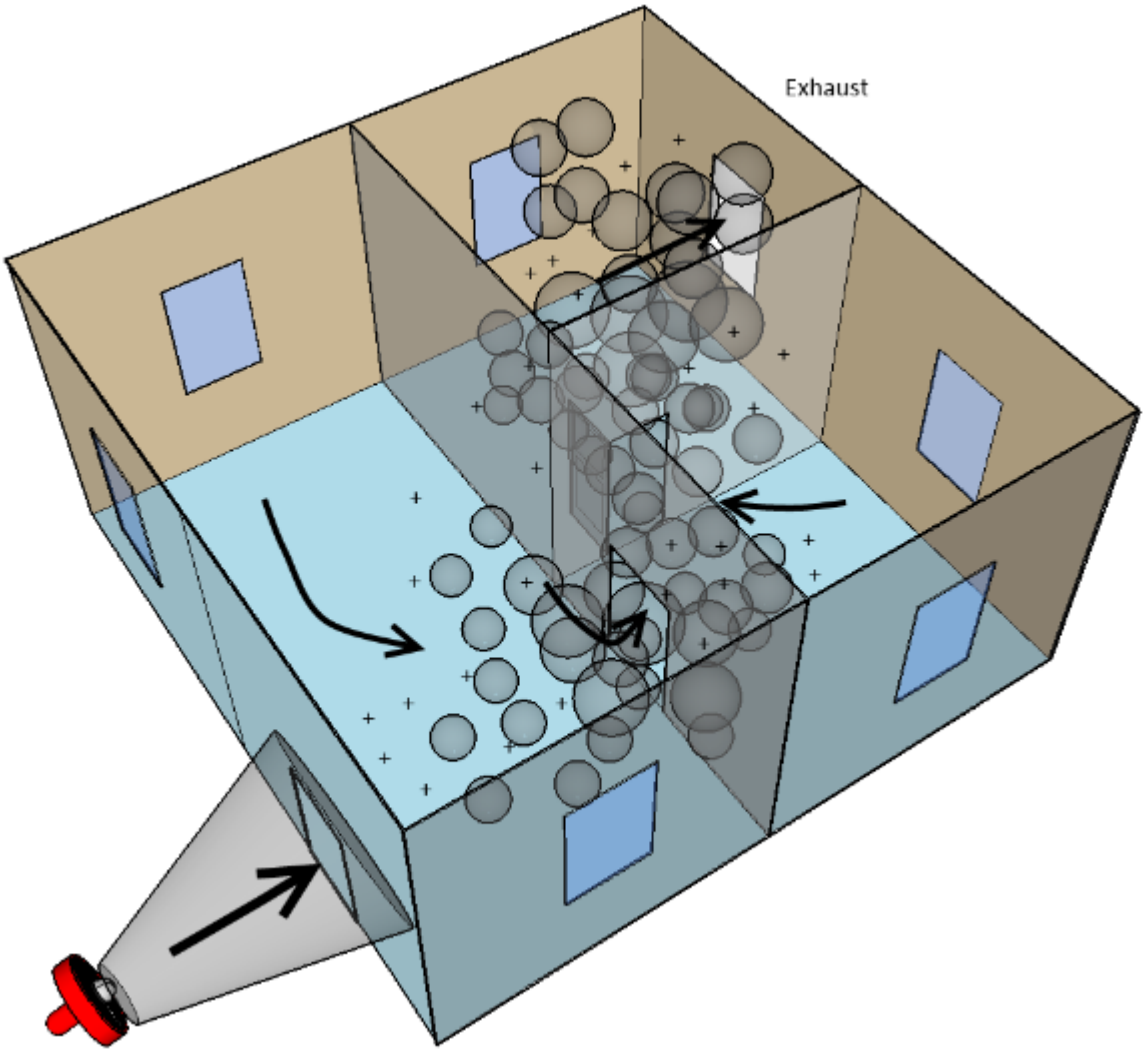


Figure 7: Positive pressure ventilation

Source: Building Research Establishment

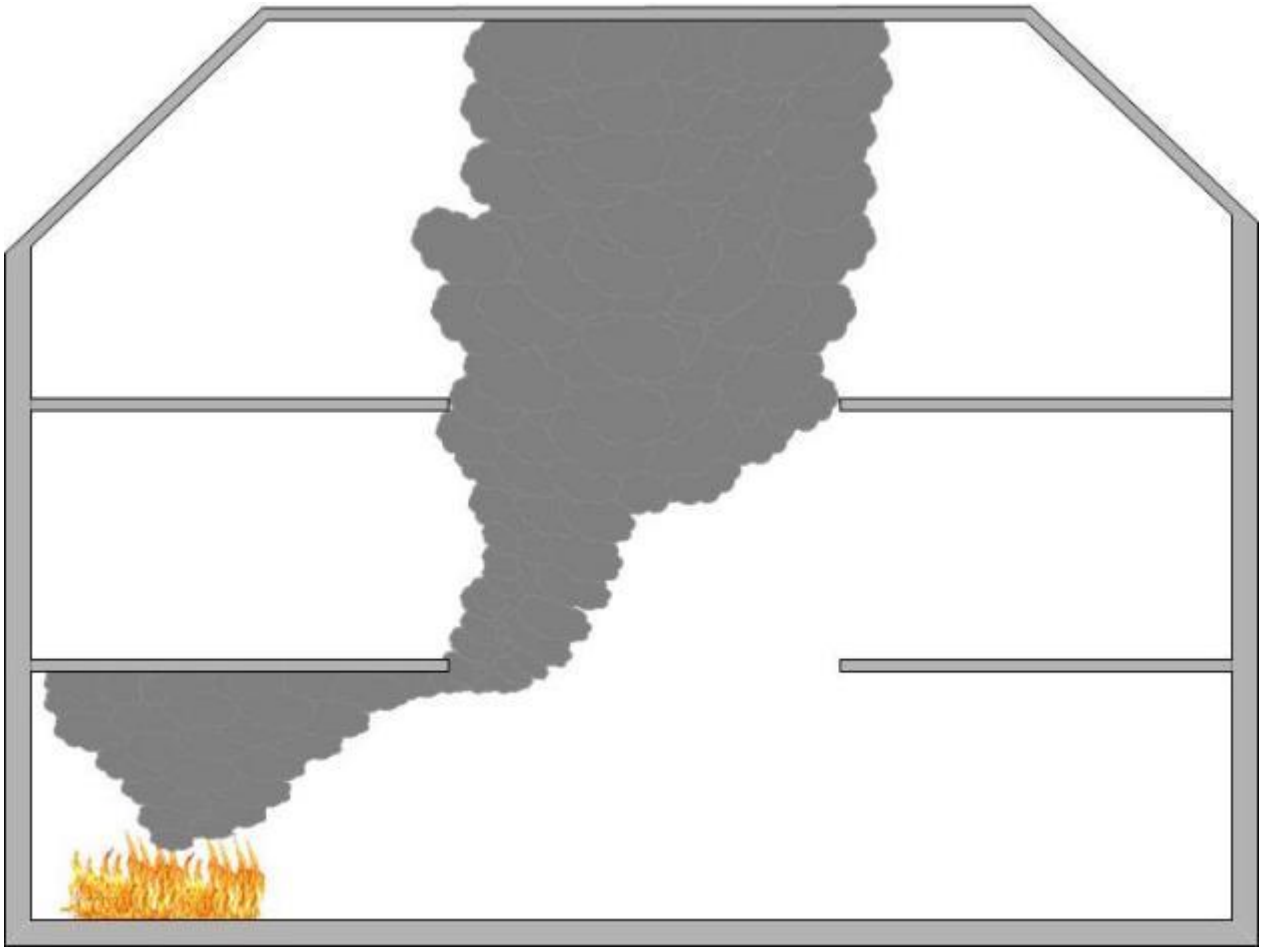


Figure 8: Heating, ventilation and air conditioning system in an atrium

Source: Building Research Establishment

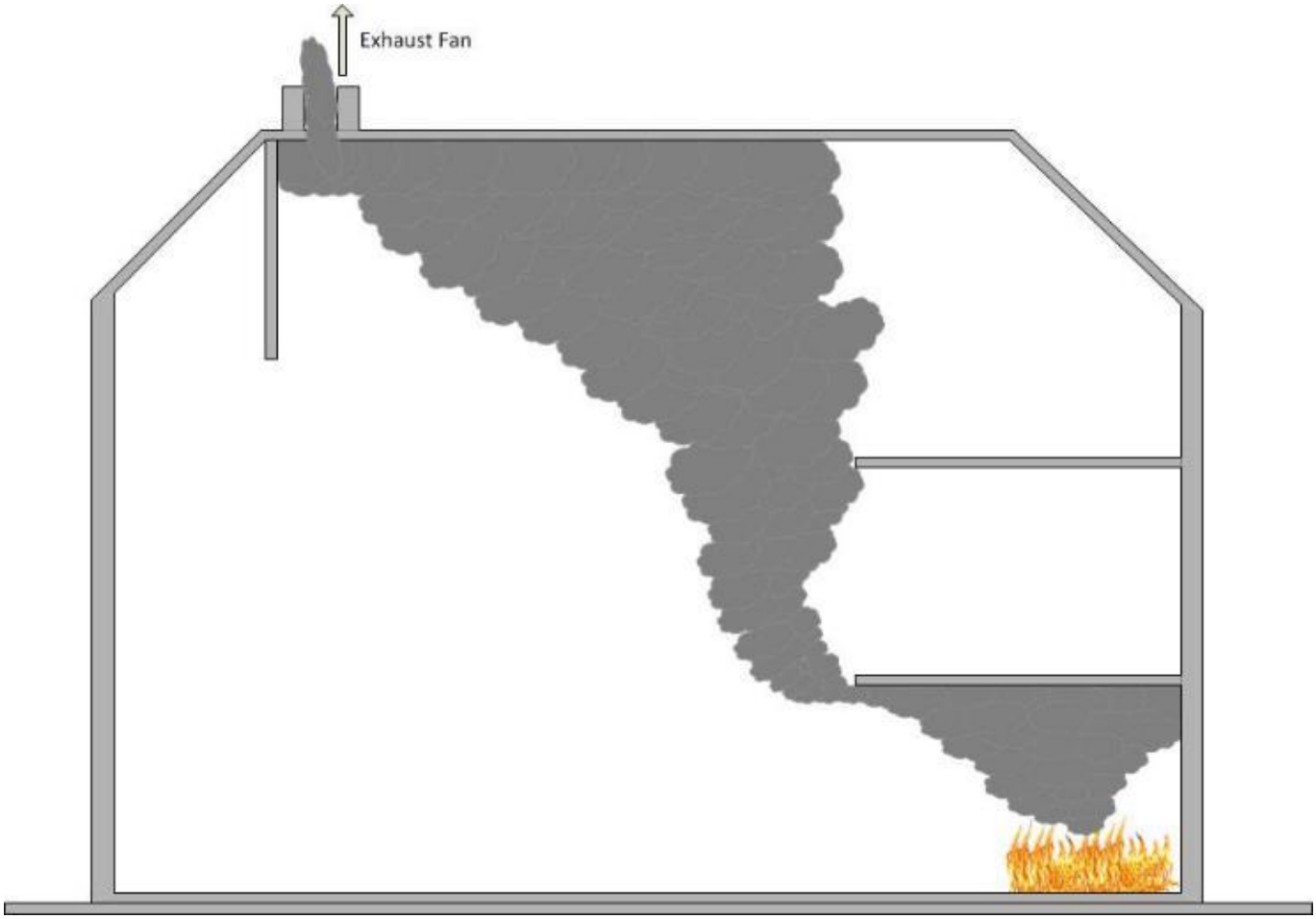


Figure 9: Heating, ventilation and air conditioning system

Source: Building Research Establishment

The success of any ventilation plan or strategy will to a greater degree depend on the techniques employed to effectively plan and manage:

- Where air will enter a building, structure, or location (inlet vent)
- Where hot gases and smoke will leave a building, structure, or location (outlet vent)
- The route that they will take (flow path)

Personnel should be aware that creating a vent in a previously under-ventilated area can increase the risk of creating a backdraught.

In broad terms, two techniques may be considered, which present both barriers and enablers to the ventilation process:

- Vertical (or top) ventilation: Making an opening at high level to take advantage of the natural characteristics of hot gases and smoke, for example, buoyancy, allowing them to escape
- Horizontal (or cross) ventilation: Making openings in external walls, using doors and windows

to aid the removal of hot fire gases and smoke

Both techniques can be employed using natural or forced methods of ventilation.

