



Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000

## Renewable Lubricants Bio-Shredder Machine Lubricant Evaluation Pilot Spring/Summer 2011

Administered by:

Joshua Gallegos, contractor, Pollution Prevention (P2) Program, Sandia National Laboratories  
in cooperation with Kirk Hess, Chaparral Machine Services, Albuquerque, NM



### Introduction:

SNL has hundreds of paper shredders in use across the site for the destruction of official use and other documents. These machines require regular lubrication with an oil that is either applied manually, or by an automatic pump system. Although “vacuum pump” type oil is often used, in both the case of manual and automatic application, the sole function of the oil is blade lubrication. With the relatively low heat and pressure of this application, it is well suited for a biobased oil substitution.

Pollution Prevention staff identified a biobased oil manufactured by Renewable Lubricants and marketed as a paper shredder oil, for use in this evaluation. Several gallons were purchased for use in pilot tests at SNL and in shredders at Chaparral Machine Services location. The purpose of this evaluation was to compare the performance of Bio-Shredder oil with the performance of conventional shredder oil product currently in use at SNL. Product performance was evaluated in automatic lubricating, high security, crosscut paper shredders that meet National Security

Agency (NSA) 02-01 standards for this type of device. Two machines of different manufacture were evaluated at Chaparral. During the approximately 3.5 month test period, Chaparral attempted to duplicate the shredding activity of a high volume office environment similar to those common at SNL.



Figure 1: A standard issue of low quality machine oils is gumming-up in shredder blades; particular attention was given to identifying this issue throughout the evaluation.

Chaparral Machine Services is a service provider to SNL and has been in the paper shredder maintenance and repair business since 1990. A locally owned and operated company covering the entire state of New Mexico and El Paso, Chaparral specializes in sales, service, and repair of paper shredders. Chaparral is an approved warranty repair center for many makes of shredder and is knowledgeable in repairs for all makes and models. Kirk Hess, owner and operator of Chaparral Machine Services, served as the primary contact/shredding machine expert for this evaluation.

**Evaluation:** Below are notes from throughout test period

Initial Visit to Chaparral Machine - February 21, 2011

Met with Kirk Hess (owner/lead mechanic) of Chaparral Machine to discuss pilot of Renewable Lubricants Bio-Shredder oil in NSA rated, high security paper shredding machines. Hess informed me that Chaparral has received several requests for a biobased shredder oil from customers in recent months and that he is excited about the prospect of sourcing biobased product for sale in Albuquerque.

It was agreed that Pollution Prevention (P2) group would provide the Renewable Lubricants (RL) product to Chaparral Machine for evaluation in a paper shredding machine, at their location. Chaparral agreed to completely remove all previous oil/paper debris from the paper shredder to be evaluated prior to application of the biobased product, and that all metal parts of the machine would be “factory” clean.

Phone conversation with Chaparral Machine - February 24, 2011

Hess has identified two machines for use in the evaluation. The first machine is a Dahle 20835EC – classified cut/high security paper shredder. Second machine is an SEM 266 – classified cut/high security.

Prior to beginning evaluation, Hess performed the following:

Previous lubricating oil was removed with acid wash (removed cutting head, head soaked in, and then sprayed with acid using a pump sprayer, specific product used proprietary). Cutting head was replaced, then spray cleaned using carburetor cleaner to remove remaining oil. At this point the cutting head was completely free of lubrication, oil and acid having been removed. According to Hess, this was “as close to new condition as possible”.

Hess began running 20lb copy paper through the machine this week; 500 sheets so far. To begin, machine was run “dry”, until it jammed. Amp meter readings were taken on how much current the machine was pulling while shredding between zero and 10 pages at a time. Hess will inform me when he is ready to add biobased oil to shredder.

Phone conversation with Chaparral Machine - February 28, 2011

Hess lubricated machines as if preparing to send out to customer. This involved removal of cover and manually applying oil to entire cutting head with squeeze bottle (pre-lube) prior to starting machine and automatic pump lubrication. (pre-lube approximately 2 ounces)  
Evaporation test: On February 20<sup>th</sup>, Hess dripped a few drops of oil on the plastic cover of one of the shredders. Eight days later, the oil does not appear to have thickened or evaporated.

---

Readings from current meter (Fluke 322 clamp style current meter) on Dahle and SEM machine running with no oil, and then oiled with Bio-Shredder oil running 1-10 sheets of paper:

Dahle 20835 Current Meter Readings (amps)

Pages	0	1	2	3	4	5	6	7	8	9	10
Clean	2.92	3.3	3.7	4.4	5.1	6.0	7.3	8.6	10.0	11.5	18.5
Oiled	2.8	3.1	3.3	3.7	4.1	4.6	5.1	5.7	6.3	7.1	8.3

SEM 266 Current Meter Readings (amps)

Pages	0	1	2	3	4	5	6	7	8	9	10
Clean	8.4	8.8	9.1	9.9	11.1	12.6	14.6	17.1	21.8	25.2	35.13
Oiled	8.5	8.9	8.9	9.2	10.4	10.5	11.7	13.1	14.8	17.2	20.3

---

Visit 2 to Chaparral Machine - March 16, 2011

Following up on phone conversation: Before running, machines were pre-lubed with 2.0 oz of RL Bio-Shredder machine oil and then only by automatic pump during operation.

