From:	Wilson, Jon Mr (DIO SEE-EPS SG3)
To:	NorfolkVanguard@pins.gsi.gov.uk
Subject:	20190213-FAO - Ms Karen Ridge -Examining Authority Question - Aircraft crash Site - MOD Response
Date:	13 February 2019 15:34:17
Attachments:	Attachemnt A- Factual information regarding the crash of a Danish F-16 i....pdf Attachment B- Enclosure 2.pdf Attachment C- Enclosure 5.pdf Attachment D- Enclosure 12.pdf Attachment E- Env Health Rep F16 Norfolk.pdf Attachment F- Loose Minute- RDAF-F16-ACCIDENT-11DEC86.pdf

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Dear Ms Ridge,

The Norfolk Vanguard Offshore Wind Farm
Application for a Development Consent Order under Section 56 of the Planning Act 2008

Further to my letter of the 25th January 2019, I write to provide the response of the Ministry of Defence (MOD) to written question 17.8. This stated:

Relevant representation [RR-261] dated 16 September 2018 from Susannah Spain states that in 1996 there was an F16 plane crash that contaminated the cable run route selected by Vattenfall to the National Grid substation at Necton, referring to "MoD documentation" that the alleged contamination contains radioactive substances. Please comment, providing information available to you, in redacted form if necessary, that describes the incident and identifies the exact location of the crash and the actual or assumed position of all potentially contaminated substances and what action has been taken as a result.

The MOD can confirm the following in relation to this question:

The Nature of the Incident:

- Royal Danish Air Force (RDAF) F16 crashed near the village of Necton in Norfolk at 0954 on 11 Dec 1996.

Location of the crash:

- 52 degrees 39'29" N 00 degrees 47'83"E. Approximately 16 kilometres east of RAF Marham.

Actual or assumed position of all potentially contaminated substances:

- Impact crater 9x19m and 2-3m deep, with wreckage spread out over a 'fan-shaped' area of +/- 80 degrees, of approximately 700m.
- Direction of movement and subsequent 'fan' from impact was 089 degrees.
- Contaminated substances within this area:
    - Aircraft wreckage
    - 6000lb of fuel
    - Oil products
    - Burnt carbon composite fibres
    - 200 rounds of 20mm ball ammunition and 2 acquisition missiles
    - Hydrazine from the aircraft's Emergency Power Unit. The ruptured tank and a number of deposits were located within a 60m, 'down slope' area from the crater.

Actions taken:

- Aircraft wreckage recovery was conducted under RDAF primacy, whilst post-crash management (PCM) was conducted by the RAF in accordance with MOD procedures.
- Booms placed across the furthest corner of the field to prevent fuel being flushed into a nearby stream.
- All areas of fuel contamination were identified and plotted.
- Trenches 50cm deep were dug at 5m radius from the crash site, beaten down and lined with plastic sheeting, to accommodate remediation of contaminated soil removed from the crater.
- The crater, which had the highest levels of contamination, was reclaimed and contaminated top soil eventually removed, under licence, to licensed facilities.
- Hydrazine located and remediated, by dedicated RDAF team. Site declared free from hydrazine on 15 Dec 96.
- It was recommended by the RAF Institute of Health and Medical Training (IHMT) that crops contaminated with carbon fibre composite were dampened down and removed, before being disposed of as contaminated waste, to prevent it entering the food chain.
- It was also recommended that areas of light fuel contamination should be ploughed and harrowed to allow oxygenation and evaporation of hydrocarbon vapours.
- The RAF IHMT engaged with local Environment Agency (EA) personnel and the local authority Environmental Health Officer and carried out the environmental assessment of the site. Full details are contained in report: IHMT/5/97 dated February 1997 (attached).
- The local EA officer expressed the opinion that there was little risk to the adjacent aquifer or the nearby stream.
- The RAF IHMT recommended that a competent person, in consultation with Defence Land Agency , continue to assess the whole area for any further environmental impacts.

Attached are the relevant documents held by the MOD relating to this crash incident. Please do not hesitate to contact me should you wish to discuss this matter further.
Regards,

Jon Wilson

Senior Safeguarding Officer
Estates – Safeguarding

Defence Infrastructure Organisation

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Defence Infrastructure Organisation

Annex to Defence Command
Denmark File no: 2018/028377
Doc no: 1886742

DEFENCE COMMAND DENMARK AIR STAFF

Factual information regarding the crash of a Danish F-16 in December 1996 at Marham, Norfolk, UK.

The following facts are derived from the 1996 provisional report by the Danish MoD Commission on Accidents in Flight.

Coordinates of the crash site:

52°39'29''N 00°47'83''E Approximately 16 kilometers east of RAF Marham.

The impact created a crater approximately 9 x 19 meters and about 2 meters deep. The wreckage was spread over an area which consisted of a harvested field of mangolds, a field that had been ploughed in the autumn and a field sown with winter corn.

The accident spread carbon fiber, hydrazine, oil products and some 6,000 lbs of fuel. The concentration of hydrazine was neutralized using chlorine products.

The aircraft crashed into a field in an agricultural area. The aircraft's direction of movement at the moment of impact was 089 degrees. On impact with the ground the aircraft broke up and pieces of wreckage were spread over a fan-shaped area within an angle of +/- 80 degrees relative to the direction of movement and up to a distance of approximately 700 meters from the main impact point. The aircraft broke up into pieces with such force that only a few pieces of wreckage were longer than 50 centimeters.

2

STC/4511/1/8/FS 12 Dec 96

TO: STC DO

SUBJECT: DANISH AIR FORCE F16 ACCIDENT ON DEPARTURE FROM RAF MARHAM - 11 DEC 96

1. A Royal Danish Air Force (RDAF) F16B crashed near the village of Necton, some 9 nm east of RAF Marham, at 0954Z today, 6 minutes after take-off from RAF Marham en-route to Vaerlose. The crew of 2 both ejected successfully and the aircraft came down in open farmland with no civilian casualties or collateral damage to property.

2. The F16, based at Skydstrup, arrived at Marham on 6 Dec 96 planning for an over-night stay which was extended due to weather. The F16 was serviced by Danish groundcrew who were required once the aircrew turn-round became invalid, after 24 hrs. Signs of fire were reported,by ATC, to be coming from the aircraft on take-off and as the pilot de-selected reheat he had a fire caption illuminate at which point the crew ejected. Engine blades have been recovered from the RW.