Locating the fire

Locating a fire is critical in formulating a robust, safe, and effective ventilation strategy. The following factors should be considered:

- The location of the fire may be evident on arrival, but it is possible that the fire has developed in hidden areas or not be visible at all. It is vital to identify any routes of potential fire development and any flow paths that may be created, considering the impact on firefighting operations and their potential to create or intensify undetected fire development.
- In the majority of incidents, ventilation should only be used when a fire has been located and the likely impact of ventilation has been assessed. If the seat of fire is difficult to locate, tactical ventilation can be used to clear adjacent rooms, corridors, or staircases to:
    - Help identify the seat of fire
    - Maintain safe access and egress routes to and from a hazard area
    - Reduce the potential of phenomena, such as fire gas ignition
- Monitoring systems, such as automatic fire detection systems or closed-circuit television (CCTV), can be used to identify the seat of fire
- Thermal scanning and thermal imaging equipment may help to identify the seat of the fire

Ventilation strategy

The ventilation strategy implemented at any fire will be affected by a range of factors but in broad terms, the strategy should initially be based around either one or a combination of the following:

- Offensive ventilation: Close to the fire to have a direct effect on the fire itself, to limit firespread and to make conditions safer for personnel
- Defensive ventilation: Away from the fire, or after the fire, to remove heat and smoke, particularly to improve access and escape routes and to control flow paths to areas of the building unaffected by the fire
- Control flow paths and anti-ventilation: Planned and co-ordinated confinement of fire gases and reduction of air flows into the fire, to prevent the fire and smoke from spreading, protecting access and egress, and limiting oxygen to reduce fire development

When planning and developing any ventilation strategy, it is vital that due consideration be given to the impact that any unplanned or poorly considered ventilation can have. The safety of personnel and people in the building is vital when forming a ventilation strategy. The impact and effects of ventilation and fire conditions should be constantly monitored and reassessed and, if appropriate, tactics should be adjusted.

The benefits and effects of any planned ventilation should be considered together with the:

- Location of the fire
- Location of people and protection of escape routes
- Access and egress of personnel
- Internal and external layout and design; including any fire-engineered solutions
- Likely fire dynamics and development
- Presence of natural ventilation, including local topography that may affect wind effects and pressure differentials
- Effect of heating, ventilation, and air conditioning (HVAC) systems incorporating smoke control, sprinklers, and design features, such as atriums and smoke curtains
- Impact of natural fire phenomena on fire development, for example Coandă, stack, trench or piston effects or wind-driven fire
- Potential for a dust explosion

Ventilation strategies should be reassessed continuously to ensure that safety is maintained and that any planned ventilation activities are supporting the overall incident plan, considering relevant factors including:

- Wind direction and strength
- Whether ventilation is appropriate and the correct ventilation tactics
- Whether personnel should be withdrawn while ventilation takes place
- Location of outlet vents, which should ideally be downwind and at a high level
- Whether external covering jets are in place
- Whether an inlet vent is created and kept clear, ideally as soon as possible following creation of the outlet vent
- The requirement to constantly monitor the effects of ventilation

Post-fire considerations

Consider:

- Using ventilation post-fire to assist in clearing any smoke and other airborne particles as part of the salvage activities
- Ensuring that bullseyes (hot spots) are identified and fully extinguished before the fire scene is handed over; turning over and damping down will assist in identifying such areas
- Advising the fire investigation officer or other agencies of any ventilation activities undertaken during firefighting operations, as this may have some relevance to the subsequent fire investigation in respect of fire development and post-fire indications; for more information refer to Operations – Preserve evidence for investigations

Strategic actions

Fire and rescue services should:

- Consider providing means of controlling ventilation at incidents
- Consider arrangements for providing forced ventilation at incidents
- Ensure any equipment provided for forced ventilation is maintained and used according to the instructions of the manufacturer

Tactical actions

Incident commanders should:

- Ensure covering jets are in place before creating exhaust vents
- Consider the effect of firefighting tactics and the flow path of smoke on access and egress
- Consider limiting ventilation to control fire development
- Develop, implement, and maintain a ventilation strategy
- Monitor the effects of the ventilation strategy and adjust if necessary
- Consider using tactical ventilation to improve conditions and maintain access and egress routes
- Ensure any fire and rescue service equipment deployed for forced ventilation is used appropriately
- Consider gas monitoring, including the levels of carbon monoxide, when using positive pressure ventilation

Control measure - Personal protective equipment (PPE): Fires and firefighting

Control measure knowledge

Personal protective equipment (PPE) for firefighting purposes is a key requirement for fire and rescue services. Services should provide PPE for firefighting that conforms to BS EN 469:2005 Protective clothing for firefighters — Performance requirements for protective clothing for firefighting.

Fire service personnel should be aware that in the event of flashover, structural firefighting PPE on its own is unlikely to provide adequate protection to the wearer.

