2 December 2010

TO: NTSB Board Members

FROM: Carson Helicopters Accident Party Team

RE: LAX08PA259, Weaverville, CA helicopter accident

Carson Helicopters would like to take this opportunity to ask Board members to carefully consider the important points contained in the following synopsis in their review of the information and analysis provided for the Weaverville accident.

We appreciate the efforts of the NTSB and the Board to work towards a responsible conclusion to this investigation, and in the spirit of continuing flight safety would ask that all factors be carefully considered in this tragic incident.

Thank you for your consideration.

Synopsis of Pertinent Facts in the Crash of N612AZ

LAX08PA259

22 November 2010

NTSB Board members are tasked with a review of the NTSB final report and a causal finding for the crash of the S61N helicopter. In the course of this review, they will be asked to look at a large volume of data and the party submissions contained in the public docket. Carson Helicopters would like to take this opportunity to offer a synopsis of facts that have become clear in the course of this investigation.

1. ***The pilots were unknowingly utilizing a mislabeled 2.5 minute power chart and an incorrect weight for the aircraft in mission planning.***

-In the course of this investigation, it became apparent to Carson management and other members of the investigation team that there were issues with the power charts used by the pilots and the weight estimate of the aircraft.

- Carson forthrightly acknowledged these issues upon discovery and has made significant changes within the company to ensure that no one individual can effect this type of behavior within the operation again. However, these issues did not cause the crash of N612AZ. ***The facts clearly show that only an additional power loss could have caused N612AZ to crash.***

2. ***The actual flight conditions indicate N612AZ should have flown away from H44***

- The NTSB has relied on temperature and wind conditions that are averaged from stations 9 miles or more away from the accident site to artificially create inflated performance conditions, instead of using the actual data from the accident scene taken directly from CVR voice recordings. The direct result of the NTSB's simulated temperature and wind data is an incorrect hover performance analysis *(Carson Submission, V-B-3)*.

- On the CVR voice recording the co-pilot can be heard reading the temperature as 20 deg. C as they are on short final and less than 40 seconds before the aircraft is already powered down at H44 prior to the accident takeoff. The NTSB has tried to reconstruct an elaborate flight path to justify its use of 23 degrees by guessing at the altitude when the temperature inbound is read,

but this study is irrelevant when we can look to the copilot's next temperature reading taken while idling on the pad at H44.

- *While they are sitting on the pad at H44*, the copilot can be heard on the CVR reading the OAT gauge (which had been inspected for function only a few days prior) as 12 to 13 degrees cooler than the mission planning temperature of 32 C. In other words, the temperature as read by the copilot while the aircfraft is sitting on the pad at H44 is 19-20 deg.C. **The copilot has very recently affirmed in a written interview with the NTSB investigators that he was indeed reading the OAT gauge as he said these words. This is clear affirmation that the temperature at the time and location was 19-20 deg. C. The NTSB investigators chose not to specifically ask him about this important affirmation for nearly 2 years.**

- The experienced heli-tak manager can also be heard on the CVR telling the copilot the winds are 3 to 5 knots on the aircraft's nose.

- In spite of these affirmations onsite from a highly experienced professional ex-military pilot and heli-tack ground crew at the time of the accident, the NTSB has chosen instead to engage in convoluted averaging of temperatures from 9+ miles away as justification for meteorological conditions of 23 deg. C and no wind.

- Carson provided the NTSB with an independent analysis from a highly respected and experienced meteorologist familiar with this region that clearly shows the NTSB estimates are not validated by the available meteorological station data. The NTSB has not refuted this report in any fashion.

- It is clear the best available data is from the voice recordings at H44 read directly from the OAT gauge *(Carson Submission, Austin Met. Report, Exhibit 32)*.

-The NTSB's own Hover Study and Hover Study Addendum clearly show that at 20 deg. C and 3 knots of wind, the aircraft has 420 lbs. of margin (at the NTSB aircraft weight) and should fly away. **In fact, this is a greater margin of available performance than the crew had on the first takeoff from H44 earlier in the day (230 lbs. of margin) (NTSB Hover Study).**

3. Two independent flight tests validate the composite blade FAA performance charts and the power available in the accident density conditions and demonstrate the aircraft should have had power to fly away

a. Whipple flight test (Carson Submission, II-F, Exhibit 5, Docket 438758, 446197)

- Carson repeatedly asked the NTSB team to participate in a flight test duplicating accident conditions (at Carson expense). The NTSB refused to participate, so Carson commissioned an independent aviation safety consultant with vast S61 experience, and a third party operator to

provide an exemplar S61N composite blade-equipped aircraft and pilots for a series of hover tests in similar density conditions to the accident aircraft (Whipple Aviation Test Report, 2009).

- In eight separate hover tests with weights ranging up to and in excess of 19,300 lbs., the exemplar helicopter was able to come to a hover and then accelerate away at density conditions exceeding the accident conditions.

- Even when the collective was pulled to extreme maximum stop, the aircraft stabilized at 94-95% rotor RPM and would still hover or exhibit positive rates of climb.

-The only condition that would induce a loss of rotor RPM in a rapid and steady fashion below 94%, similar to that experienced by N612AZ immediately before the crash, was when power was pulled back on one engine by 20%. This indicates that a partial power loss to one of the engines is clearly a possible primary cause of the crash of N612AZ.

b. Carson-Sikorsky Hover Test (Docket 453702)

- Carson Helicopters and Sikorsky Helicopters conducted a documented and instrumented hover test in October 2010 in order to demonstrate compatibility with the FAA-approved performance charts for the composite blade-equipped S61N helicopter.

-The test demonstrated that the aircraft met the performance of the FAA approved RFMS # 8 performance charts. These charts as shown in the NTSB Hover Study show that the accident aircraft had sufficient power to fly away from H44.

- The test demonstrated that the composite blade-equipped aircraft lifted 1800 lbs. more than a metal-bladed S61N, and more importantly, matched all previous empirical test data for Carson CMRB-equipped aircraft from previous flight tests conducted by Carson, the FAA and the British Royal Navy.

- The hover tests matched the performance shown in the Whipple Aviation flight tests conducted in 2009 with a different, but similarly equipped, S61N aircraft

- This large body of independently verified flight data all support the conclusion that the performance of the CMRB-equipped aircraft and the Whipple hover tests that show the aircraft had more than sufficient power to fly from H44 if it had two healthy engines.