3. Following ejection, the crew landed in trees remote from the ac final crash site. The crew were taken to Kings Lynn hospital, by SAR helicopters from RAF Wattisham. [redacted]

Redacted Sect 44

4. RAF Marham assumed PCM responsibility and, in addition to the immediate crash services, despatched an Incident Officer (OC Eng & Supply), who made a heli-borne inspection of the crash site, and personnel to secure the site. The ac crash site is compact and the ejection seats and cockpit canopy have been recovered, at some distance from the main area of impact. Crash site hazards are hydrazine, MMMF and 200 rounds of 20mm ball ammunition.

5. An ARO Redacted Sect 40- WO A was despatched from RAF St Athan, ETA 1700 hrs, and the AR&TF are alerted for wreckage recovery. RAF Coltishall, who have PCM responsibility for Norfolk, will assume PCM responsibilities at 1200 hrs on 12 Dec 96. **ARO and AR&TF are on site. The main wreckage is in a deep crater in boggy ground, with debris over about one square mile. The provisional estimate is that the site will need to be guarded for about 14 days. Due to overseas detachments, Coltishall cannot maintain its guarding commitment, 60 personnel, past Sunday 15 Dec. CMLO is attempting to arrange support from Marham, Neatishead and Honington in order to minimise disruption to personnel in the xmas period.**

6. OC RAF Marham Redacted Sect 40- Gp Capt G advised the base commander at Skydstrup of the accident and an F16 exchange pilot from RAF

Lakenheath is en-route to Marham to assume initial liaison. IFS advised the Danish Defence Attache and contacted the Danish FS authorities, who will form a national Safety Investigation Committee, IAW the appropriate STANAG 3531.

7. The 11 man team, under the chairmanship of a [redacted] Lt Col D, arrived at Marham by Hercules transport about 1800 hrs 11 Dec 96. The team has similar disciplines to an RAF board and includes a 5 man specialist wreckage site clearance team. The team are based at Marham and OC Ops Wg [redacted] reports them to be capable and enthusiastic, having established good working relationships. An air reconnaissance by Wessex of the crash site was conducted 12 Dec 96. Testing for hydrazine has been completed and carbon fibre contamination has been found to be present on the site.

8. The nation where the accident occurred may, with the concurrence of both nations, attach an officer to the operating nation's investigation committee as an official assistant or observer and OC STANEVAL RAF Marham [redacted] has, with the concurrence of AOC 1 Gp, assumed this role. An IFS BOI advisor [redacted] is available should he be required.

9. CPRO has actioned the PR aspects of the accident.

[redacted]

CFSO
ext 7638

of a Redacted Sect 40- Lt Col D The team is expected to arrive at Marham by Hercules transport about 1800 hrs today.

7. The nation where the accident occurred may, with the concurrence of both nations, attach an officer to the operating nation's investigation committee as an official assistant or observer. IFS Redacted Sect 40- Sqn Ldr L has recommended the appointment of Redacted Sect 40- Sqn Ldr M currently OC Jim at RAF Coltishall but until recently an IFS BOI Adviser. HQ 1 Gp have been advised of this requirement.

8. As an interim measure, Redacted Sct 40- Sqn Ldr J an IFS BOI Adviser, is available to assist OC Ops RAF Marham Redacted Sect 40- Wg Cdr H with preparation for the Investigation, should he require assistance, but IFS would not wish him to become the observer to the Investigation.

9. CPRO has actioned the PR aspects of the accident.

Redacted Sect 40- Wg Cdr K

CFSO
ext 7633

Redacted Sect 40

DISCLOSURE 5

STC/4511/1/8/FS

PSO to AOCinC
PSO to COS
SO to SASO
SO to AO Eng & Supply
PSO to AOC 1 Gp
Air Cdre Ops
Gp Capt Supt & Trg
Gp Capt Air Ops

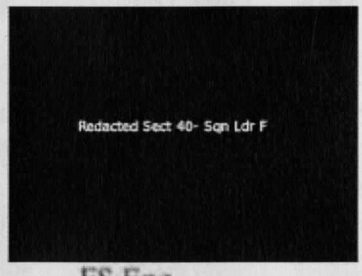
20 Dec 96

UPDATE ON DANISH AIR FORCE F16 ACCIDENT - 11 DEC 96

1. The Danish Board of Inquiry has now completed its preliminary report of the factual events of the accident. However, it is in Danish and a translation will not be available for several days.

2. The Danish and RAF wreckage recovery teams are still working to clear the site, they have already removed most of the wreckage from the area surrounding the primary impact point, but now have a painstaking task to clear the remaining debris from what is a large crater. Work is expected to continue till the end of the first week in the new year. The wreckage will be recovered to Denmark for thorough investigation.

3. By Saturday, 21 Dec, the RAF guard force will be reduced to a total of 16 personnel of all ranks due to the reduced spread of the wreckage. RAF Coltishall continue with the lead on Post Crash Management, but are being supported by RAF Marham, RAF Honington, RAF Cottesmore, RAF Coningsby and RAF Wittering who will all provide personnel over the Christmas period.



FS Eng
Ext 6360

Redacted Sect 40

ROYAL AIR FORCE
St Athan Barry Vale of Glamorgan CF62 4WA
A Unit of the RAF Maintenance Group Defence Agency
Telephone PSTN Direct Dial-In 01446 7901446 798116
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See Distribution

file ref: 140/7

Please reply to The Officer Commanding
Your reference

Our reference
SA/7932/Eng

Redacted Sect 40

24 January 1997

10 Feb 97

REPORT ON THE RECOVERY OF AN RDAF F-16 TRAINER ET 205 FROM MONA FARM, NECTON, SWAFFHAM, NORFOLK.

1. Enclosed is the report appertaining to the recovery of ET205 which crashed at Mona Farm, Necton, Norfolk on 11 Dec 96.

2. Recommendations are made for considerations of AMM2 and EIFS(RAF).

F10/2

Redacted Sect 40

Copy to
OC Sp Wg
OC ETW
OC Admin Wg
Original on F16 - Flight Safety

Redacted Section 40- WO A

for Officer Commanding

Enclosure

1. Report on the Recovery of F16 Falcon Trainer ET205

Distribution:

External:

Action:

HQLC Brampton (AMM2)
EIFS(RAF) - Rm 16 RAF Bently Priory

Information:

RAF Marham

Internal:

Action:

Information:

OC AESW
OC ASTS (on file)

SA/7932/Eng

REPORT ON THE RECOVERY OF AN RDAF F-16 TRAINER ET- 205 FROM MONA FARM, NECTON, SWAFFHAM, NORFOLK.

