Report of Meeting
L-60-1 Surveillance Panel
Aug. 12th , 2026

Attendees:

SwRI -	**Wright,** Lange
Lubrizol -	**Schaup,** Westmoreland, Janca, Grewe, Arnold
Afton -	**Sangpeal,** Bell, Campbell, Horvath
Intertek -	**Murray,** Portell
TMC -	Beck, Venhoff, **Transue**
BASF -	Goyal**, Caridi**, Mosher
Dana -	**Gibson**
Cummins-Meritor -	Catania
Army -	**Comfort**
Dauch -	**Muransky**
Fuchs -	Bender, Maxim, Finzenhagen
Oronite-	**Warden**
Shell-	Uy, Schweitzer
Exxon-	**Jetter**
Daimler Truck NA-	**Vander Wal**
Richful Lube Additives-	**McCollum**
International Motors-	Jeanelle
VBase-	Hunt

Voting Members in **BOLD**

1.0 Membership Review

2.0 Meeting minutes Approval

Motion #1 → Lange 1st /Schaup 2nd approve the meeting minutes from the May 13th, 2026 , ASTM Meeting. Motion passed unanimously, 14-0-1 (Yes-No-Abstain).

3.0 Action Item Review

Previous Action Items:

- Pilot batch purchase (Closed as of 9/10)
- Off cadence meetings (Open)

4.0 Dana Gear findings

- It was determined by Dana using SEM that there were no surface differences between the two prepped surfaces (leaded and unleaded). This refutes the theory that the lead is being smeared across the gear surface when the gears are being prepped. Additionally, it was extremely difficult to detect the presence of lead on the leaded gear. The email that contains these findings will be attached in the appendix for review.

5.0 Paths forward concerning L-60 leaded gear shortage

- The Dauch gear test plan will be established at a later date, Nick Schaup to schedule meeting.
- Lead coupons were discussed as a possibility to run, Nick Schaup to schedule a meeting to discuss further
- Re-Used gear data, as of this meeting Lubrizol has not completed it's second set of re-used gear runs. Once completed the data will be sent to the TMC and the panel will convene to review that data.

6.0 Dauch Order

- Dauch order was shipped in September

6.0 Old Business

7.0 New Business

8.0 Action Item Summary

- Action Item #1: What if Analysis for target updates Wesley Venhoff
- Action Item #2: Schedule meetings to discuss each bullet in the Path(s) forward section Nicholas Schaup

9.0 Adjourn

Motion #2 → Schaup 1st /2nd Lange to adjourn. Motion passed unanimously, 14-0-1 **(Yes-No-Abstain).**

Respectfully submitted,

Nicholas Schaup
L-60-1 Surveillance Panel Chairman

D02.B0.03

L-60-1 Surveillance Panel Meeting

8/12/2026

Nick Schaup

Agenda

- Call to Order/Agenda review
- Membership review
- Meeting Minute Approvals
  - May 13 th 2026, Surveillance panel meeting
- Action Item Review
- Dauch Gear update
- Surface analysis by Dana
- Old Business?
- New business
- Adjournment

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Membership Review

Allen Comfort	**US Army**
Trevor Gibson	**Dana**
Margaret Caridi	**BASF**
Micheal Portell	**Intertek**
Jessica Carowick	**Cummins**
Brad Transue	**TMC**
Nick Schaup	**Lubrizol**
Matt Sangpeal	**Afton**
Payton Wright	**SwRI**
Steve Jetter	ExxonMobi
Troy Muransky	**AAM**
Rebecca Warden	**Oronite**
Clarance McCollum	**Richful**
Andrew Smith	**Infinium**
Camden Vander Wal	**Daimler**
Addison Schweitzer	**Shell**

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Meeting Minutes Approval

– May 13th, 2026, Surveillance Panel Mtg

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Action Item Review

- Pilot batch Purchase
  - Quotes were split into 4, Dauch is working on the gears?
- Metallurgical Analysis by Dana
  - Completed, will be discussed
- What if analysis for target updates
  - To be completed soon

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Dauch gear update

- Original data package was insufficient to produce gears. Lubrizol shipped a set of gears to Dauch to be replicated on 7/2.
- Reached out for an update on 8/11

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Metallurgical Analysis of leaded gears by Dana

- One set of unleaded and one set of leaded gears were shipped to Dana on May 29th
- Trevor to present results

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Path forward

- Duach higher sulfur content steel
  - Labs to run these once manufactured
- Lead coupons
  - Labs to run one test lead “washer” coupon with unleaded gears
  - Run on 145
  - Meeting to be scheduled in the next two weeks
- Re-used gears
  - Review each stands results against each stands severity chart
  - (Treat the test as chartable)
- Exploration of re-distribution of gears
- Set up a conference call with Dauch