4. The NTSB weight of the aircraft is unrealistically heavy

- The NTSB has assigned a weight to the aircraft that is unrealistic and too high by more than 400 lbs. This makes a significant difference in the performance margin. *(Carson Submission, V-B-1)*

- Carson has provided extensive historical weight data for the aircraft, including four different weighings with the aircraft equipped as per the chart "C" at the time. We have also provided the fleet averages for 10 other S61 aircraft similarly equipped. All indicate lower weights than the NTSB estimated aircraft weight *(Carson Submission, V-B-1, Exhibits 27-31).*

- Carson has shown the NTSB where they have erroneously double-added equipment to the aircraft to arrive at a weight that is unrealistically high by at least 400 lbs. Utilizing the correct weight of the aircraft shows that at 20 deg. C, and calm winds, the aircraft had a performance margin of 750 lbs *(NTSB Hover Study).*

- Even utilizing the disputed NTSB weight of 19,008 lbs., at 20 deg. C the aircraft had a margin of 330 lbs. with calm winds on the accident takeoff *(NTSB Hover Study).*

5. Contamination in # 2 FCU caused a power loss *(Carson Submission, IV-A through E, Exhibits 8, 10-23)*

Carson has maintained throughout this investigation that there was almost certainly a power loss of some type to the aircraft. We strongly urged the NTSB to do a thorough investigation of the engines and fuel control units (FCU). Investigation of the FCU's revealed that there was substantial contamination found in the fuel filter and the PRV (Pressure Regulating Valve) of the #2 FCU. Some members of the team have tried to indicate that this contaminant is not enough to cause a problem, and that the CVR spectrum shows the engines at full Ng (gas generator speed).

-The contaminants found in the PRV of the #2 FCU were of more than sufficient quantity and size (up to 25 microns) to effectively seize the PRV. The PRV has very narrow clearance (4 microns) and acts as a trap for particles circulating in the FCU. Presence of material in the PRV can cause engine management issues and more importantly, **is indicative of particles elsewhere in the FCU that can cause multiple power problems, particularly at high power demand.** Flight testing showed a temporary power loss of even 20% in one engine would cause unrecoverable rotor RPM loss such as that experienced by N612AZ immediately prior to the crash.

- There is documented history by GE and Hamilton Sundstrand of irregular fuel response and subsequent power loss problems due to foreign material in the FCU *(Docket 444680-444684).*

- Bench testing of an FCU with contaminants confirms it does not properly regulate power to the engine. Contaminants can also cause improper stator vane actuation that can cause temporary power loss without degradation of Ng speeds.

-There were pressure regulating FCU issues and sudden power loss due to a contaminated FCU with N612AZ less than 2 months prior to the accident.

-There is documented history of sudden, transient power loss due to contaminants in the CT58 FCU dating back to 2002 with Carson aircraft and other operator S61 helicopters. This history

was not fully shared by Sikorsky, GE and Columbia until legal discovery during this investigation*(Docket 444680-444684).*

- Carson has strongly urged the NTSB staff to track and compare contaminants. They have chosen not to do this. Carson commissioned an independent laboratory to compare micron photographs of other problem FCUs with contamination to the contamination in N612AZ. **The long strand silica and graphite particles are an identical match in all micron photos from several malfunctioning FCUs.**

-Carson supplied this data and lab photos to the NTSB. A sample is attached to this report. The NTSB staff did not pursue this evidence of a systemic trend in FCU contamination.

-**This is an ongoing Safety-of-Flight issue**. At least one FAA inspector has an ongoing investigation into the source of this contaminant, **because this contaminant in the FCU has caused previous power losses and will do so again until the source is determined.**

-Early in this investigation the NTSB staff mishandled fuel control parts and lost chain of custody of the parts. Several FCU parts were lost and/or swapped between units. The staff also subsequently incorrectly conducted a filter blockage inspection after removal of particulates from the filter and then misstated the procedure in their report. It was only corrected after Carson showed the inspection was improperly done and improperly reported. Since early in this process, the NTSB staff has chosen not to pursue possible sources for the contaminant material or its tested effect on power management in the FCU *(Carson Submission V-A-1,2,3,4).*

6. Other important factors tied to FCU power loss*(Carson Submission, III-A through E, NTSB Operations Report,Docket 444680-444684)*

- There were Ng fluctuations (a possible early sign of FCU fuel management problems) on the #2 engine of N612AZ the last flight day before the accident.
- All three torque gauges recovered in the wreckage showed the #2 engine with less torque. The one torque gauge recovered fully intact and uncompromised showed the #2 engine with 30% less torque than #1 engine at impact.
- It has been documented in the GE manual and by direct Carson experience that it is possible to have engines at topping Ng and have low power output to the free turbine engine. This can happen without high T5 temperatures or other indicators that would alarm the pilots.
- The #2 engine internal turbine parts showed dramatic differences in wear and damage from the #1 engine internals, which would be consistent with different torque availability in the free turbine section.
- The #2 engine emergency throttle was found halfway engaged in the wreckage and recovered intact. The NTSB investigators have claimed it is a friction detent and may have been compromised during the crash, but the throttle must be pulled out and

forward to engage. The copilot has submitted an affidavit to the NTSB from a fellow pilot witness that affirms **the copilot told him after the accident that he had engaged the #2 emergency throttle right before the crash.** There had to be a direct reason why the #2 emergency throttle was engaged in an emergency situation. The copilot likely witnessed the torque split between engines on the gauges.

7. The CVR sound data is not reliable for engine Ng determination*(Carson Submission II-E, Docket 419427)*

- The main piece of physical evidence the NTSB team has relied upon is the CVR sound spectrum analysis of the engines. They have dismissed or excluded virtually all other significant physical evidence in order to rely on the CVR Ng sound analysis. However, in this S61 helicopter, the "black box" CVR recorder consists of 2 microphones in the cockpit. This creates serious issues with relying too heavily on the engine sound analysis.

-There are no pickups directly from the engines, nor are there any digitally recorded engine parameters. The engine Ng readings are derived by subjectively filtering selected harmonics of the engine noise recorded only by a cockpit microphone. The accuracy of such data is quite subjective, and the NTSB has revised the harmonics used in their analysis at least twice.