INTRODUCTION

1. On the morning of the 11 Dec the crew of a Royal Danish Air Force (RDAF) F-16 , ET 205, a student pilot and instructor, briefed for a return sortie from RAF Marham to their base in Denmark. After a routine start-up under the guidance of their own groundcrew, ET 205 took off at 0948 hrs. ATC reported to the crew that sparks were visible from the reheat flame as the aircraft rolled along the runway. After getting airborne the crew looked to the rear of their aircraft and saw flames reaching forward of the tailplane. The instructor pilot in the rear seat initiated command ejection, and the crew ejected successfully and came down safely in woods, just south of Narborough, some 2nm NE of RAF Marham. The aircraft continued on a random trajectory, climbing to 1200 ft, before descending and crashing on open farm land near the village of Necton, 10 nm E of RAF Marham.

RESPONSE

2. The Duty Aircraft Officer (ARO) was alerted by EIFS(RAF) at 1100 hrs and tasked to proceed to the crash scene and assist the RDAF investigators. The ARO and Site Co-ordinator left at 1200 hrs and on route made contact with both the Defence Land Agent (DLA) and the RAF Institute of Health and Medical Training (IHMT). Arriving during darkness at 1730 hrs, the ARO met and was fully briefed by the appointed Incident Commander (IC), OC Eng of RAF Marham. From this brief, it was quickly established that apart from the health and safety implications of hydrazine, aviation fuel and carbon composite fibres deposits, it should be a relatively straight forward recovery operation. The ARO then visited RAF Marham were he was introduced and briefed by OC Ops Wing, OC Eng HQ Flt, OC AEF and the RDAF Aircraft Investigators (AI). Having ascertained what had been said at both briefs, the ARO then informed AR&TF Control to the F16 recovery manpower and equipment requirements.

SITUATION/TOPOGRAPHY

3. Aircraft. The aircraft crashed on agricultural land owned by Redacted Sect 40 Civ B of Mona Farm. On impact, it produced a 3m deep crater and spread aircraft wreckage and aviation fuel over a wide area of what can only be described as a deeply harrowed and recently harvested sugar beet field. The crash site was also contaminated with hydrazine from the Emergency Power Unit (EPU) and burnt carbon composite fibres. The aircraft's ejection seats and canopy were located some 8 miles away in another recently ploughed field, with the parachutes being found close by, but stuck high up in 40ft trees.

CRASH SITE

4. The main wreckage area itself was gently sloping ground of some 100 acres and contained within its boundaries was a bush type copse, two small ponds and a field drainage river. A dirt track ran along three sides of the site and the Necton to Ivy Todd public road on the other. A safe and sensible cordon had been placed around the complete perimeter of the site which allowed uninterrupted use of the aforementioned road.

RECOVERY TEAM DEPLOYMENT

5. A recovery team of 9 including a qualified LSS wreckage plotter left St Athan, as directed through AR&TF Control by the ARO, at 1100 hrs on 12 Dec 96. They reported to the site at 0730 hrs on 13 Dec 96 and were tasked to set up the AR&TF control, support and accommodation facilities. By 1200 hrs on 13 Dec 96 the team were in position to respond to requests by the RDAF AI.

COMMAND AND CONTROL

6. In support of the F16 crash, RDAF had deployed a small party of personnel, which included a Board of Inquiry (BOI) president, aircraft investigators, hydrazine safety experts and a armament specialist. It was obvious by their limited number that this recovery would need AR&TF support in full. Therefore, after consultation with both EIFS and Danish BOI president, it was amicably agreed that the recovery of the F16 would be carried out under RDAF primacy, but iaw RAF Post Crash Management (PCM) procedures as contained in the AP100V-10.

7. The IC and the guard force were generated from RAF Marham; the nearest Unit to the crash site. They took control of the site from the onset and fully implemented the procedures and directives as laid down in the AP100V-10. This guarding commitment was later taken over by RAF Coltishall who maintained the excellent site control set by RAF Marham.

SURVEY AND RECOVERY

8. On the evening of 11 dec 96, Redacted Sect 40- Maj C OC AEF, RAF Marham, ARO and the RDAF armament specialist visited the site were the deployed ejection seats and canopy came to rest. Under a Redacted Sect 40- Maj C request the outline of the seats and canopy was painted on ground in order that their positions might be plotted in daylight on the next day. The seats were then disarmed and along with canopy were transported for safe keeping to RAF Marham. The parachutes and associated survival packs were retrieved from their lofty heights, again during daylight some 36 hrs later.

9. The initial survey of the main crash site was carried out on 12 Dec 96 by Redacted Sect 40- Lt Col D (BOI president), Redacted Sect 40- Maj C and the two RDAF hydrazine safety experts. They quickly located the aircraft's hydrazine tank, which had split open leaving several deposits within a 60 metre area down-slope from the crater. This area was deemed the inner cordon and only RDAF personnel were permitted to enter whilst the hydrazine threat was being alleviated by their specialist team. This lasted 3 days. During this time the RAF IHMT was advising the ARO on all health and safety measures to be employed, consulting with the local environmental agencies and carrying out an environmental assessment of the site. At the RDAF request a wreckage plot was commenced on the afternoon of 13 Dec 96. And, at the same time areas on the periphery of the outer cordon were being searched to ensure no parts had fallen from the aircraft prior to impact. The Defence Land Agent (DLA) arrived and began to contact the respective landowners. The Danish AI team, led by Redacted Sect 40- Maj C started to identify and remove vital parts of the wreckage from the inner cordon. At the request BOI president, AR&TF personnel found, plotted and removed the aircraft's engine and jet pipe which had landed in many different locations outside of the inner cordon. There were very few executive visits, if any, made to the main crash site or to the respective landowner during this early period of the recovery.

10. On the 14 Dec 96, a non flying window of opportunity allowed AR&TF and RAF Marham personnel to conduct a FOD sweep on either side of RAF Marham's main runway. This was mainly due to an eye witness report stating that pieces of red hot metal were seen coming from the F16's exhaust during its final take off. A sweep of the actual runway had been carried out shortly after the F16's last flight. Although these searches offered up some articles of interest, none were found to be F16 related.

RECOVERY OF MAIN SITE

11. The site was declared safe from the hydrazine on 15 Dec 96. On the same day, [redacted] left for Denmark. They were very polite and extremely generous in their praise of the AR&TF involvement. They left behind a liaison SNCO and a two man safety team for the duration of the recovery. The vital aircraft evidence that had been collected so far had been sent to RAF Marham for an onward and speedy dispatch to Denmark. The IHMT were on site accessing the carbon fibre hazard and advising the ARO on the dress category required. The recovery team, supplemented by spare personnel of the guard force were completing the sweep of the fields surrounding the crash site.