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Old Business

New Business

Adjournment

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Schaup, Nick

From: Gibson, Trevor <trevor.gibson@dana.com>
Sent: Tuesday, August 11, 2026 2:19 PM
To: Schaup, Nick
Cc: Westmoreland, Jonathan
Subject: [EXTERNAL] RE: SEM EDS Analysis of leaded gears

Sensitivity: Confidential

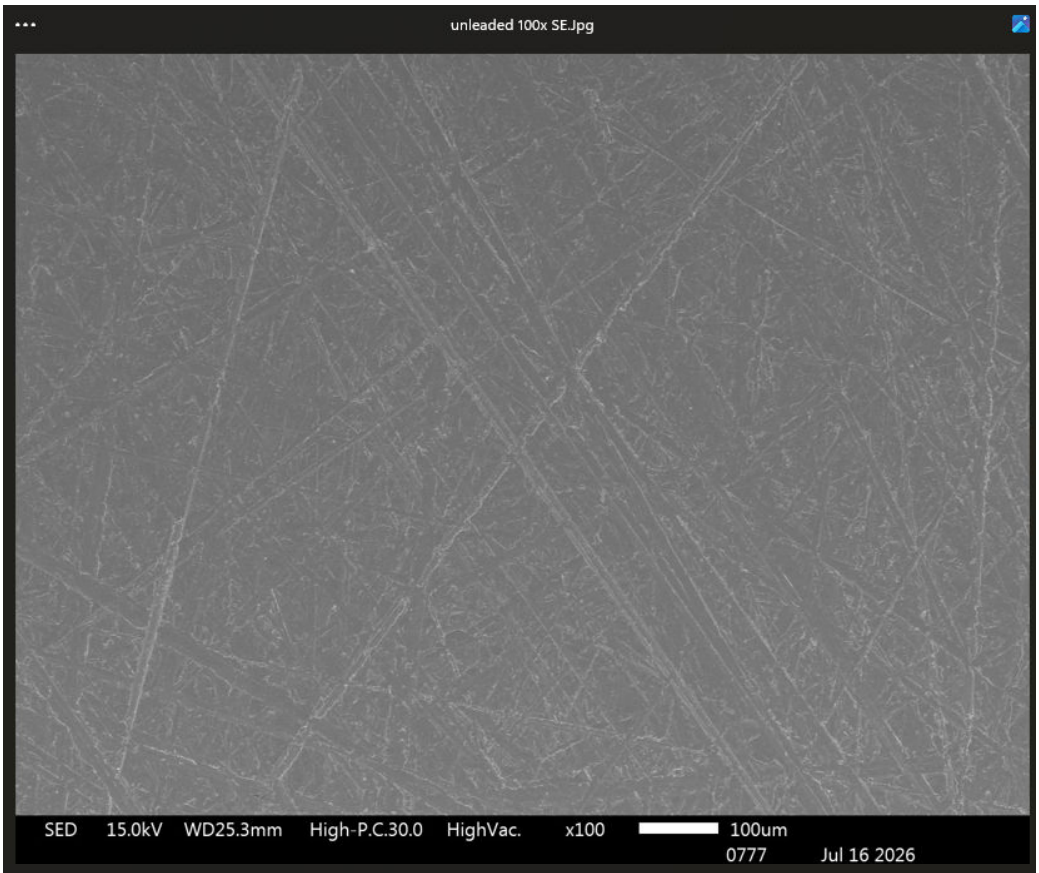
Follow Up Flag: Follow up
Flag Status: Flagged