- The original data is incredibly noisy and of limited quality. The filtering applied (as per the NTSB CVR expert) is subject to a great deal of personal interpretation. Separation of the engine noises is arbitrary and not completely reliable due to the original quality of the data. In addition, it is misleading to assume that high gas generator speed equals full torque output in the free turbine section. An engine at full Ng (if that can even be derived from this microphone data) does not mean that the engine is at full torque output.

-The rotor RPM, on the other hand, is easily tracked and can be audibly heard to be slowing dramatically in the CVR cockpit data. This data shows a steep and irrevocable loss of rotor RPM well below a recoverable stage at 91% when the recording stops. *This is consistent with a torque power loss to the rotor system, regardless of Ng reading.*

-The real world data from the Whipple test showed that even with maximum collective and weights exceeding the NTSB derived a/c weight, *this CMRB rotor system will not droop past 94-95% with healthy engines. However, even a moderate power loss in one engine will cause irrevocable rotor RPM loss at these weights.*

8. Incorrect assumptions about topping power

-The NTSB team has repeatedly made reference to the engines being at "topping power" based on the CVR spectrum Ng data. First, the data itself is suspect, but more importantly, "Topping Power" in the CT58 engine is defined as full Ng rpm and 721 degree T5 temperature. If the engines are at full Ng rpm but not at high T5 temperatures (721 deg.), then the engines are not

at topping power. **There is no way for the NTSB to ascertain topping power without both parameters, and they have repeatedly mis-characterized the engines as being at topping power when this is not known. The copilot has stated that he did not see any indications that the aircraft was ever at topping power during the flight operations of the day. This indicates that the T5 temperature was not elevated, and thus the engines were not at topping power. Any reference to this in the NTSB report is incorrect without temperature data, and is a mis-use of the CVR sound data.**

In summary:

1. Actual meteorological conditions and weights show the aircraft had sufficient power margins to fly away from H44. *The investigators have ignored actual temperature readings, and engaged in multiple suppositions about weather conditions that are not supported by available data in order to support their Hover Analysis.*
2. Real world flight data from multiple tests and FAA-approved performance charts demonstrate the aircraft had sufficient power to fly away from H44. *The investigators have relied on synthetic power studies and consistently refused to participate in flight tests that clearly show actual performance.*
3. Significant contaminant material was found in the #2 FCU and several physical indicators all show issues with the #2 engine.
4. There is a significant history with power loss due to contaminants in the CT58 FCU and the contaminants match those found in N612AZ. *The investigators have not thoroughly examined this material, have not pursued possible sources, and have not investigated GE and Sikorsky records.*
5. CVR microphone gas generator speeds are unreliable and not a good indicator of actual torque available to the engines. The CVR data does not indicate whether the engines were at topping power or not. *The investigators have relied heavily on this CVR spectrum analysis without full instrument readings available and ignored a large body of other evidence that contradicts their thesis.*

Questions for Board Members to consider when reviewing information with the investigative team

1. If the conditions at the accident site were 19-20 degrees C., with wind from 0 - 5 knots from the southeast, what effect would that have on the helicopter's performance? Would it have been able to hover out of ground effect?

2. If the helicopter's weight was actually about 18,600 lbs., what effect would that have on the aircraft performance? Would it have been able to hover out of ground effect?

3. Why did the investigators not conduct a flight test to replicate the accident conditions as requested and offered by Carson?

4. Can particulate contamination of up to 40 microns affect the function of the JFC-26 fuel control unit?

5. Can a malfunctioning fuel control unit result in a loss of power (Nf) in the CT58 engine without a significant reduction in the gas generator (Ng) speed?

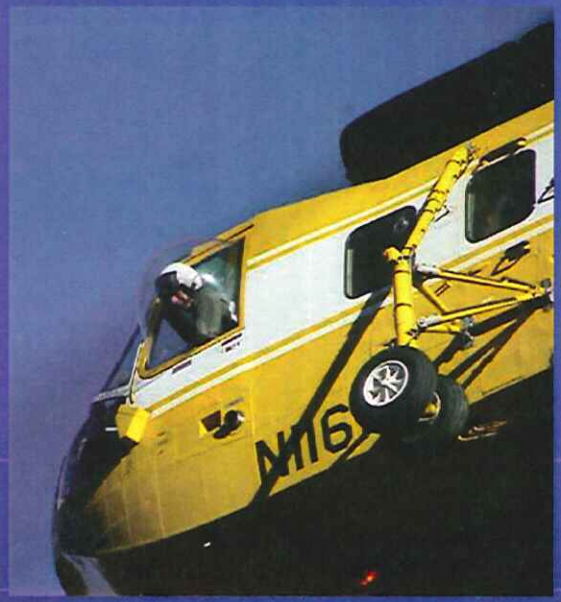
6. Assuming both CT58 engines on the S61N helicopter are producing full rated power under the density altitude conditions attributed to the accident site, can the pilot cause a rapid loss of main rotor RPM (Nr) below 94% by application of collective control input?

7. What effect would a 20 - 30% loss of power (torque) in one engine have on the main rotor speed (Nr) of the S61N under the accident conditions?

8. If the engines are at full Ng rpm (approximately 102%) but the T5 temperature is unknown, how can it be said that the aircraft was at topping power at any time ?

9. Why is the NTSB disregarding the testimony of the copilot (experienced mountain helicopter pilot, former military blackhawk pilot, former crewman for B52 nuclear strike team) regarding his recall of the temperature on the pad on the accident takeoff, and his testimony that the aircraft did not reach topping power (Ng plus T5) at any time that day ?

CARSON HELICOPTERS INC.



Comparison of four sets of FCU-PRV Particle Contamination

Hayes Helicopter	2002
Carson-GE	2004
N612AZ	2008
N103WF	2008

Hayes Helicopter (Canada)