Redacted Sect 40- Mj C and Lt Col D

12. Recovery operations of the main site commenced in earnest on 16 Dec 96 and continued until 13 Jan 97. The progress was steady at first with the AR&TF team still being supplemented by six of the guard force. This was soon to change with overall guard force being slowly reduced and the threat of adverse weather. However, morale remained high and the non stop work continued up until the 24 Dec 96. The team was then stood down for 2 days. On the 28 Dec, the recovery team was split into two, one half continued to collect top surface wreckage whilst the other commenced excavation of the crater. A tracked excavator/digger and dumper truck were hired in support of the latter. Both operations were curtailed on 31 Dec 96 due to snow blizzards. The new year saw the complete site covered in snow, a situation where only excavation work was feasible. Except for two acquisition missiles, little wreckage was found in the crater. The RAF EOD team concurred this fact by checking the crater with their specialist detector equipment. On the 7 Jan 97 excavation of the crater was completed and the full team return to the field. The recovery operation continued till the 13 Jan 97. During this time both small ponds within the site were dredged for wreckage, none found. The main wreckage removed, stored in ISO containers and sent, via RAF Marham, to Denmark. The crater reclaimed, apart from the top soil level. And, finally in association with the DLA and IHMT, the ARO had all contaminated soil removed to licenced tips. The site was then handed over on 14 Jan 97 to the DLA for the completion of land recovery and compensation.

13. Environmental Health/Health and Safety at Work Aspects. The Hydrazine hazard gave concern throughout the recovery. However, the RDAF specialist team, dressed in chemical protective suits and full breathing apparatus, dealt with the initial contamination and there after, monitored the site through out the complete recovery. Both soil and water samples were taken by the IHMT team who were a necessary back up to the ARO. They briefed the DLA and the Landowner on their findings and full details can be found in their Report No.IHMT/5/97. Protective equipment was used, as directed by the ARO, by the AR&TF team and the support personnel of RAF Marham and Coltishall.

14. Team. An AR&TF recovery team of 10 carried out this task.

SUPPORT

15. RAF Marham gave every possible logistic and administrative support to the F16 recovery. Redacted Sect 40- Sqn Ldr E OC Eng Wg HQ Flt of RAF Marham, was instrumental in this which set a fine example of inter unit co-operation.

RECOMMENDATIONS

16. This accident highlighted the dangers of hydrazine and the resultant need for specialist training, protective clothing and equipment, points that were made very clear by RDAF Hydrazine Safety Team during the recovery. This is an area that must be explored, sooner rather than latter, as we might not have the support of a specialist team the next time.

SUMMARY

17. This recovery operation was a splendid example of close cooperation between Units, different NATO Forces, Civilian Contractors and the Landowner(s). It gave a good insight into how the RDAF BOI and AI went about their work and how their safety team dealt with the hazards of Hydrazine. It was also very pleasing to receive the many compliments, from both RDAF and Redacted Sect 40- Civ B the Landowner on the disciplined and professional attitude shown by the young men of AR&TF. Finally, as the ARO I could not have asked for better support from all the different agencies involved.

ROYAL AIR FORCE INSTITUTE OF HEALTH AND MEDICAL TRAINING

PUBLIC HEALTH MEDICINE DIVISION

A REPORT ON AN ENVIRONMENTAL ASSESSMENT OF THE CRASH SITE OF A ROYAL DANISH AIR FORCE F16 FIGHTING FALCON DUAL SEAT TRAINER NEAR NECTON, SWAFFHAM, WEST NORFOLK

Report No: IHMT/5/97

February 1997

ROYAL AIR FORCE INSTITUTE OF HEALTH AND MEDICAL TRAINING

A REPORT ON AN ENVIRONMENTAL ASSESSMENT OF THE CRASH SITE OF A ROYAL DANISH AIR FORCE F16 FIGHTING FALCON DUAL SEAT TRAINER NEAR NECTON, SWAFFHAM, WEST NORFOLK

REPORT NO: IHMT/5/97

SUMMARY

1. On 11 December 1996, a Royal Danish Air Force F16 Fighting Falcon Dual Seat Trainer crashed in an arable field near Necton, Swaffham, West Norfolk. A team from the Public Health Medicine Division attended the site to assess the environmental impact of the crash and to advise on the necessary steps to minimise or eliminate any effect on the environment.

2. A considerable quantity of fuel and carbon composite fibre was spread over an area of approximately 1200m^2. In addition, hydrazine contamination had occurred as a result of damage to the aircraft's Emergency Power Unit.

3. Recommendations were made for the restoration of the crash site.

[redacted]

Flight Lieutenant
Officer Commanding
Environmental Protection
and Public Health

[redacted]

Wing Commander
Officer Commanding
Public Health Medicine Division

[redacted]

Wing Commander
Officer Commanding
Royal Air Force
Institute of Health
and Medical Training

12 February 1997

CONTENTS

ROYAL AIR FORCE INSTITUTE OF HEALTH AND MEDICAL TRAINING

A REPORT ON AN ENVIRONMENTAL ASSESSMENT OF THE CRASH SITE OF A ROYAL DANISH AIR FORCE F16 FIGHTING FALCON DUAL SEAT TRAINER NEAR NECTON, SWAFFHAM, WEST NORFOLK

INTRODUCTION

1. On 11 December 1996, a Royal Danish Air Force (RDAF) F16 Fighting Falcon Dual Seat Trainer carrying approximately 6,000lb (3,375 litres) of fuel crashed into a ploughed field between Lodge Farm and Mona Farm near Necton in West Norfolk after taking off from RAF Marham. The aircraft produced a 3m deep crater and spread aircraft wreckage and aviation fuel over a wide area of the field. The crash site was also contaminated with hydrazine from the aircraft's Emergency Power Unit (EPU) and burnt carbon composite fibres.

2. In association with the Environmental Health Department (EHD) Duty Crash Response Officer (DCRO), a team from the Public Health Medicine Division (PHMDiv) of the RAF Institute of Health and Medical Training (IHMT) attended the crash site on 11-16 December 1996 to assess the environmental impact of the crash and to advise the Aircraft Recovery Officer (ARO) on the steps necessary to minimise or eliminate any adverse pollution effects. Further monitoring was carried out on 27-30 December 1997 during the excavation of the crash crater, and on 7 January 1997 for completion of the consignment notice prior to removal of soil contaminated with fuel.