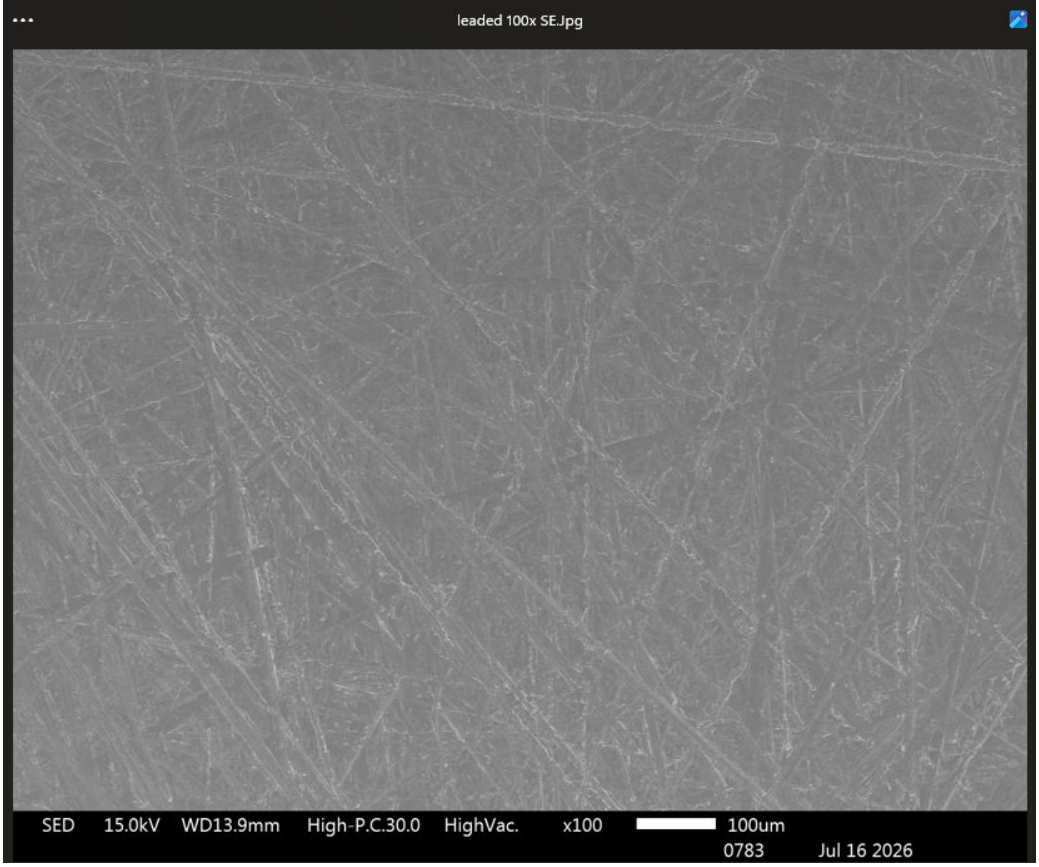
CAUTION: This email originated from outside of Lubrizol.
Do not interact with the content of this email until you validate the sender, links, or attachments. If unsure, report it using the Phish Alert Button.

Hey Nick,
Yes, I do have some to share. I was hoping to put it in a formal report but just haven't had time with this international trip I'm prepping for….

Long story short… We were able to section the parts longitudinally and at least confirm the presence of lead in the part. The lead attaches itself to the tail of the sulfur inclusions and does not smear itself on the surface of the steel. In fact, even with electron dispersive spectroscopy, it was difficult to even detect the presence of the lead in the steel. Here is a rough summary. I hopefully will still be on the call remotely and can speak to the data.

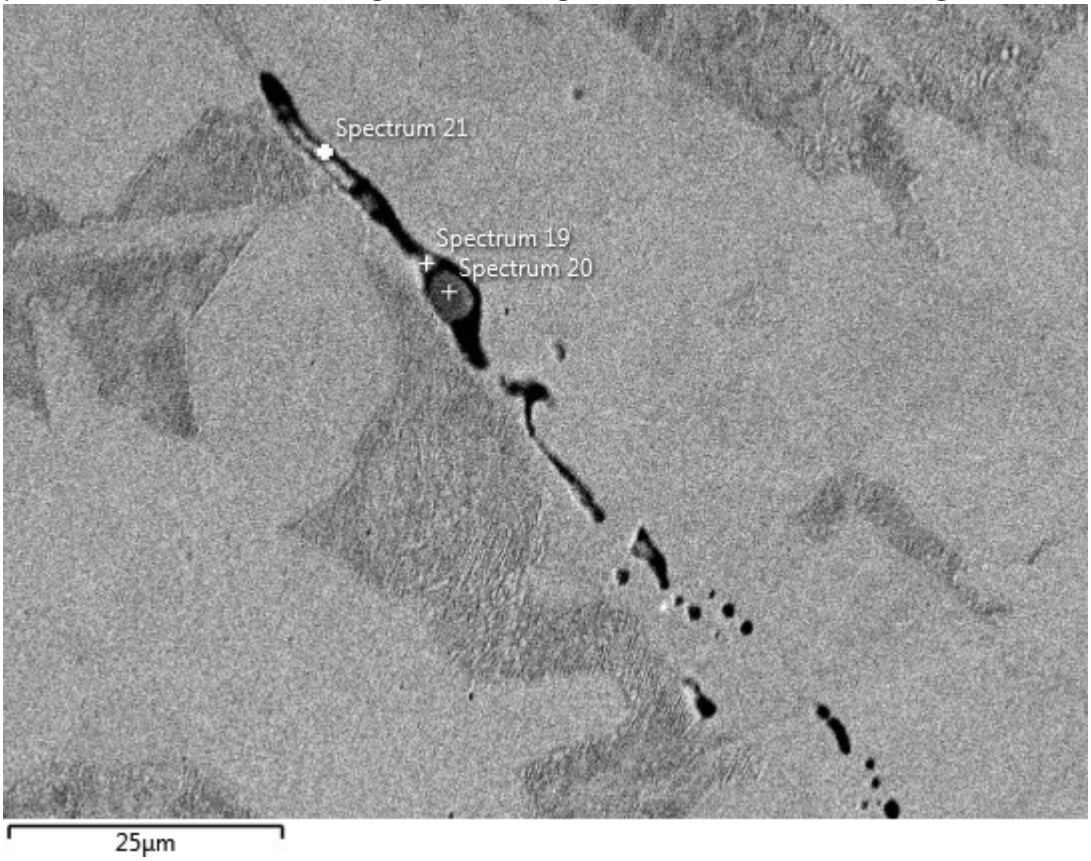
 SEM analysis of the leaded and non-leaded gear samples revealed **no surface differences**, disproving the original theory that lead was smearing across the surface. Checked with both Secondary Electron and Backscatter Electron (hoping the lead would show up a different shade due to it's atomic weight).