PRV- FCU Contaminant 2002

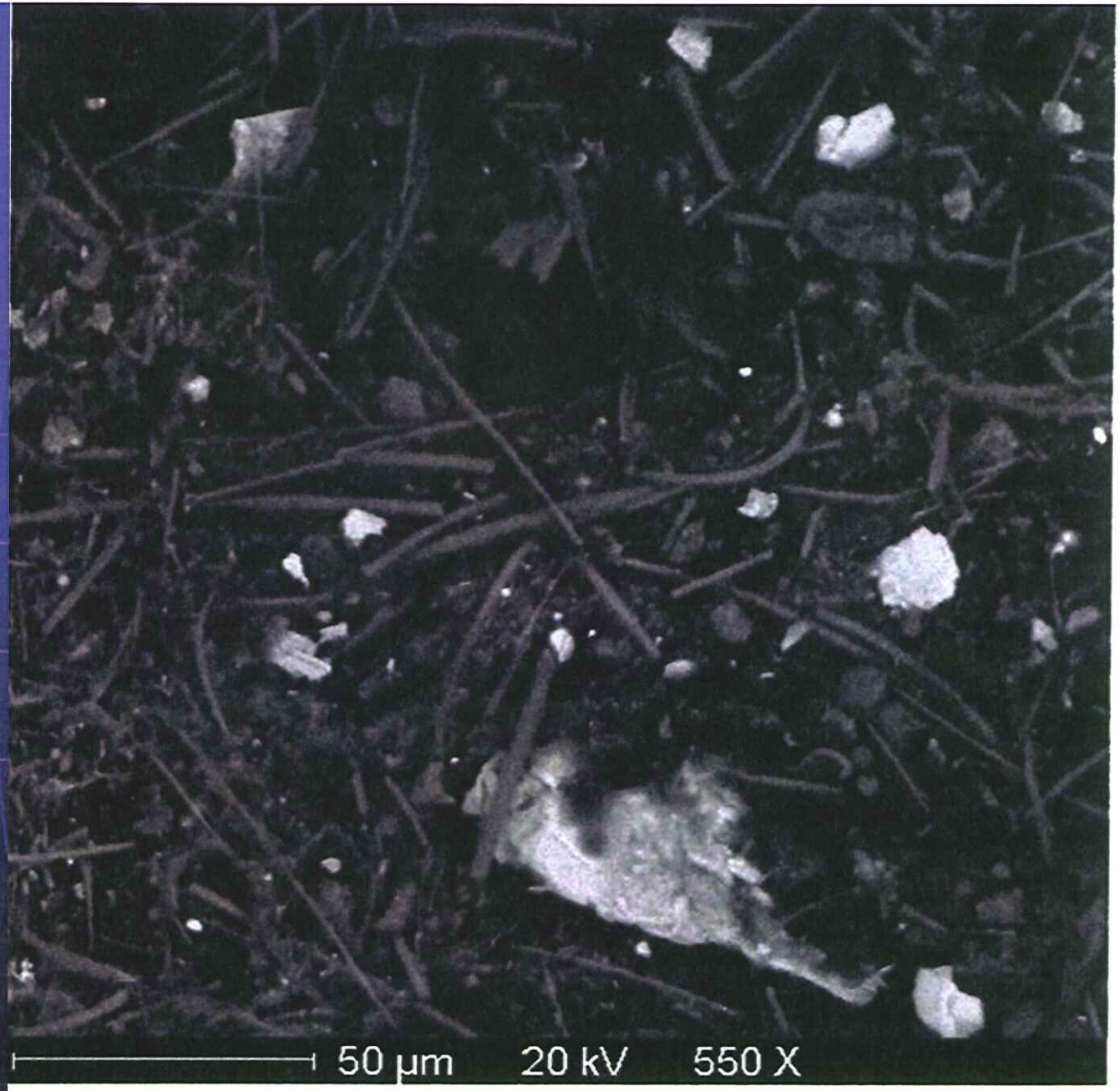
430 X

B.S.E.