THE ASSESSMENTS

FIRST ASSESSMENT - 11-16 DECEMBER 1996

3. Consultations with the Environment Agency and the local authority Environmental Health Officer, together with a subsequent ground water vulnerability survey, confirmed that the stricken aircraft had crashed in the vicinity of a major chalk aquifer used for the abstraction of private and public water supplies. The soil above this aquifer consists of a 20m layer of boulder clay and flint. The soil structure has a moderate ability to attenuate diffuse source pollutants, but liquid discharges could penetrate this soil layer. However, the local Environment Agency officer expressed the opinion that there was little risk to either the aquifer or the nearby stream. Annex A shows the groundwater layout of the area surrounding the crash site.

4. The main threat to personnel on the site and to the environment was from hydrazine liquid, a highly toxic rocket fuel used in the aircraft's EPU. The canister containing the hydrazine had split, resulting in several deposits within a 60 metre area down-slope from the crater. In order to alleviate this threat, the RDAF flew in a specialist hydrazine team. During the first 3 days of the crash recovery operations the RDAF team neutralised the hydrazine deposits using a 17% solution of calcium hyperchlorite. The soil in the immediate area of each deposit was then turned over so the clay soil beneath could deactivate the substance. All such deposits were marked with appropriate warning signs for the benefit of the aircraft recovery team.

5. During the period required by the RDAF to neutralise the hydrazine deposits, the team from the PHMDiv carried out visual and olfactory monitoring along the course of the adjoining stream. No specific evidence of pollution from the aviation fuel was found. However, there was a potential for contamination due to the sub-soil land drainage system (mole drainage) installed in the field. This system consists of a drain made in the soil by pulling a bullet-shaped device through the soil and adding clay pipes so that the compacted sides of the tunnel maintain that form for several years. These drains were located at a depth of approximately 1.5m, irrigating to the adjacent stream. Given the adverse weather conditions, any subsequent rainfall could have resulted in residual aviation fuel being flushed into the stream via the drainage system. To prevent such an occurrence a temporary boom was placed in the far corner of the field, downstream from the site.

6. Once the hydrazine team had completed their task, on-site analysis of the immediate area surrounding the crash site was carried out using a photo-ionising detector attached to a soil probe to monitor for hydrocarbon gases and vapours. Measurements were taken at one metre intervals to a depth of one metre, where possible, using a 30mm diameter Gouge Auger. Where high concentrations of fuel were detected, additional measurements were taken to establish both the extent of the contamination and the maximum depth. Additional measurements were also taken at the periphery of the crater to a distance of 5 metres. All the areas of fuel contamination were plotted and are graphically displayed at Annex B. These areas included the engine impact section and the location of one of the aircraft wings.

FINDINGS

7. The ARO was of the opinion that the body of the aircraft was buried in the bottom of the crater, which was 3 metres in depth. This was the area of heaviest contamination by aviation fuel. The area where the engine wreckage had landed was also heavily contaminated and the survey carried out by the team from PHMDiv showed that the soil immediately below this site was contaminated to a depth of 15cm. One of the wings had landed down-slope of the a pond near the crater, scattering fuel over a 720m^2 area to a varying depth of 2-5cm. In addition there was a light scattering of fuel in the area between the engine wreckage site and the main crater and another light scattering of fuel extended for approximately 30m north of the crater.

8. Deposits of burnt carbon fibre were found throughout the crash site area. The problem of carbon composite fibres was limited as superfine fibres would be dispersed from the area and, given the wet weather prevailing at the time, most of the remaining carbon composite fibre would be dampened down. However, larger pieces of carbon fibre could cause needlestick injury if not removed from the crash site.

RECOMMENDATIONS

9. The following recommendations were made following the first assessment of the crash site:

a. Crops contaminated with carbon fibre composite are to be dampened down and removed, along with any contaminated soil, and incinerated, or disposed of as contaminated waste, to prevent them entering the food chain.

b. Prior to their removal, it is recommended that all visible pieces of carbon fibre composite are dampened down to reduce the build up of composite dust particles.

c. All fuel/oil collected in the bottom of the crater during the removal of the wreckage should be removed and disposed of by a competent contractor under the direction of the Defence Land Agency.

d. All the areas of light fuel contamination between the engine wreckage site, the wing wreckage site and the main crater should be ploughed to turn the soil and then harrowed to increase the surface area of the soil, thereby allowing more oxygen into the soil and facilitating the evaporation of hydrocarbon vapours.

SECOND ASSESSMENT - 27-30 DECEMBER 1996

10. The aircraft carcass was due to be moved on 27 December, however, adverse weather conditions meant that no recovery work could be carried out that day. Nevertheless, the pollution monitoring team re-surveyed the crash site and the nearby stream for any possible extension of the fuel contamination.

11. The crash recovery team began removing the wreckage from within the contaminated area 5m around the crash crater on 29 Dec. On the advice of the DCRO, trenches were dug outside this 5m wide contaminated area to accommodate contaminated soil removed from the crater and the surrounding area during the wreckage recovery operations. The trenches were excavated to a depth of approximately 50cm. The soil in the trenches was beaten down to compact it and provide an impermeable layer. In addition the trenches were lined with plastic sheeting to prevent any contaminants leeching into the ground. The soil was sifted to locate any wreckage and any contaminated soil was then placed in the trenches. Soil which was deemed "clean" was placed in separate piles and labelled accordingly. Initially, there was some confusion regarding the crash recovery team's definition of "clean soil". The crash recovery team defined clean soil as that which was free of all

pieces of aircraft wreckage. Therefore, inadvertently, soil contaminated with hydrocarbons from the periphery of the crater was mixed with uncontaminated topsoil. When this became apparent all the soil heaps were re-sampled by the pollution monitoring team and the "clean" (uncontaminated) soil was identified and appropriately labelled.

FINDINGS

12. The contaminated soil which had been excavated from the crater and placed in the lined trenches was measured using a photo-ionising detector. Measurements recorded showed there was in excess of 200ppm of hydrocarbons from aviation fuel in the soil.

13. The soil removed from the periphery of the crater was found to be slightly contaminated, as first thought, but all signs of hydrocarbon contamination from aviation fuel were removed following exposure of the compact soil in the ground to the air.

RECOMMENDATIONS

14. The following recommendations were made following the second assessment of the crash site:

a. The contaminated soil placed in the trenches should be raked at the end of each working day to facilitate the introduction of oxygen into the soil and accelerate the evaporation of hydrocarbon vapours. Once all the wreckage and contaminated soil from the crater has been removed from the site, then this aerated soil could be returned to the periphery of the crater.

b. After the wreckage and soil have been removed from the crater the pollution monitoring team should quantify the amount of contamination and its constituents. This must be carried out prior to the removal of any contaminated soil from the site in order to comply with the Special Waste Regulations 1996. Contaminated soil must not be removed from a site **under any circumstances** until the consignment note has been completed with information of the levels of contaminant in the soil.

