TK GLOBAL

Summary of the TK Global Report on Takata Desiccated PSAN Inflator Safety

December 2019

1 Introduction

This report summarizes the materials presented by TK Global, the successor to Takata, in response to the requirements of the Amended Consent Order, dated November 2015. The TK Global materials, presented to members of the affected OEM community and NHTSA during October 2019, were created pursuant to TK Global's obligation under Consent Order Paragraph 30 to "make a showing concerning the safety and/or service life of desiccated…Takata PSAN inflators… by December 31, 2019."

This report represents a sub-set of the materials presented to the OEMs and NHTSA with additional descriptive text added for clarity. This report begins with an Executive Summary capturing the key findings followed by a number of sections with additional supporting details. The complete materials presented should be reviewed for full details of the TK Global analysis of desiccated inflators to this point.

The key element of the report is a forecast of the safe service life for Takata-manufactured desiccated inflators containing Phase Stabilized Ammonium Nitrate (PSAN) propellants.

In this report, there will be references to Takata for specific items and actions that preceded closing of the TK Holdings Inc. bankruptcy and majority asset sale to Joyson Safety Systems, and TK Global (successor to Takata for PSAN issues) for specific items and actions that occurred after closing.

2 Executive Summary

2.1 Background

As stated in the introduction, this report summarizes the TK Global submission to the NHTSA aimed at satisfying the Consent Order obligation to "make a showing concerning the ***safety and/or service life*** of …desiccated Takata PSAN inflators..." For the purposes of this report, we defined "***safety***" as the absence of age-related propellant degradation exceeding a critical state level where an inflator rupture is plausible. We define "***service life***" as the time to reach the aforementioned critical state of age-related propellant degradation. Throughout this report, the loss of propellant density is used as a proxy for the state of degradation.

TK Global is not aware of any relevant industry or government standard for an acceptable service life that can be applied for this analysis and makes no judgement as to the acceptability of any particular service life forecasted in this report.

TK Global has not discovered an accelerated aging test that equates directly to field service life for desiccated (or non-desiccated) PSAN inflators. Instead, TK Global relies on multiple methodologies which provide valuable qualitative and quantitative assessments of the desiccated systems, as compared to the predecessor non-desiccated systems, and allows us to provide a forecast for service life of the major inflator types over a range of environments.

TKG arbitrarily limited our service life forecasts to 30 years. Some assumptions which must be made in a forecast model create increased uncertainty as timelines are extended.

2.2 Statement of Root Cause of the PSAN Inflator Field Ruptures

The following root cause statement was made in March 2015 by Takata in a meeting with representatives of multiple vehicle manufacturers.

The research and evaluation to date continue to point to the following factors as required elements in the underlying cause of the observed field events:

A decade-scale moisture migration into the inflator driven by local high absolute humidity conditions.

A slow change in the propellant physical conditions as evidenced by internal PSAN grain growth, pore agglomeration and potentially ionic migrations in the presence of elevated internal moisture and high temperature conditions, which are strongly influenced by certain vehicle platforms.

A resulting threshold-based porous burning phenomena related to the change in propellant physical conditions which causes high pressures, occasionally resulting in ruptures.

The industry-standard validation programs may not sufficiently test for this slow process in the high absolute humidity environments.

Additionally, there may be isolated instances of manufacturing departures related to seal integrity (tape application issues or tape damage due to welding) that may result in moisture intrusion and subsequent performance degradation.

The manufacturing influences upon the observed field events remain under investigation.

Research conducted in the last four years has continued to support the original statement. Outside investigators conducting their own independent research into the field rupture issue have also come to essentially the same conclusion as originally stated by Takata and confirmed through the research and testing of TK Global.

The additional time in the field and research conducted since 2015 has also further illuminated the importance of the propellant form factor (tablet versus wafer versus batwing) to the response of the PSAN propellant to the high heat and high humidity environments and the process by which the mechanical properties of the propellant may degrade to a critical state and pose a risk for rupture. Table 1 below identifies the number of global field ruptures in non-desiccated 2004 inflators by propellant form factor as compared to the respective volume produced. To date, there have been no field ruptures attributable to propellant degradation of desiccated 2004 and 2004L propellant inflators. It is also worth noting that the batwing form factor, which has the worst field experience, was not used in any of the desiccated PSAN inflators.