Carson
Helicopters

PRV-FCU
Contaminant
2004

550 X



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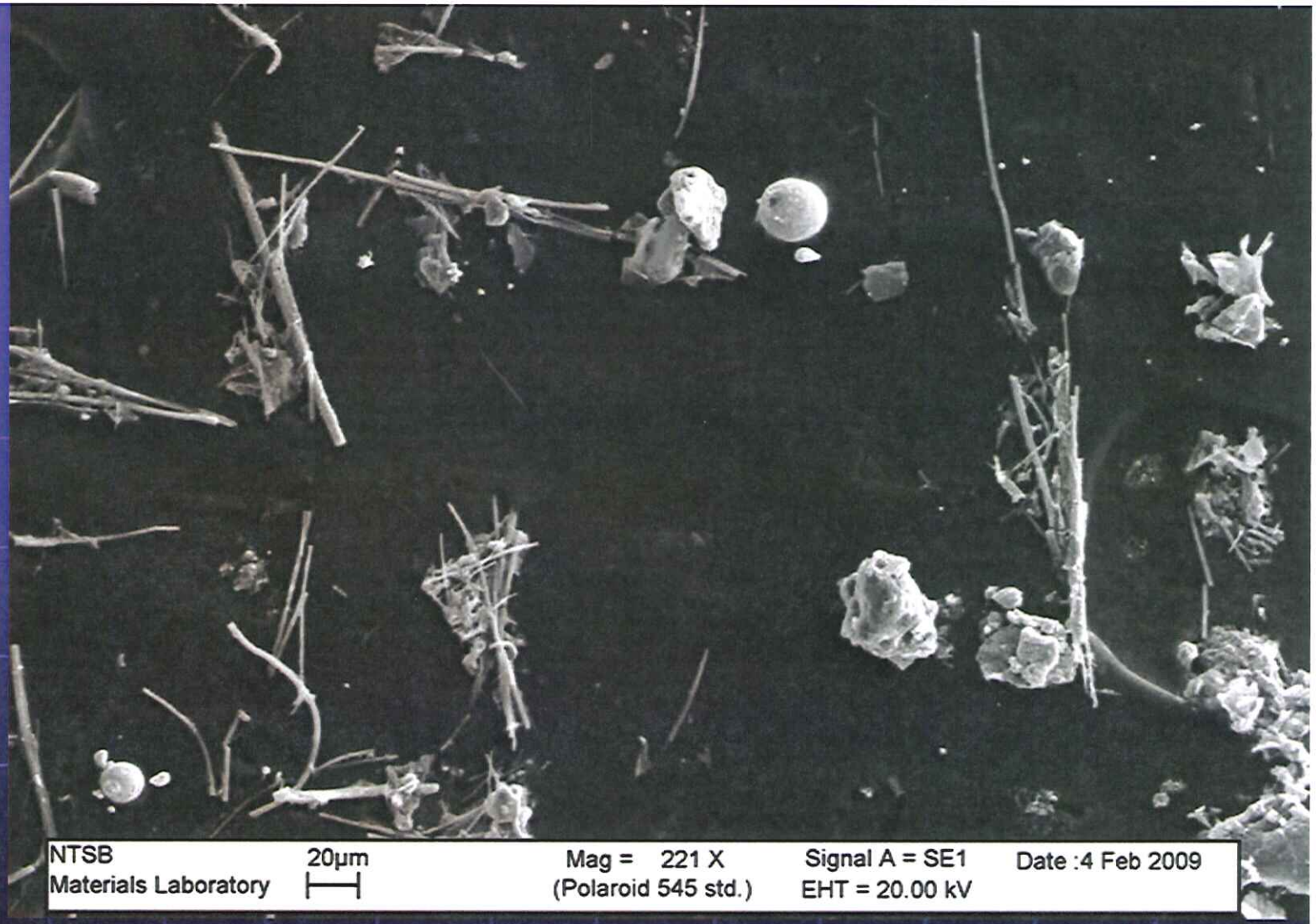
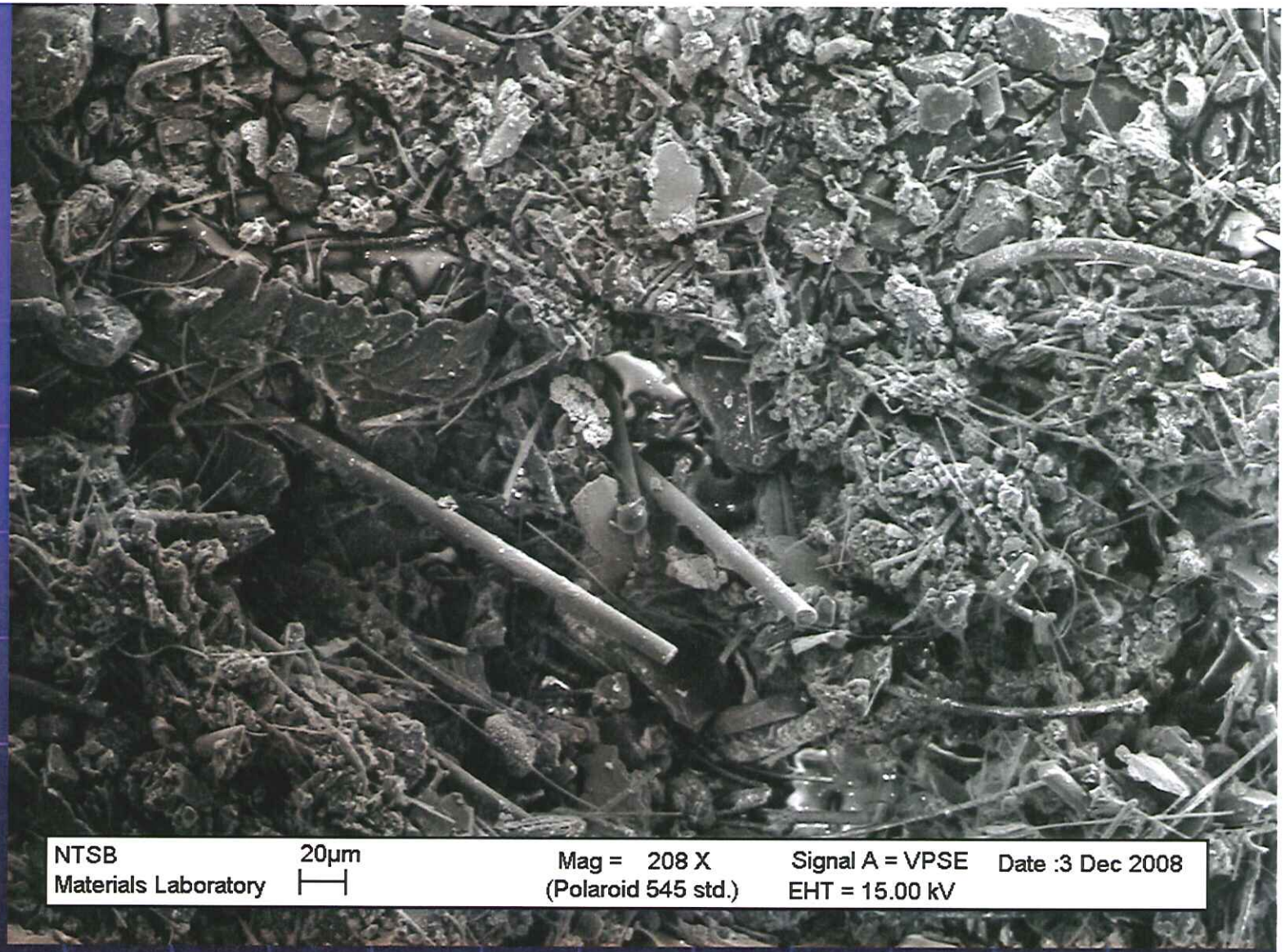
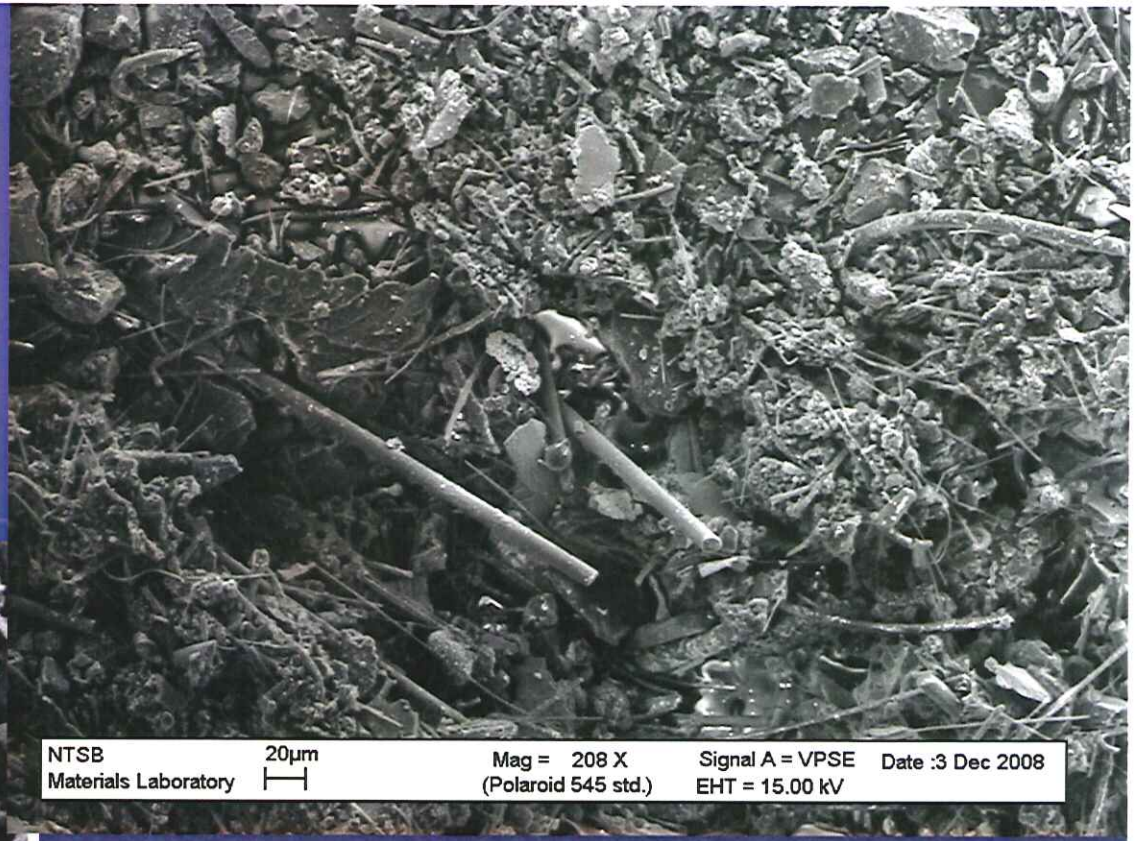