FINAL ASSESSMENT - 7 JANUARY 1997

15. The pollution monitoring team returned to the site on 7 January 1997 to quantify the amount of contamination in the soil that was to be removed for the consignment notice. It was observed that the contaminated soil which had originally been placed in the trenches had been transferred to a hard standing at the top-end of the field, where the farmer had stored straw. This soil was analysed using a "PetroFLAG" hydrocarbon test kit in order to quantify the level of contamination present from aviation fuel.

FINDINGS

16. After indicating the presence of fuel contamination using the photo-ionising detector, additional sampling using the "PetroFLAG" showed levels of contamination ranging from 99-265ppm, dependant on where the sample was taken from in the contaminated soil heap destined for removal(see Annex C).

RECOMMENDATIONS

17. The following recommendations were made following the final assessment of the crash site:

a. The contaminated soil should be contained within the crash site area and should only be be removed from the site by a competent waste contractor and disposed of in accordance with the statutory requirements of the Special Waste Regulations 1996.

b. Arrangements should be made for the DCRO to return the crash site to take part in the handover of the field to the farmer and his agent once it has been cleared of all contamination.

c. A monitoring strategy should be set up by a competent person, in consultation with the Defence Land Agency, to continue to assess the whole area for any further environmental impact, including the possibility of carbon fibres (if any) entering the food chain and the biodegradation of the aviation fuel on agricultural land. This recommendation is made because at present no data is available on the long term breakdown of carbon composite fibres from aircraft crashes in a natural environment.

CONCLUSIONS

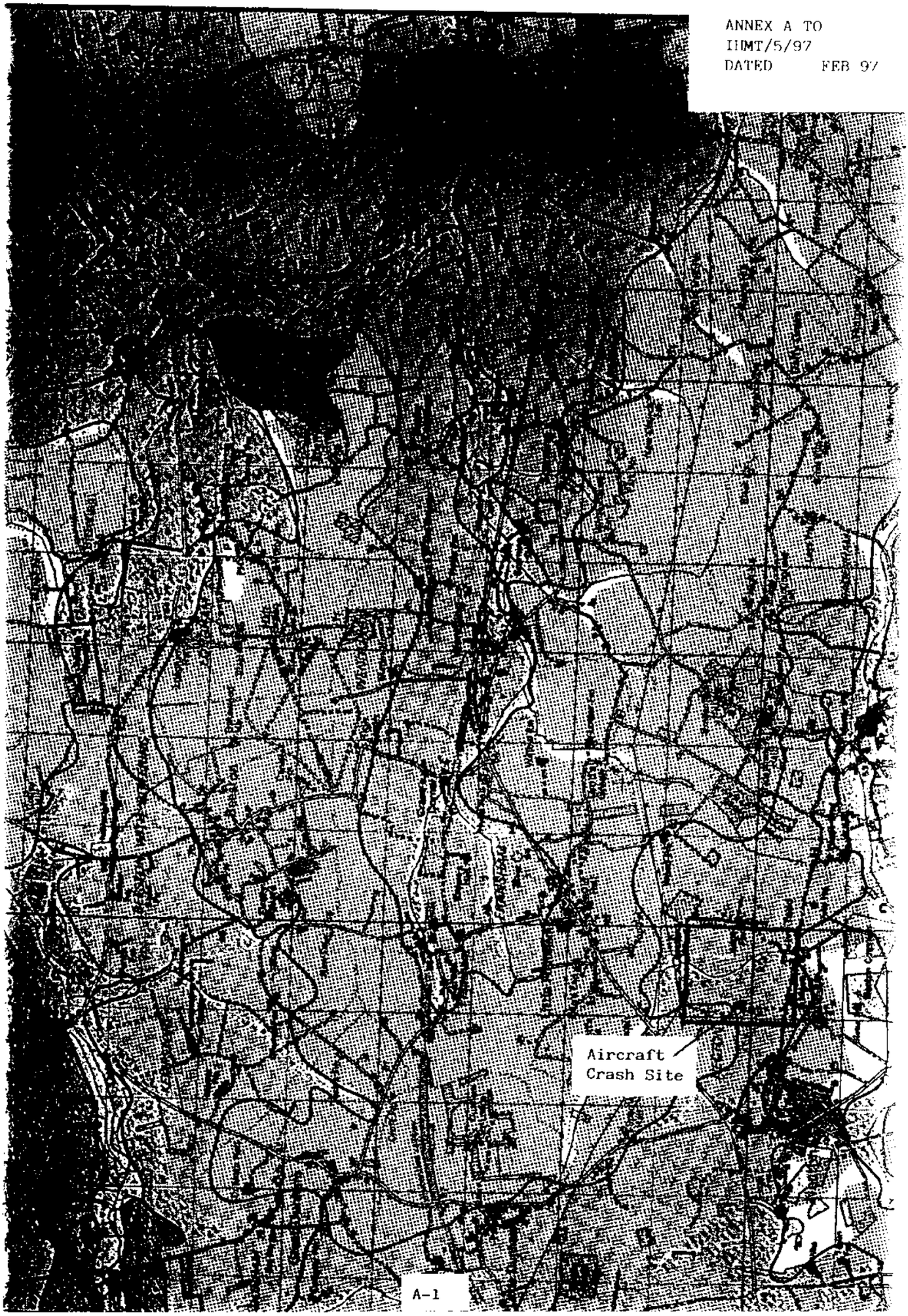
18. The pollution problems associated with the F16 aircraft crash site were considerably widespread throughout the ploughed field. The potential problems associated with hydrazine contamination were dealt with by the team from the RDAF. With the exception of the aircraft crater and the engine wreckage site where there was heavy contamination, an area of approximately 1200m^2 was lightly contaminated by fuel and carbon composite fibres to varying depths.