Strategic actions

Fire and rescue services should:

- Ensure that the types of personal protective equipment (PPE) used comply with relevant standards and meet the requirements of their risk assessment for fires and firefighting

Tactical actions

Incident commanders should:

- Ensure that Firefighting PPE is worn in accordance with service risk assessment, procedures and training
- Consider the need for additional PPE where compatible with firefighting PPE (e.g. high visibility, eye protection)

Control measure - Respiratory protective equipment

Control measure knowledge

Respiratory protective equipment (RPE) is a type of personal protective equipment designed to protect the wearer from breathing in harmful substances, or from oxygen-deficient atmospheres, when other controls are either not possible or are insufficient on their own.

The use of RPE allows efficient, effective and safe working practices to be adopted at incidents of all sizes and type where an irrespirable atmosphere presents a hazard to personnel. There are two main types of RPE; respirators and breathing apparatus (BA).

Further information about the use of RPE can be found in the British Standards Institution (BSI) publication, ISO/TS 16975-1:2016 Respiratory protective devices – Selection, use and maintenance: Establishing and implementing a respiratory protective device programme.

Respirators

Respirators are filtering devices that remove contaminants from the air being breathed in; non-powered respirators rely on the wearer breathing to draw air through the filter. Respirators are not suitable for use in oxygen-deficient atmospheres.

Breathing apparatus

Breathing apparatus (BA) requires a supply of breathing-quality air from an independent source such as an air cylinder. Breathing apparatus (BA) enables firefighters to breathe safely in otherwise irrespirable atmospheres. The use of BA as a control measures is likely to be applied as part of the incident plan for any incident involving:

- Smoke and fire gases
- Working in confined spaces
- Hazardous materials including:
    - Asphyxiants
    - Dusts
    - Toxic, flammable or explosive substances

Airlines

Airline equipment supplies air to the wearer from a cylinder that is located remotely from them. The technical procedures for the specific airline equipment in use should be followed. Airline equipment should only be used by trained and competent personnel. It be appropriately used and maintained, to avoid the air supply to BA wearers being compromised.

Following an appropriate risk assessment, it may be decided to use airline equipment to provide breathing apparatus capability. Its use may be appropriate:

- If an extended air supply to self-contained BA wearers is required
- If use of self-contained BA is unsuitable
- At incidents in the open, where airlines are used to provide a breathable atmosphere without the weight of a self-contained BA set
- For specialist operations that involve restricted access

Although the use of airline equipment reduces the overall weight carried by a BA wearer and can provide a limitless supply of air, the physiological limitations of the BA wearer should be considered when airline equipment is used.

Face mask fit testing

If RPE is used, it must be able to provide adequate protection for individual wearers; RPE cannot protect the wearer if it leaks.

Face mask fit testing is a method of checking that a tight-fitting face piece matches the wearer's facial features and seals adequately to their face. A face mask fit test should be carried out as part of the initial selection of the RPE and it is good practice to ensure testing is repeated on a regular basis. Further detail on face mask fit testing is provided in the Breathing apparatus foundation material.

Further information is contained in the Health and Safety Executive's publications:

- Respiratory protective equipment at work: A practical guide (HSG53)
- Guidance on respiratory protective equipment (RPE) fit testing (INDG479)

Maintenance

Maintenance is a requirement for all RPE, except for disposable (single use) RPE, and should be carried out by properly trained personnel. Thorough maintenance, examination and tests should be carried out at regular intervals in accordance with the manufacturer's instructions.

Breathing apparatus foundation material

The breathing apparatus foundation material provides the procedures underpinning the planning, use, and command and control of BA. It should also assist fire and rescue services with:

- Developing safe systems of work when deploying BA
- Managing BA operations
- Testing and maintenance of BA equipment
- Defining roles and responsibilities for BA
- Developing BA training
- Readiness of BA wearers
- Pre-planning for intraoperability and interoperability

For more information refer to The Foundation for breathing apparatus.

Strategic actions

Fire and rescue services must:

- Provide personnel with suitable and appropriate RPE that fits and protects the wearer
- Ensure that personal RPE worn simultaneously is compatible and does not negatively impact other safety measures

Fire and rescue services should:

- Specify the type of RPE required for hazards identified through risk assessments and communicate this information to personnel
- Have suitable arrangements for the provision, testing and maintenance of respiratory protective equipment
- Ensure personnel regularly undertake face mask fit testing of RPE

Tactical actions

Incident commanders should:

- Carry out a risk assessment before deploying personnel wearing RPE
- Ensure personnel wear the appropriate type of RPE
- Consider the use of airline equipment

Control measure - Employ safe navigation techniques

Control measure knowledge

The presence of smoke and fire gases will reduce visibility and the effectiveness of sensory perception, which will complicate the process of navigation even in relatively simple environments. Teams deployed in breathing apparatus (BA) should adopt procedures as trained and maintain close contact between personnel. (See Breathing Apparatus Foundation). In large or complex structures, additional measures may need to be implemented to ensure that fire crews can safely navigate to and from the scene of operations and maintain safe access and egress at all times.