Table 1 Non-Desiccated 2004 Inflator Field Ruptures and Propellant Form Factors

Non-Desiccated 2004 Inflators			
Propellant Form Factor	**Field Ruptures**	**~Inflators Produced**	**Field Ruptures per Million Produced**
Batwings	260	25 M	10.4
Wafers	142	130 M	1.1
Tablets	35	90 M	0.4

2.3 Desiccated Inflator Approximate U.S. Population

In the course of PSAN inflator production, Takata used three different types of PSAN propellant. These propellants were designated 2004, 2004L and AMP. 2004, launched in the year 2000, was the original formulation and is the subject of the broad Takata inflator recalls. 2004L is an improvement on 2004 and contains a superior binder system which renders it less susceptible to moisture-adsorption-related degradation. It went into production in 2008. AMP, which stands for Advanced Main Propellant, was the third generation PSAN formulation which included further enhancements of the binder system and moisture adsorption characteristics. AMP was launched in 2014 and only used for one OEM and in very limited quantities. No 2004L or AMP inflators have ruptured in the field or in Healthy Part testing due to propellant aging.

Based on airbag module production numbers, TK Global estimates the total population of desiccated PSAN inflators in the U.S. is approximately 56 million as detailed in Table 2 below. This number is based on initial production quantities and is not corrected for field attrition. Further, this estimate does not account for modules produced overseas that ended up in U.S. vehicles, or U.S.-produced modules that ended up overseas. This summary does not represent an estimate of the total affected U.S. vehicle population as many vehicles contain multiple inflators of the types noted.

Table 2 Approximate U.S. Desiccated PSAN Inflator Volumes by Type

Approximate U.S. Desiccated PSAN Inflator Volume (as-produced, millions)				
Propellant Type	**Driver Inflators**	**Passenger Inflators**	**Side Impact Inflators**	**Total**
2004	1.6	3.2	12.0	16.8
2004L	21.6	17.4	-	39.0
AMP	-	0.3	-	0.3

2.4 Field Return and Lab Test Data

There are three key evaluations that have significantly influenced our conclusions on the desiccated inflator service life effort. These are (i) Field Return testing, (ii) Accelerated Aging Cycling Tests, and (iii) Laser Scanning Micrometer (LSM) experiments. The section below summarizes the key observations from these tests.

2.4.1 Field Return Inflators

Ballistic testing and live dissection analysis have been performed on more than 28,000 desiccated inflators returned from the field through the support of multiple vehicle manufacturers. The data has been used to compare the condition and performance of the desiccated inflators to the known condition of the non-desiccated inflators after a similar exposure to field conditions.

The analysis of the 2004L propellant inflators with 8 or more years of field exposure has not shown the propellant degradation, either in terms of density loss or accelerated burning, as was experienced with the 2004 propellant in non-desiccated inflators. However, the absence of any degradation to this point makes it difficult to extrapolate degradation patterns into the future for service life analysis. Future field return analysis is needed.

There have been a small number of evaluations of field-returned inflators with 2004 propellant and 13X desiccant. While there is no significant degradation in these samples, the field age is low so no firm conclusions can be drawn from these observations.

2.4.2 Accelerated Aging Cycling Tests

Several accelerated aging studies have been performed to analyze the effect of desiccant and the robustness of the 2004L propellant formulation as compared to the 2004 non-desiccated inflators. The cycling tests performed on desiccated and non-desiccated inflators included: (i) thermal shock tests which cycled the inflators from 0 to 80°C for 4000 cycles, (ii) long-term cycling tests with elevated external humidity levels and max temperatures set at 50°C, 60°C and 70°C, and (iii) high temperature cycling test of inflators made with saturated desiccant.

The cycling studies to date have demonstrated: (a) the relative robustness to high temperature cycling of the desiccated 2004 propellant inflators compared to their non-desiccated counterparts; (b) that temperatures above 50°C are required to induce 2004 propellant degradation within the time limits of the study; and (c) the relative robustness of 2004L propellant as compared to 2004 propellant when exposed to similar high temperature and humidity cycling. However, while the cycling tests demonstrate the relative robustness of the desiccated inflators, and in particular the 2004L propellant systems, to the non-desiccated 2004 propellant inflators, accelerated cycling studies do not replicate the field environments and cannot be used to provide a reliable forecast of the inflator safe service life.