Accident Helicopter N612AZ
from # 2 FCU Filter 221 X



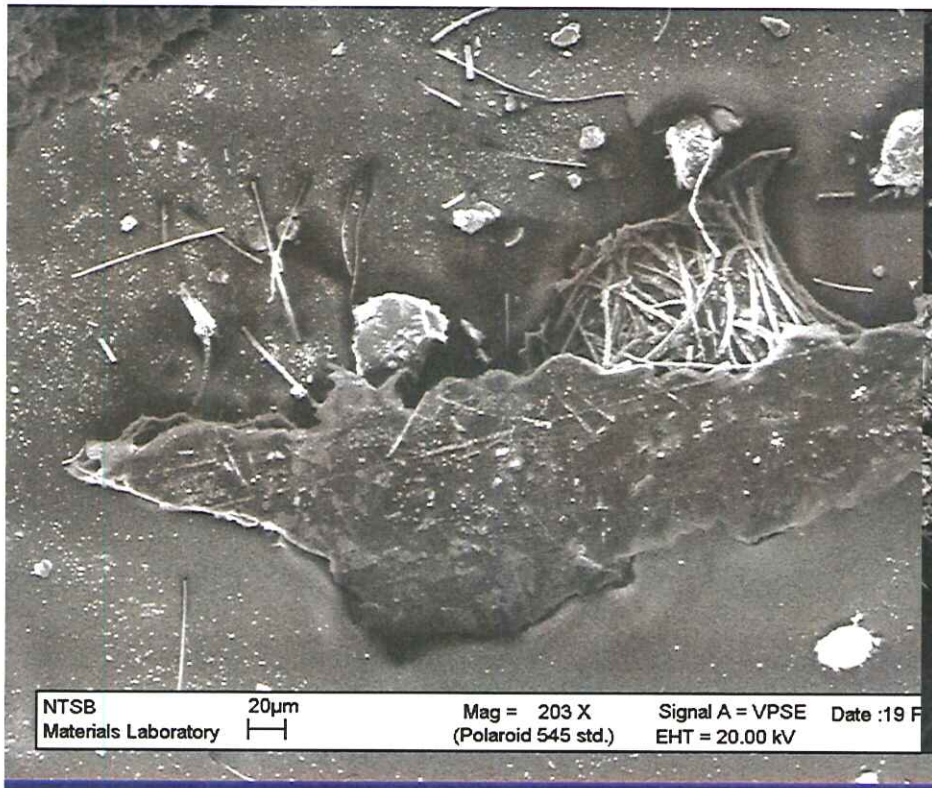
Accident Helicopter N612AZ # 2 FCU-PRV 208 X

N612AZ PRV - 208X



B.S.E.

