

Technical Bulletin Issue 1 - Preserving Evidence

Preserving evidence is not just necessary at a crime scene, it is something that should be adopted for material failures, accidents, and submission of all samples for analysis. Every investigation should follow a 'chain of evidence' and in this bulletin we will explore some simple rules for getting the best out of your laboratory work.

Many relatively simple cases could be challenged by the customer due to inadequate evidence procedures or poor 'continuity of evidence'. If they challenge results only when it comes to accepting liability, it can be inconvenient or sometimes even impossible to prove the results were from their components, especially if the analysis was destructive. Sometimes we have a choice of destructive analysis, or non-destructive methods such as electron microscope-EDAX, so this could be a subject for discussion when you send samples in.

Here are a few examples of problems we have experienced over the many years of carrying out material investigations:

- Gear failures may also benefit from oil and swarf analysis but they sometimes arrive already cleaned, and with no sump debris. It leaves us with only part of the picture.
- Pieces of a fracture are received but the main fracture surface is missing. We need to find the root cause of the problem.
- Complicated items like a failed gearbox are not accompanied by a drawing, leaving us time-consuming interpretations of gear working and over-run faces etc.
- Samples are sometimes not identified, are not packaged properly, or suffer subsequent damage in transport.



This fractured wheel-spoke reveals fatigue marks but they could easily be destroyed by dropping or rubbing in transit, as it is only 3mm diameter. This makes packaging an important part of the examination.

START WITH CORRECT PACKAGING

The term 'chain of custody' is used by the courts to show that an item can be completely accounted for from start to finish. Some of our more sensitive exhibits have to be delivered and collected by a policeman to preserve that chain of evidence. But for engineering clients, a trackable secure package delivered by a courier will usually be adequate. Those items still need a 'chain of evidence' though, proving that the items you sent were

the items we received. Ideally, an evidence bag should be used because it has a tamper proof seal, but most courier pack bags have a very strong seal and are a good alternative even if a box is also used. Provided we can say that the sample we received could not have been contaminated, intercepted or damaged in transit, that is usually sufficient even for quite sensitive cases.

Although you may not realise it, our investigation of your sample starts with an examination of the packaging, because damage to the package might have compromised the quality of the sample. Cardboard boxes reveal impacts, crushes and water damage, while plastic courier bags show tears, stress marks and impact bruises. We take these into consideration when we carry out our examination.

Liquids should be supplied in an appropriate container. Stainless flasks from a camping shop cost around £10 - 20 and will avoid contamination issues for liquid samples. They will also protect the liquid from leakage damage or bursting in transit, and will avoid the possibility of the liquid changing its properties if frozen in the hold of a plane. Don't assume flasks are clean though, we recommend that you fill and empty them five times with boiling water and let them drain and dry before use.

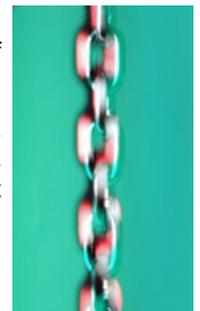
The report should identify exactly what component came from where

We often receive water samples in old 'pop' bottles. These are fine provided they have been thoroughly washed then rinsed out with the liquid being sent. Most soft drinks have a range of chemicals in them that can affect our analysis. The plastic used for these bottles, PET (Poly Ethylene Terephthalate), is fairly inert. But this could be the wrong container choice if we are looking for traces of organic materials as the plasticiser can leach out with time.

The forensic scientist's most aggravating samples are small particles either attached to a strip of Sellotape, or are placed in a self seal polythene bag. The former is notoriously difficult to extract particles from the surface, and traces of the adhesive can make electron microscopy a problem. But it has to be accepted that there is no better way to collect fibres. Miniscule particles in a plastic bag become attracted by static, making their removal very difficult, as they then fly around by themselves in their highly charged state. Better, then, to put them in a small wrap of paper and put that in the bag.

DEVELOP A CHAIN OF EVIDENCE

It might seem overkill to consider a chain of evidence for a failed component but in months or years to come our report entitled 'failed bolt' will be difficult to place, and valuable experience could be lost for ever. It is good practice to give us details for the exhibit so that we can incorporate that in the report, giving it a unique identity that is traceable and recoverable for future use.



The chain of evidence is simply a tracking record beginning with notes that describe where the evidence was received or collected. Collection techniques, preservation, packaging, transportation, storage and creation of the inventory list are all part of the

process used in establishing the chain of custody. Because we are forensic scientists by training, we will preserve that chain of evidence whenever we cut a sample, or send a piece off for specialist scientific analysis. Indeed, even simple jobs leave behind a string of pictures and notes here that can be used if results are challenged. This adds some cost, but unseen effort is your guarantee of a job well done.

PHOTOGRAPHS OF THE SCENE AND EXHIBITS

When we started out in business we used Hasselblads, roll film, and hand printing of photographs in the darkroom. Now, we can all take half-decent pictures with a low cost digital camera and send them at the speed of light by email. Getting the most out of this wonderful system helps us to concentrate on what is important, and helps you get the best report for the least cost. It also ensures we can plan a site visit correctly equipped.