2.4.3 Laser Scanning Micrometer

The Laser Scanning Micrometer (LSM) testing involves the use of a device to replicate the realistic inflator headspace conditions for temperature and humidity which can be expected in the field to provide precise laser measurements of the responsive diameter growth of the propellant tablet or wafer as the temperature and humidity cycles. In test performed, this method has shown excellent qualitative correlation of the effect of temperature and humidity cycling within the inflator headspace to the known degradation patterns of 2004 propellant.

The LSM testing has further demonstrated the superior performance of 2004L propellant versus 2004 propellant in response to the same headspace environments. The LSM test data also correlates with the relative dimensional observations from the field and accelerated aging studies.

2.5 Service Life Determination Approach

The TK Global Safe Service Life Assessment is based on a Moisture Transfer Simulation Model and a Cumulative Damage Model. The field observation, cycling studies and the LSM tests are used as inputs to the models. The relationships of these models and the calibration sources used are depicted in Figure 1.

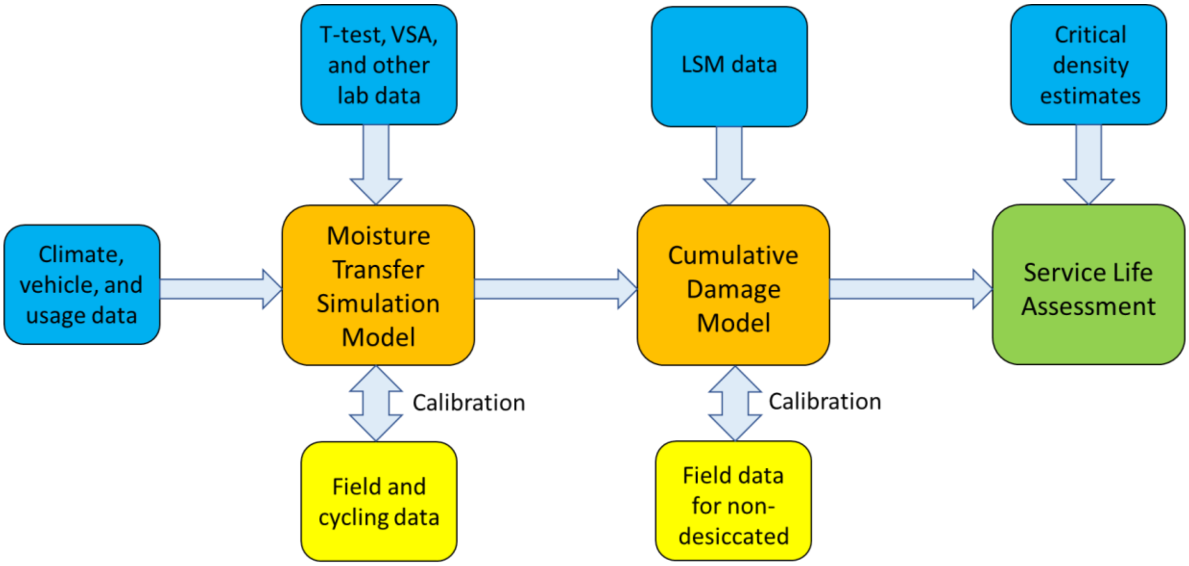

Figure 1 TK Global Service Life Model Flow Chart

The result of our effort is a predicted time-to-critical state that matches well with the broad population of field and cycling data.

The information is best interpreted as a relative assessment between the various inflators and climate conditions, rather than a guarantee of a particular service life for a particular inflator in a particular environment. The effort is focused on population-wide characteristics. The analysis cannot predict the frequency or effect of manufacturing departures or extraordinary environments which may affect any particular inflator.

The forecasts represent our current understanding of the complex micro-climate inside the inflator and how the PSAN propellant responds to this micro-climate over time. Our Cumulative Damage Model was intentionally calibrated conservatively to field and experimental data.

In all these evaluations, the results indicate a consistent pattern of outcomes.

- Inflators exposed to a lower peak temperature have a longer safe service life than inflators exposed to higher peak temperatures.
- The addition of desiccant to inflators using 2004 propellant extends the safe service life beyond that of their non-desiccated counterparts by minimizing moisture transfer into the propellant.
- 2004L propellant inflators have a much longer safe service life than 2004 propellant inflators primarily due to the superior binder system used in the 2004L propellant system.
- Inflators using the AMP propellant system should exhibit a similar safe service life to inflators containing 2004L propellant.