**Dahle machine** uses factory installed Bijur lubrication pump. Automatic pump pushes roughly  $1.3 \text{ cm}^3$  of oil out every 12 seconds the shredder motor runs. 88 ounces of lubricant were added to reservoir. Dahle machine has shredded approximately 5000 pages with Bio-Shredder oil, to date. Lubrication pump is fully functional, no problems detected. Chain and sprockets show some buildup of oil, likely caused by spray from cutting head (Hess). Nothing unusual noted.

Oil appears to be functioning well in the cutting head. No abnormal sounds, jams, or difficulty in feeding. Hess will continue to have his employees shred as much paper as possible.

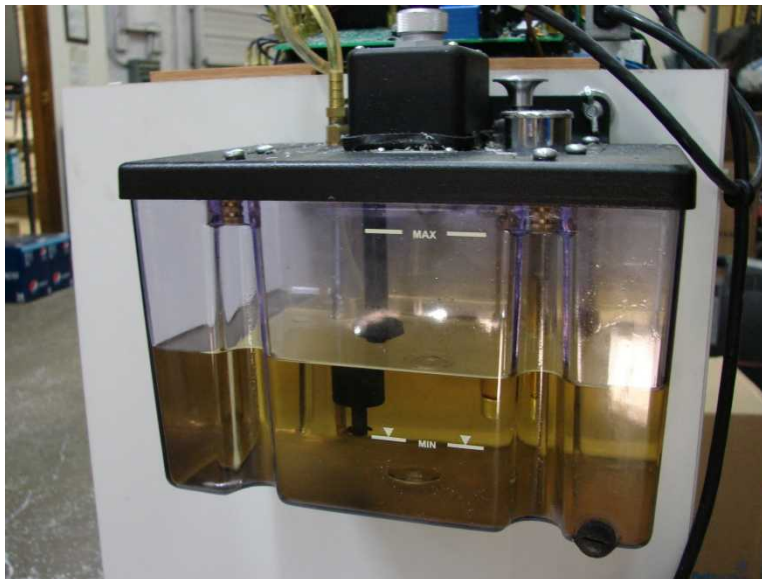


Figure 2: Oil reservoir and automatic pump unit

**SEM machine** was run for three days with Bio-Shredder oil, a total of about 500 sheets, and then returned to owner. The owner is using conventional oil in the lubricating pump. Hess will inform P2 of any issues that arise with this pump that may or may not have resulted from mixing of conventional and biobased oil. (**UPDATE:** As of October, 2011, Kirk has not been contacted with issues on this shredder, SEM machine was returned to customer March 20<sup>th</sup>.)

Evaporation test: Drops of oil placed on machine cover have run down the cover and spread out on the plastic. No stickiness is noticeable on the area where oil has spread; area is still slick to the touch.

Final visit to Chaparral Machine - June 8, 2011

Dahle machine has shredded between twelve and fifteen thousand sheets of 20lb copy paper with Bio-Shredder oil as lubricant. Approximately 64 ounces of the Renewable Lubricants oil provided was used by the machine in shredding this quantity.

Hess reports no malfunctions or problem symptoms throughout the test period. A small quantity of paper dust appeared on inside of head cover where oil had been. No gum-like build-up of lubricating oil was detected. Shredder parts were examined closely for build-up including: head



cover pieces, drip plate below oiler wick, shredder blades, and inside of plastic case. Gear grease was noticeable on chain drive system and on directly exposed parts of plastic case (in drive line). Greatest accumulation of paper dust was found on fan blades, according to Hess, common for this type of system.



Figure 3: Dahle shredder head, cover, and wick at end of evaluation

#### **Final comments:**

Renewable Lubricants Bio-Shredder oil performed as well as conventional products used for paper shredder lubrication for the period of this evaluation. Machines did not exhibit oil buildup on the blades which is the most common problem issue with shredder lubricants. When left to the open air, Renewable Lubricants product did not evaporate as is also common with low quality oils. Instead, after more than eight days, the oil spread out onto the plastic cover of the machine. Cutting head remained clean and lubricated for duration of evaluation period. Jams were not experienced on either test machine during shredding and the pumps exhibited no issues delivering product to oil wick. Oil distribution from wick remained even throughout evaluation indicating no clogging or drying in wick. At the conclusion of this evaluation, Kirk Hess and Chaparral Machine Services provided endorsement of this product for use with classified cut/high security shredder equipment.