DEBRIEF

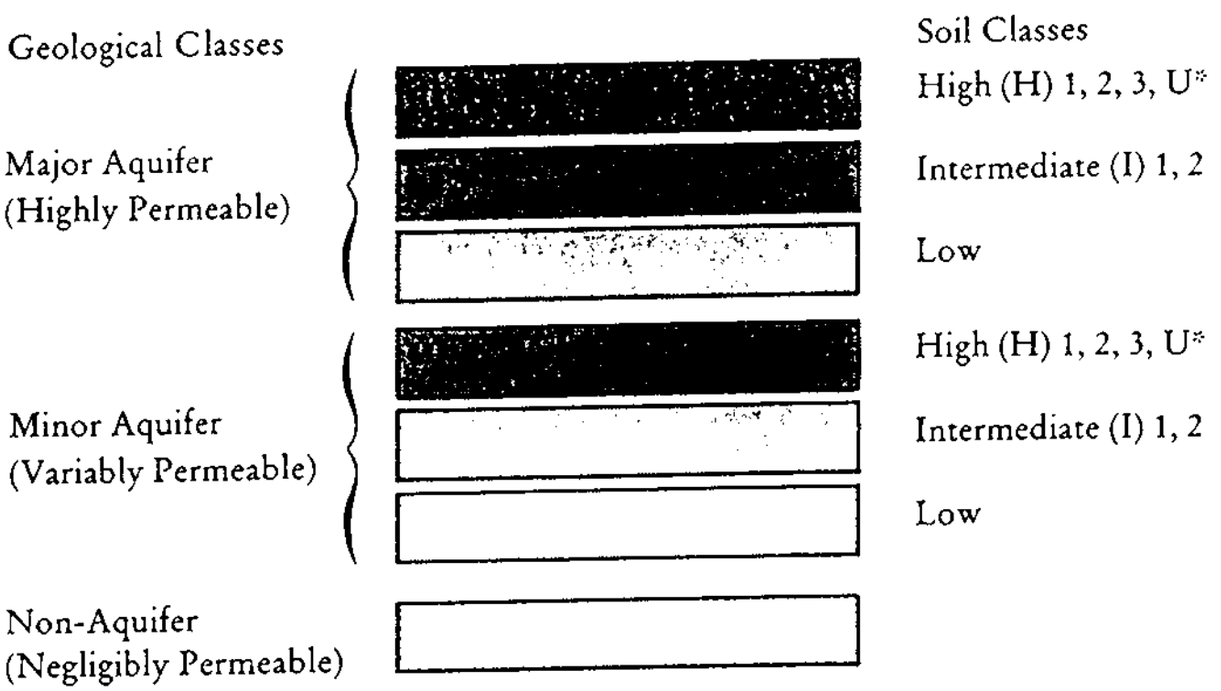
19. The DCRO briefed the ARO on-site on the team's findings and the recommendations contained in this report. The ARO then briefed [redacted] of the Defence Land Agency. Ongoing briefings and updates took place between the DCRO, [redacted] of the Environment Agency, and [redacted] the local authority Environmental Health Officer.

ADDENDUM

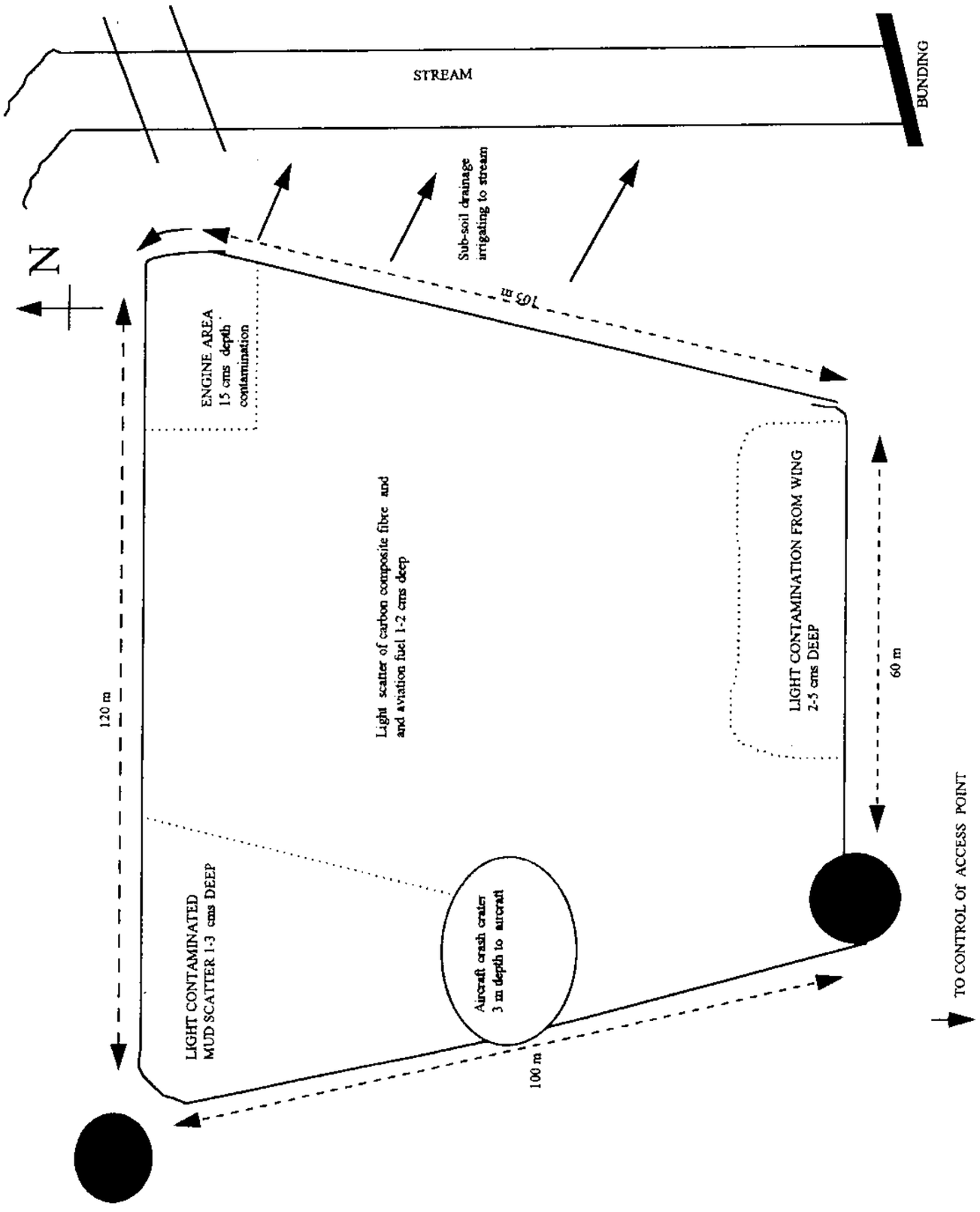
20. Following the meeting between the DCRO, the Defence Land Agent, the farmer and the farmer's agent during the handover of the field, the pollution monitoring team from PHMDiv have been tasked to carry out further monitoring of the site of the F16 aircraft crash in the arable field for any adverse environmental effects and the re-emergence, if any, of carbon composite fibres.