Hayes Helicopter
PRV 430 X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Materials Laboratory
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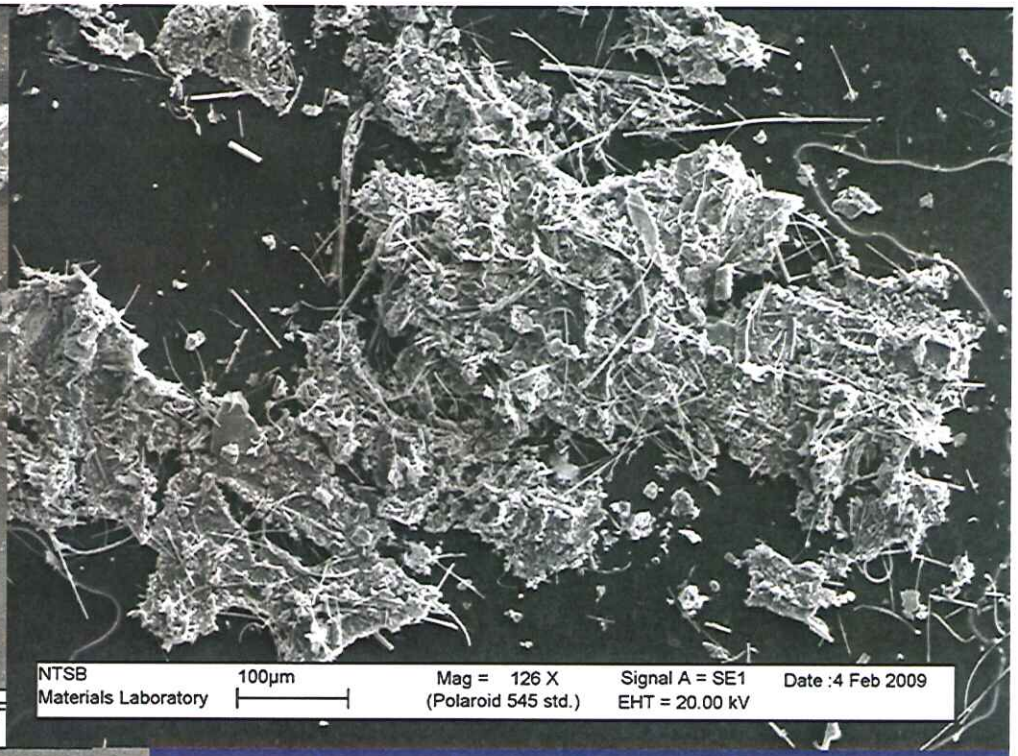
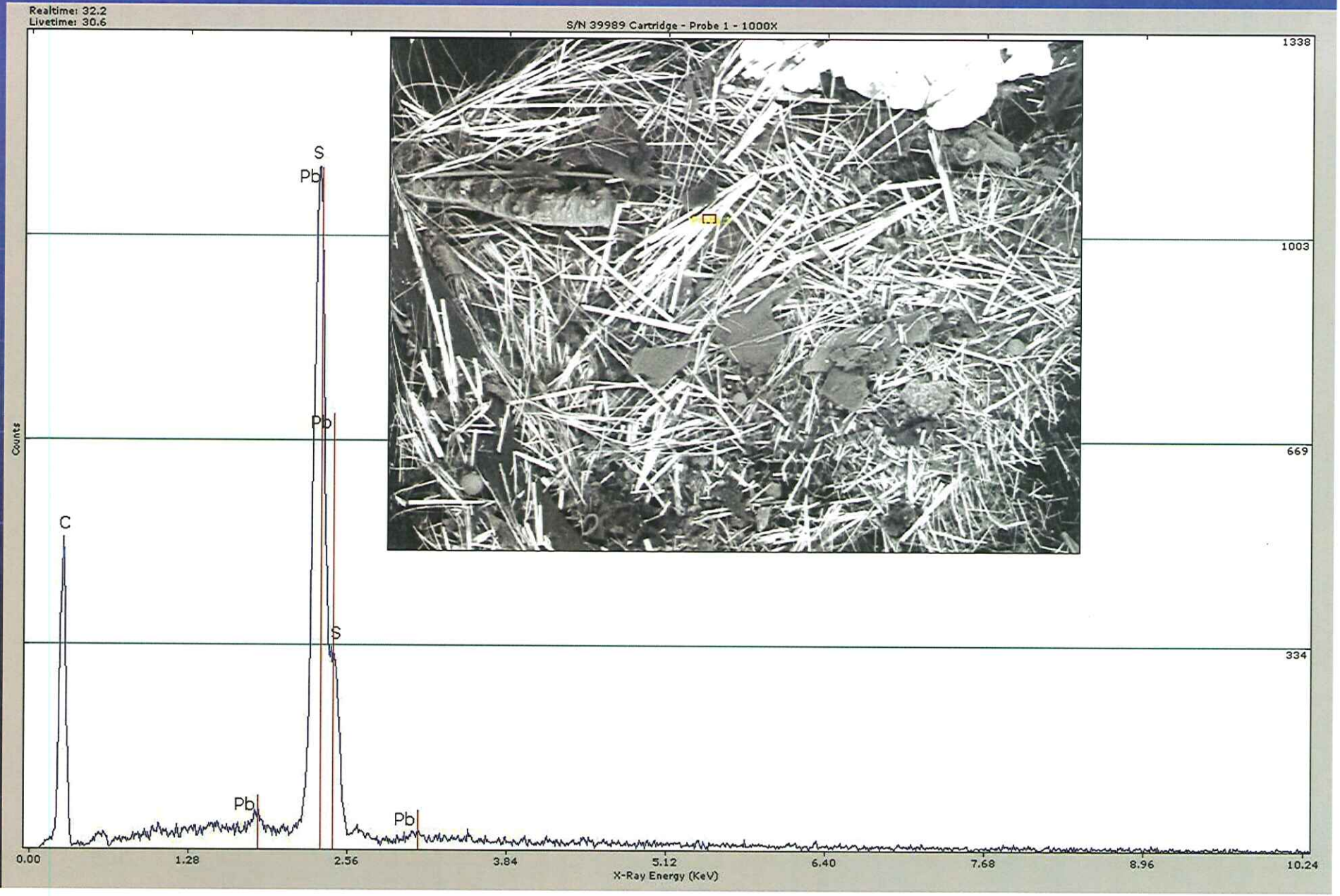
(Polaroid 545 std.)
Signal A = VPSE
EHT = 20.00 kV
Date :19 F