Strategic actions

Fire and rescue services should:

- Ensure all crews are trained in safe navigation techniques to be used in smoke and darkness

Tactical actions

Incident commanders should:

- Brief crews committed into the hazard area on the safe navigation techniques to be adopted

Hazard - Fires involving flammables, explosives and combustible dusts

Hazard Knowledge

See National Operational Guidance:Hazardous materials Physical Hazards for incidents involving substances that are likely to present a physical hazard when involved in a fire situation.

Hazard - Military vessels

Hazard Knowledge

The construction of military vessels is unique and differs from any other commercial sea-going

vessel. This will be due to the extensive division of the vessel into small watertight compartments by transverse and longitudinal bulkheads with watertight hatches. This type of construction makes internal firefighting operations difficult due to restricted and enclosed spaces or compartments.

The issue of responsibility in firefighting on board military vessels is complex and a comprehensive understanding between Royal Navy (RN) and fire and rescue service personnel is essential; therefore, the JESIP will also apply to incidents involving military vessels.

The following information applies to Royal Navy vessels, submarines and vessels of the Royal Fleet Auxiliaries (RFA), in both ports and dockyards.

Responsibility

The responsibility for command and control of any firefighting operations aboard RN/RFA vessels varies according to the state of operational readiness of the vessel at the time of the incident.

Generally, the vessels will be:

- In commission with an operational crew on board, or
- In an unmanned refit state (afloat or in dry dock), not in commission, in the hands of contractors

When a RN/RFA vessel or a nuclear submarine is in commission the following procedure will apply:

- On arrival, the fire and rescue service incident commander will be met at HQ1 or the brow (usually marked by a red flag) and escorted directly to the vessel's officer responsible for safety
- Following consultation with the fire and rescue service incident commander, the vessel's officer responsible for safety (known as the officer of the day) will decide whether to ask the fire and rescue service to stand by or may alternatively ask the fire and rescue incident commander to undertake firefighting operations.

When a RN/RFA vessel or a nuclear submarine is NOT in commission the following procedure will apply:

- On arrival, the fire and rescue service incident commander will be met at HQ1 (which may be on the quayside) and liaise with the contracts manager who is responsible for vessel

Command and control of firefighting operations

If the vessel's officer responsible for safety decides that RN/RFA firefighting resources are sufficient to deal with the incident, the fire and rescue service in attendance should remain on standby. The senior fire officer should remain at HQ1 for liaison and consultation purposes until a fire and rescue service presence is no longer required.

If the vessel's officer decides that fire and rescue service assistance is required to extinguish the fire, the senior fire and rescue service officer will be asked to undertake firefighting operations. At that point, command and control of operations will be formally delegated to the senior fire and rescue service officer in attendance. Close and effective liaison with RN or RFA nominated representative should be maintained throughout the period of the incident.

Munitions

Military or RN vessels may have a quantity of small arms or larger munitions. Ascertaining the presence and locations of munition stores will be a priority for the incident commander. Incident commanders should also be aware of the potential for commercial shipping to be carrying small arms for defence purposes.

Control measure - Liaise with the officer of the day or contract manager

Control measure knowledge

Close liaison with the responsible person for the vessel and the permission to board or support firefighting activities will be key to any firefighting operations.

It is good practice to maintain a decision log for all incidents involving military vessels, which will assist with any post-incident debriefs and investigations.

Strategic actions

Fire and rescue services should:

- Make arrangement for suitable training on military vessel familiarisation, where there is an anticipated risk

Tactical actions

Incident commanders should:

- Liaise with the officer of the day or contract manager on military vessels

- Identify whether munitions are present, and/or involved, at fires involving military vessels
- Be prepared to take formal responsibility for firefighting actions if requested and delegated

Bibliography

Fire service manual volume 2 marine incidents HMFSI, Home Office, HMSO

Manual of Firemanship book 4 pt2 incidents involving Aircraft, Shipping and Railways 1990, HMSO

Firefighting in HM ships in ports

Further Reading

Formal Investigation Report: Herald of Free Enterprise

Report on the investigation of the grounding and flooding of the ro-ro ferry Commodore Clipper

Inland Seas Education Association - Stability Unit, Part 1: Introduction to Stability