2.6 Minimum Safe Service Life Forecasts

Using the modeling methods detailed later in this report, we forecast the minimum safe service lives for representative desiccated inflators in the worst-case U.S. environment (Miami environment, hottest vehicle cabin temperatures, greatest long-term exposure to the sun during usage) as detailed in Table 3.

We are providing service life forecasts based on the primary chamber outcomes (where applicable) for several families of desiccated inflators. These forecasts can be broadly applied to similar inflators. TK Global has not assessed every inflator type, inflator chamber (primary and secondary) or design variant for the determination of service life at this time.

In Table 3 below, we are showing a relative age improvement for the desiccated SSI-20 over the non-desiccated version, rather than a specific service life. After 13 years of field exposure, there have been no propellant-related field ruptures in the *non*-desiccated SSI-20 inflator. We believe this is due to the more benign environment experienced by the seat mounted side airbag modules, which are ~10-14°C lower than driver/passenger inflators in the same vehicle.

Based on CDM simulation work done comparing other desiccated and non-desiccated inflators from one family, we forecast a >20% increased service life for the desiccated SSI-20 over the non-desiccated version.

As reflected in our service life forecasts, our research confirms the robustness of the desiccated 2004L vs. the desiccated 2004 propellant system.

Table 3 Forecast Minimum Safe Service Life for Representative Desiccated Inflators in Highest Risk U.S. Environment

Propellant	Inflator Type	Forecast service life for the highest-risk U.S. environment	Oldest current field age
2004 + 13X	SDI-D (tablets)	12.4 years	8 years
	PSDI-5D (tablets)	17.8 years	8 years
	SPI-D, SPI-2D, PSPI-D, PSPI-1.1D, PSPI-LD (wafers)	14.6 years	3 years
	SSI-20 (tablets)	>20% improvement vs. non-desiccated	11 years
2004L + 13X	SDI-X, SDI-X 1.7, SDI-X2, PSDI-X, SDP, PDP (tablets)	>30 years	11 years
	SPI-X, PSPI-X (wafers)	28.4 years	11 years
AMP + 13X	PDP-A (tablets)	>30 years	5 years

Based on the evaluations of the field returned inflators and the results of our safe service life analysis, TK Global believes that the non-recalled desiccated PSAN inflators in the field today do not currently present an unreasonable risk to occupant safety due to age-related degradation of the propellant[1].

[1] This statement applies to 2004-based inflators with 13X desiccant, as well as all inflators using 2004L propellant (the "X-series" inflators).

While the analysis presented here shows good fidelity with field and lab observations, periodic field monitoring is recommended to track the actual versus forecast performance as the field age increases.

2.7 Future Studies Proposed

TK Global plans to continue refining our service life forecasts through:

- Improvements in the LSM test methodology, including enhancements to the tablet fixturing method.
- Conducting additional LSM experiments to add robustness to the reduced propellant density correction factors and assess the cycle time influence on the LSM data.
- Improvements in the Moisture Transfer Simulation Model including mathematical improvements to speed the analysis cycle, improvements in the characterization of diffusion coefficients and improvements in the anchoring fidelity to cycle study results.

When the improvement noted above are complete, we will expand the scope of the inflators and chambers analyzed to include all important inflator families and configuration variables.

In addition to the items noted above, TK Global recommends that additional analysis of desiccated PSAN inflator systems retrieved from vehicles in the field should be conducted on a systematic basis into the future. Specifically, TK Global has been in discussions with NHTSA and some members of the OEM community regarding a plan to conduct ongoing evaluations of the field condition of desiccated inflators. Although TK Global currently has limited funding under the provision of the bankruptcy plan which is forecast to run out in mid-2021, some members of the OEM community have indicated a willingness to entertain discussions regarding the continued funding and participation of TK Global in the future testing and analysis of field-returned inflators beyond our current funding limitation.

We expect to have further discussions with NHTSA and the OEMs on the topic of field monitoring of Takata desiccated PSAN inflators.

3 Facts About the Takata PSAN Propellants

3.1 2004 Propellant

The degradation of the 2004 propellant in the field is caused by a combination of high peak exposure temperature, moisture, and time. The absence of any of the three elements prevents the degradation from occurring.