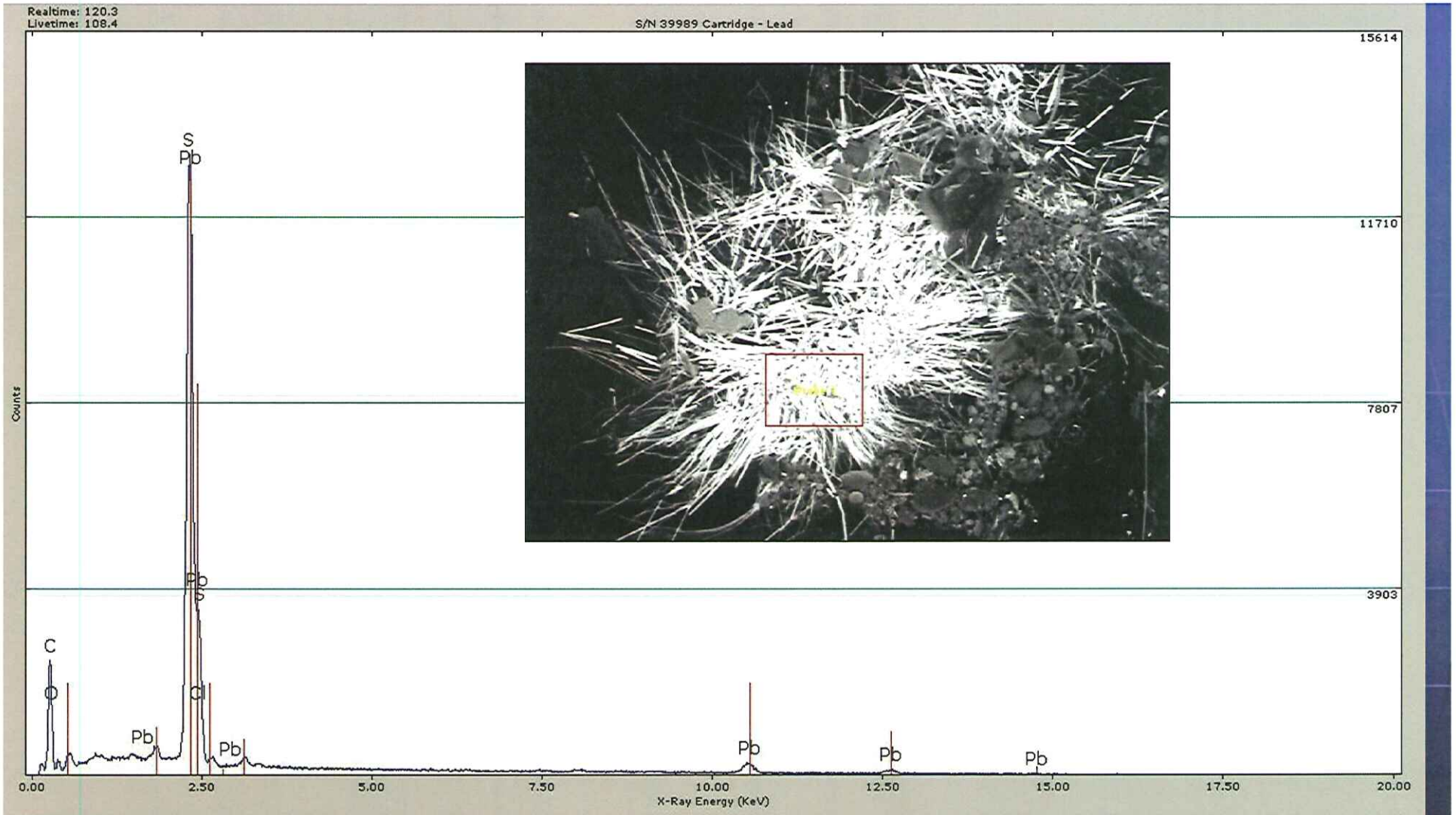

NTSB
Materials Laboratory
100µm
Mag = 126 X
(Polaroid 545 std.)
Signal A = SE1
EHT = 20.00 kV
Date :4 Feb 2009

N612AZ #2 PRV

N103WF Filter and PRV



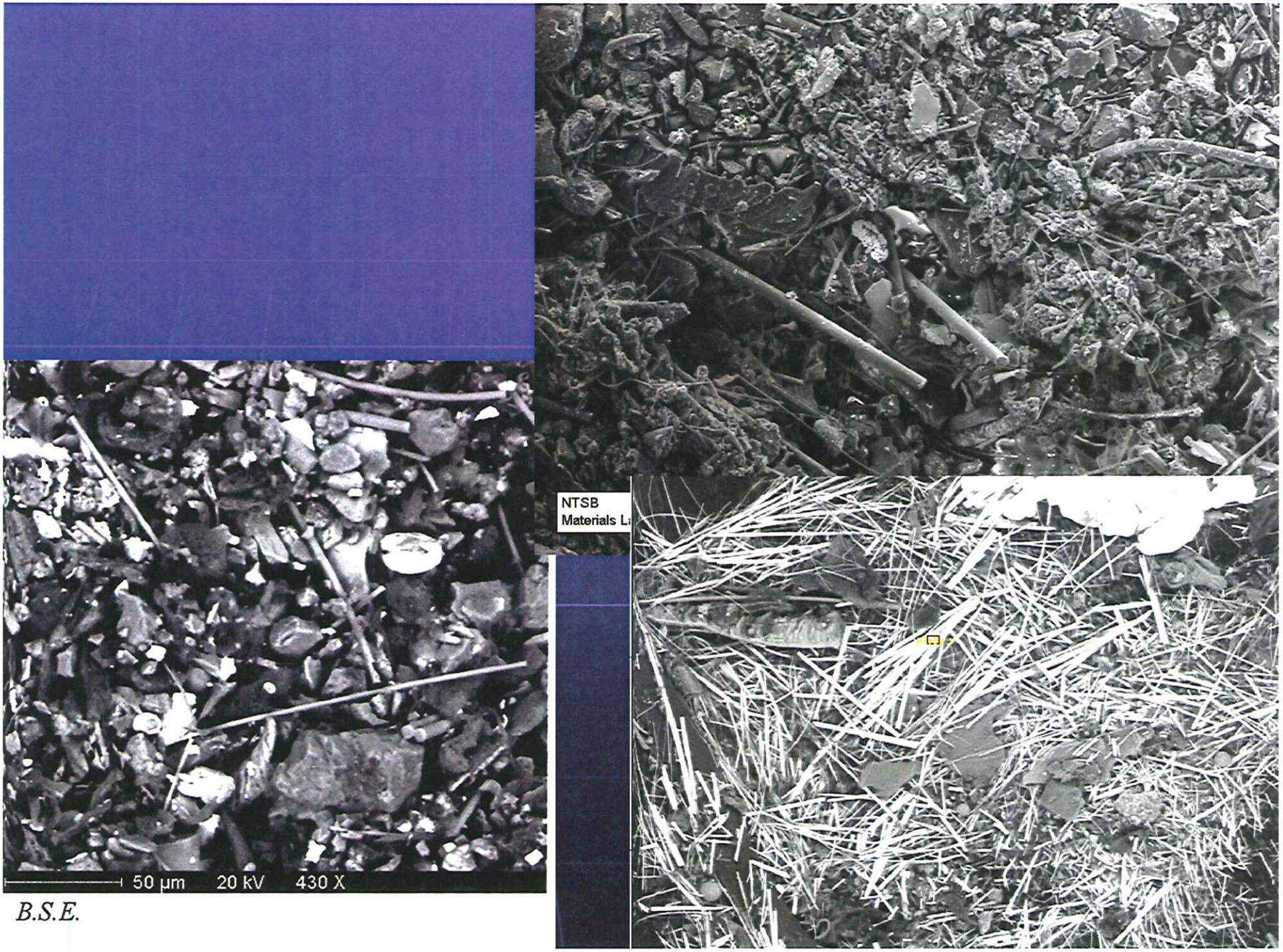
Carson N103WF (2008) Inside filter 250 X



Quantitative Results for S/N 39989 Cartridge - Lead
Analysis: Bulk Method: Standardless
Acquired 28-Jul-2009, 20.0 KeV @10 eV/channel

Element	Weight %	Atomic %
C	33.67	72.02
S	29.16	23.37
Pb	37.17	4.61
Total	100.00	

N103WF (2008) PRV



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