Aircraft
Crash Site

VULNERABILITY CLASSES



Low permeability, non-water bearing drift deposits occurring at the surface and overlying Major and Minor Aquifers are head (clayey), shell marl, Nar Valley clay, Terrington Beds, Barroway Drove Beds, glacial silts and clays and till (excluding Cromer Till).


STREAM
BUNDING
N
Sub-soil drainage
irrigating to stream
103 m
ENGINE AREA
15 cms depth
contamination
Light scatter of carbon composite fibre and
and aviation fuel 1-2 cms deep
LIGHT CONTAMINATION FROM WING
2-5 cms DEEP
60 m
120 m
LIGHT CONTAMINATED
MUD SCATTER 1-3 cms DEEP
Aircraft crash crater
3 m depth to aircraft
100 m
TO CONTROL OF ACCESS POINT

ANNEX C TO
1HMT/5/97
DATED FEB 97

HYDROCARBON TEST KIT - FIELD DATA SHEET

Date: 7 Jan 97

Calibration Time/Date: 13:20 /7.1.97

Operator: [redacted]

Calibration Temperature: 19° C

Location: F16 Crash Site Necton Nr Swaffham - Contaminated Soil Removal (Pile on hardstanding)

No	Sample ID	Weight	Time	Reading (ppm)	DF [1]	RF [2]	Actual (ppm)	Comments
1	CS	10g	13:30	99	1	2	99	TOP
2	CS1	10g	13:32	149	1	2	149	TOP
3	CS2	10g	13:34	104	1	2	104	TOP
4	CS3	10g	13:36	114	1	2	114	EDGE
5	CS4	10g	13:38	136	1	2	136	EDGE
6	CS5	10g	13:40	141	1	2	141	EDGE
7	CS6	10g	13:42	101	1	2	101	EDGE
8	CS7	10g	13:44	106	1	2	106	EDGE
9	CS8	10g	13:46	265	1	2	265	CENTRE
10	CS9	10g	13:48	166	1	2	166	SUMMIT
11	Blank	-	13:28	00	1	2	00	-
12	Standard	-	13:29	1000	1	2	1000	-
13								
14								
15								
16								
17								
18								
19								
20								

Notes:

1. DF = Dilution Factor, eg for a 5 gram soil sample the DF = 10g/5g = 2, and actual concentration equals reading x DF (reading (ppm) x DF = actual concentration).

2. RF = Response Factor, selected for the hydrocarbon contamination at the site.

ENCL NO 117

LOOSE MINUTE

D/Sec(AS)/58/1/36

11 December 1996

PS/USofS* * by CHOTS

copy to:
APS/Secretary of State* Press Secretary*
APS/Minister(AF)* Sec(AS)2*
APS/Minister(DP)* HCDC Liaison Officer*
PS/CAS* [redacted] STC - CS(P&P)1
PSO/ACAS Redacted - Sect.40 Chief Claims Officer*
AUS(H&O) Air Attache, Copenghagen

ROYAL DANISH AIR FORCE F-16 ACCIDENT - 11 DEC 96

1. I am writing to confirm the details of this morning's accident involving a two-seat F-16B aircraft of the Royal Danish Air Force (RDAF).

2. The aircraft arrived at RAF Marham on 5 December on a routine liaison visit but bad weather delayed the originally planned departure until this morning. Shortly after becoming airborne and with the aircraft in a steep climb, the crew encountered difficulties and ejected. The trajectory of the aircraft was such that it crashed in open farmland some seven miles away, just outside the village of Necton. The crew was picked up by a SAR helicopter and taken to King's Lynn Hospital having sustained only minor injuries. Early suggestions are that the accident may have been caused an engine failure.

3. Post-crash management personnel at the site are alert to the presence of a highly toxic, flammable chemical compound known as Hydrazine (H_4N_2) which the F-16 uses during the engine start-up sequence. Although only a small amount of the substance is carried, it can cause systemic poisoning and permanent kidney damage if improperly handled. RAF firecrews and personnel at the Aircraft Recovery & Transportation Flight are trained accordingly. In addition, RAF personnel detached to the scene immediately after the accident occurred took additional advice from United States Air Force personnel at RAF Lakenheath, who are more familiar with F-16 post crash management procedures.

4. NATO arrangements for investigating military aircraft accidents permit the authority owning the aircraft to investigate the crash if no other aircraft is involved. Accordingly, the RDAF will be investigating this accident and is setting up its own Board of Inquiry; a RAF observer will be in attendance.

5. I attach a draft letter for USofS to send to Gillian Shepherd, the MP in whose constituency the accident occurred. I do not believe that there is a requirement for the Department to advise the HCDC of this accident as although accidents to foreign aircraft were not specifically excluded from the reporting arrangements agreed earlier this year, the Committee's interest was focused on UK military aircraft losses and our inquiry procedures neither of which are, of course, relevant here. I also attach some defensive press lines.

[redacted]
Redacted - Sect. 40

DRAFT LETTER TO GILLIAN SHEPHERD MP

I am writing to confirm the details of the aircraft accident which occurred in your constituency this morning.

A two-seat F-16B aircraft of the Royal Danish Air Force had just taken off from RAF Marham, bound for Denmark, when the crew encountered difficulties and ejected. The aircraft crashed some four miles east of Swaffham. The crew were subsequently picked up by a RAF helicopter having sustained only minor injuries.

The investigation into this accident is being carried out by the Royal Danish Air Force under the terms of a NATO Standardization Agreement.

THE EARL HOWE

Rt Hon Gillian P Shepherd MP

PRESS LINES ON AIRCRAFT ACCIDENT INVOLVING A RDAF F-16B - SWAFFHAM - 11 DEC 96

- Confirm that a two-seat F-16B of the Royal Danish Air Force has crashed seven miles east of RAF Marham.

- The aircraft had just departed Marham and was intending to return to Denmark when the crew encountered difficulties and ejected. They were subsequently picked up by SAR helicopter having sustained only minor injuries.

- The Royal Danish Air Force has convened a Board of Inquiry at which the RAF will have an observer.

If pressed:

- The aircraft was in a steep climb when the crew ejected and the trajectory of the aircraft was such that it continued to travel some distance before crashing into open farmland. It is entirely normal practice for F-16s to enter into a steep climb upon departure.

- It will be a matter for the Danish authorities whether they wish to make the findings of their Inquiry public.

- Confirm that F-16 aircraft carry a small amount of Hydrazine, which is used during the aircraft's start-up sequence. As with any chemical compound, Hydrazine is entirely safe provided it is handled only by trained and properly equipped professionals.

- We are not aware of any claims arising from this accident but any that we receive will be considered fairly and objectively.