There is a substantial difference in outcomes between hot/humid regions and cooler regions, as well as the different cabin temperature profiles typically observed in small cars versus large cars.

The use of the AI-1 Auto-Ignition material in inflators using 2004 propellant may be a significant contributor to the degradation process through the addition of moisture to the inflator interior in quantities that exceed that absorbed through normal environmental exposure. The source of the moisture is the decomposition of the glucose which forms a part of the AI-1 formulation. This short-term flood of moisture is coincident with the observed rapid degradation in field samples at 8-10 years of life.

3.2 2004L Propellant

In contrast to the hundreds of known field and test ruptures which have occurred in inflators using 2004 propellant, ***there are no known field events related to propellant degradation in inflators containing 2004L propellant.*** Field data, lab cycling, LSM studies and modeling indicate a rate of 2004L density loss that is far less than the rate of 2004 density loss. The principle source of the superior resistance to density loss, and the associated service life extension, is the improved 2004L binder system.

No inflators using 2004L propellant contain AI-1 so there is no opportunity to generate the short-term, high moisture condition in the X-series inflators thru the decomposition of AI-1. Even if a super-saturation were to occur through some other means, the 2004L does not show the pattern of rapid density loss observed in 2004.

3.3 AMP Propellant

In 2014, shortly before the start of the PSAN recall expansion, Takata began production of inflators using a propellant know as AMP. AMP is type of PSAN propellant formulated for improved robustness against environmental stress. It was produced in limited quantities for a single OEM.

Analysis of the AMP Vapor Sorption Analyzer, LSM and Integrated Burning Rate testing indicates AMP will perform the same or better than 2004L. Given the limited quantity of available data, it is our position that AMP inflators should be treated the same as 2004L tablet inflators with regard to any service life decision.

3.4 Boosters

Takata used two boosters in the PSAN inflators covered by this report.

- 3110
- AIB

The 3110 booster does not have an autoignition function, so all designs using 3110 also include an autoignition material. The two autoignition materials are designated AI-1 and 9339. The AI-1 was previously mentioned as it has the possibility of decomposing in the field which can liberate moisture. The 9339 does not decompose in the field.

The AIB is a combined **A**uto**I**gnition/**B**ooster and no inflators using AIB contain either AI-1 or 9339.

Since the 3110 and AIB boosters have different moisture adsorption characteristics they create different headspace moisture levels, which is predicted to have a secondary influence (<10%) on forecast service lives.

4 Field Observations

4.1 Field Studies Background

As required by the Consent Order, Takata, in cooperation with multiple vehicle manufacturers, endeavored to acquire and test desiccated PSAN inflators from the field. The project, known internally as the "Healthy Part Collection," was intended to provide a cross section of inflator types, vehicle types, and locations to aid in the evaluation of the inflator service life. Evaluations were conducted on over 28,000 inflators as part of the Healthy Part Collection activity.

The goal was to determine if these inflators suffer from a defect condition, regardless of whether it is the same or similar to the conditions at issue in the broad Takata recalls, and to identify the basic rate of change in propellant density and performance to provide a basis for forecasting the inflator service life.

4.2 Density Trends

The results of these field studies showed a consistent pattern of outcomes. Principally among these is the observation that, unlike inflators containing 2004 propellants, inflators containing 2004L propellant, designated "X-series" inflators, do not show evidence of a population-wide decrease in density or increase in pressure or burning rate. Rather these inflators show stable density characteristics well beyond the age that non-desiccated 2004 inflators showed clear evidence of density loss.

This difference in response to the field environment is best captured in Figure 2. In this plot, we compare the normalized density trends for non-desiccated 2004 (orange) and desiccated 2004L (purple) propellant wafers. The difference is substantial.

Density data were evaluated for tableted propellant in desiccated inflators using 2004 and 2004L propellants. While there are no clear adverse trends observed in either the 2004 or 2004L systems, the age of the samples is too young to draw any firm conclusions.