Pictures really do paint a thousand words. General photographs of the scene of an incident help us to interpret the context of a failure. Ideally, include a ruler, everyday object like a chair, or a person to give the picture a scale. It helps to take views at different angles too.

Pareto found that 20% of his pea pods contained 80% of the peas.

Pictures of failures should be taken with and without flash, preferably also with lighting at an angle if possible because it helps to reveal more detail on a fracture. Arrows, or a finger to point to the damage sometimes also help.

If the camera has settings, use the best resolution (most pixels) as we can then gather more detail from an email by zooming in. This makes emails better than photographs. Where possible, we will include your pictures in your reports where they are relevant.

E- INVESTIGATIONS and the PARETO PRINCIPLE

We have recently pioneered the use of modern communications and image capture to conduct failure investigations remotely. The principle of e-Investigations is based around good quality pictures, image enhancement, interpretation, and reporting without even handling the sample.

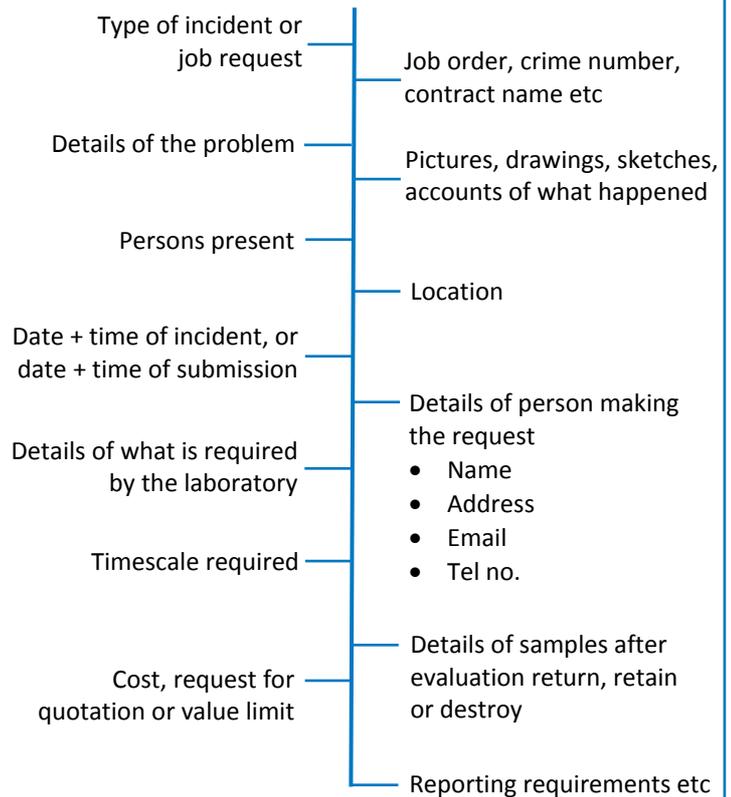
The Pareto principle appears to hold true for most applications. In 1906 economist Vilfredo Pareto observed that 20% of the pea pods in his garden contained 80% of the peas, and 80% of the land in Italy was owned by 20% of the population.

We have realised that by utilising our vast wealth of failure investigation experience we can provide 80% of the information you need by receiving good quality pictures of your failed component and providing you a report by email. This is at 20% of the cost of a full blown investigation, but it is speed that is of the essence.

- Contact us by email at info@ssdlab.com for advice on taking photographs etc.
- Send us chain of evidence details of the problem by email, with pictures of the failure etc. using the flow chart opposite.
- We'll use our data handling to identify the cause of the problem.
- We report our findings by email, with your pictures annotated.
- We have installed a superfast fibre optic server system to handle large images, and can guide you through the process.
- This system provides you with 80% of the information but at 20% of the total cost and in a timely manner. That information allows you to make an educated decision on how to proceed.
- The system is ideal for overseas clients, for remote access, or for complex failures where it is critical to identify which area to sample for more work.

Using this system will resolve most incidents quickly and efficiently, impressing your clients. We can always follow up this work with some carefully chosen detailed work if necessary.

Submitting Samples for Evaluation



AIDE MEMOIRE

PEOPLE

Sex, height, build, age, hair (colour/cut), nose, ears, eyes (colour/glasses), mouth, race (ethnic origin), tattoos, scars/marks, distinguishing features, jewellery.

VEHICLES

Registration number, Colour (body and interior), make, model, body style (2 or 4 door, van, estate, pick-up, hatchback, saloon etc), condition (new, old, damaged), others (stickers, mirrors, towbar, sunroof, aerials, wheel trims etc.).

MATERIALS ETC

Item identity, location, protect from damage or contamination, protect from elements, photograph in situ first, include location and positioning, collect all relevant material, secure by chain of evidence. Consider using the e-Investigation process.

SCENE PRESERVATION

Do not expose individuals to health risk, note may be more than one scene / failure, protect items from the elements, protect fluids and impressions, protect area from additional damage, contamination or fingerprints/footmarks etc.

Next issue: Fatigue failures.

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