 Lead appears to be concentrated at the ends of **manganese sulfide (MnS) inclusions**. Since the gears are machined transverse to the bar rolling direction, examination of the gear face only captures the cross-sections of these inclusions, making lead extremely difficult to detect. The SEM image below

shows the inclusions. The lead is at spectrum 21. I did not have the EDS report attached to show the presence of lead. This image was of the gear sectioned in the “rolling direction” of the bar.



 Optical Emission Spectroscopy (OES) confirmed the leaded material contains approximately **0.48% Pb**.

 Based on the findings, there is currently **no clear metallurgical explanation** for why lead content appears to influence carbon varnish formation, as the lead is barely detectable even with highly sensitive analytical techniques.
 A recommended follow-up would be to test an **unleaded steel** with equivalent carbon, sulfur, and manganese levels. If MnS inclusions are influencing varnish formation, the lead itself may not be the primary factor because it is localized at the inclusion tails and minimally exposed at the gear surface.
 Historical machining trends support this theory:

- Early steels utilized both lead and sulfur for machinability.
- Improvements in machining reduced the need for lead, leading to widespread use of resulfurized steels.
- Further advances reduced the need for sulfur as well, due to its negative effects on gear performance.
- Modern gear steels typically specify very low sulfur levels.

Kind regards,
Trevor G.

From: Schaup, Nick <Nick.Schaup@Lubrizol.com>
Sent: Tuesday, August 11, 2026 1:17 PM
To: Gibson, Trevor <trevor.gibson@dana.com>
Cc: Westmoreland, Jonathan <Jonathan.Westmoreland@Lubrizol.com>

Subject: RE: SEM EDS Analysis of leaded gears
Sensitivity: Confidential

Hey Trevor,

Do you have a report or something that you can share in tomorrow's meeting?

Best,

Nick Schaup
Testing Engineer
nick.schaup@lubrizol.com

Lubrizol

From: Gibson, Trevor <trevor.gibson@dana.com>
Sent: Thursday, July 16, 2026 4:19 PM
To: Schaup, Nick <Nick.Schaup@Lubrizol.com>
Cc: Westmoreland, Jonathan <Jonathan.Westmoreland@Lubrizol.com>
Subject: [EXTERNAL] SEM EDS Analysis of leaded gears
Sensitivity: Confidential

Nick,
We put the samples in the SEM and tried to find anything weird between the two. Long story short, there is no difference. My theory of the lead smearing was proven wrong. The lead orients itself at the tail ends of the manganese sulfide inclusions. The gears are cut transverse of the rolling direction of the bar. So, that means that when we are analyzing the face of the gear, we are looking at the cross section of those inclusions. Basically, you cannot detect the lead at any decent level.

We also ran the samples on our optical emissions spectroscope and determined the lead content to be 0.48%. I am going to section the leaded gears in the rolling direction of the bar to at least characterize the lead better.

At the end of the day… It really makes no sense why the lead content affects our carbon varnish the way it does…. It is barely even detectable by an analytical device with the highest scrutiny…

My only recommendation would be to duplicate the content of carbon, sulfur, and manganese in an unleaded gear for testing. If for some reason these MnS inclusions are affecting it, the lead shouldn't matter as it binds to the tail end of these inclusions, and would barely be present on the surface of the gears.

If you look at the transformation of machining throughout the decades, they had leaded steel with sulfur. Then, machining got better, they said, we don't need the lead anymore, let's just make steel with Sulfur. Thus, standard resulfurized steel was born. Then, machining got even better. People said, get rid of the sulfur, it just negatively impacts gear performance. Then, they lowered the sulfur content. Now, we always request very low sulfur…

I will put together photos and some form of report to the group when I have finished the analysis.

Feel free to share my initial findings with the group.

Kind Regards,
Trevor G.

Trevor Gibson
Manager, Materials Engineering
Dana Incorporated

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