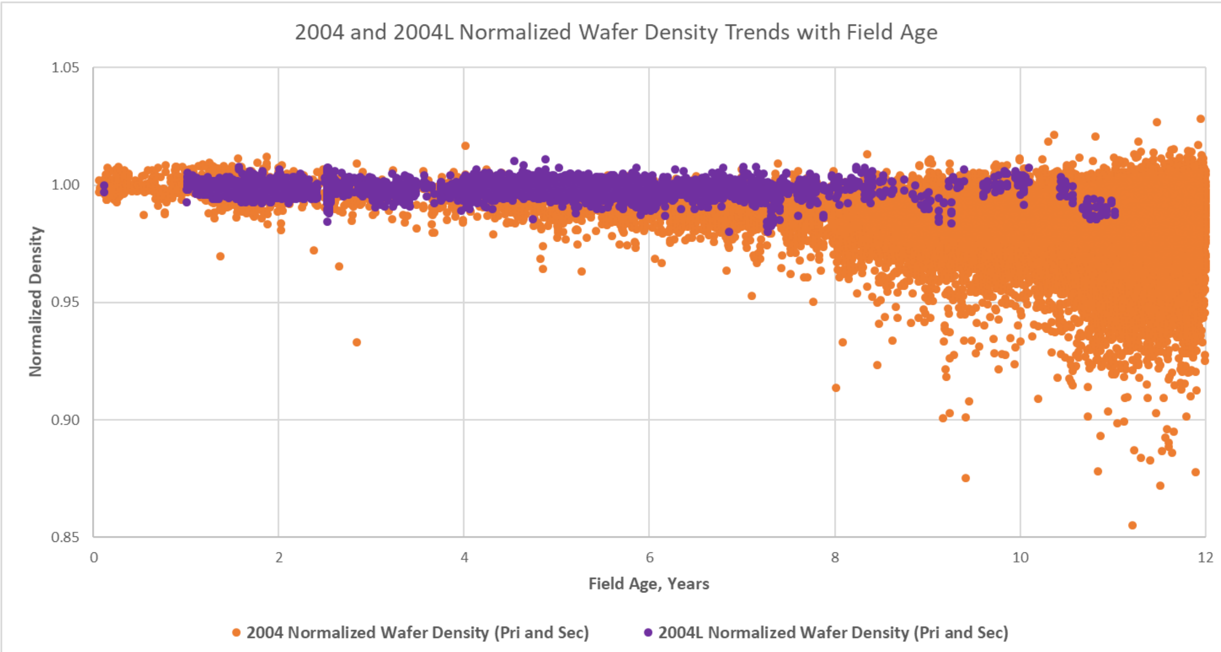

Figure 2 2004 and 2004L Normalized Density Trends with Age

4.3 Manufacturing Exceptions

As part of the evaluation of the X-series field returns from the Healthy Part Collection activity, we observed several instances of off-nominal manufacturing conditions that could impact the service life of individual inflators. These included some instances of compromised seals, filters, and missing components. While there is the potential that some of these departures may affect the ultimate service life of certain inflators, there is no current evidence of a loss of main chamber propellant density or a dangerous increase in performance associated with these observations. Further details are included in the original OEM/NHTSA presentation materials. We will continue to evaluate the sources, scope and potential long-term consequences of the manufacturing departures.

5 LSM Measurements

TK Global uses the results of the Laser Scanning Micrometer (LSM) measurements as a key element in its service life assessment effort. The output of the LSM is the measurement of the propellant diameter versus time measured while the propellant sample is being exposed to varying temperature and humidity patterns. When plotted, the results show two trends of dimensional change.

- The cyclic change in dimension due to the temperature fluctuations (thermal expansion).

- The permanent increase in dimension due to cumulative effect on the wafer.

Our analysis focuses only on the permanent dimensional change due to cumulative damage. The key value used in the analysis of the results is the slope of the permanent dimensional change trend. It is this permanent dimensional change, with the associated reduction in density, that is at the core of our Cumulative Damage Model.

Figure 3 presents a series of slope measurements taken on 2004 and 2004L wafers under various conditions of peak cycling temperature and absolute humidity. This Figure highlights the dramatic differences in the response to environmental stress between 2004 (shown in orange) and 2004L (shown in purple) and lower temperatures and absolute humidity (AH) levels (left-hand plot) and higher temperatures and humidity levels (right-hand plot).

From these studies, we can conclude:

- 2004 propellant loses density much faster than 2004L propellant when exposed to identical environments
- Higher temperatures cause faster degradation than lower temperatures
- Higher absolute humidity levels cause faster degradation than lower absolute humidity levels

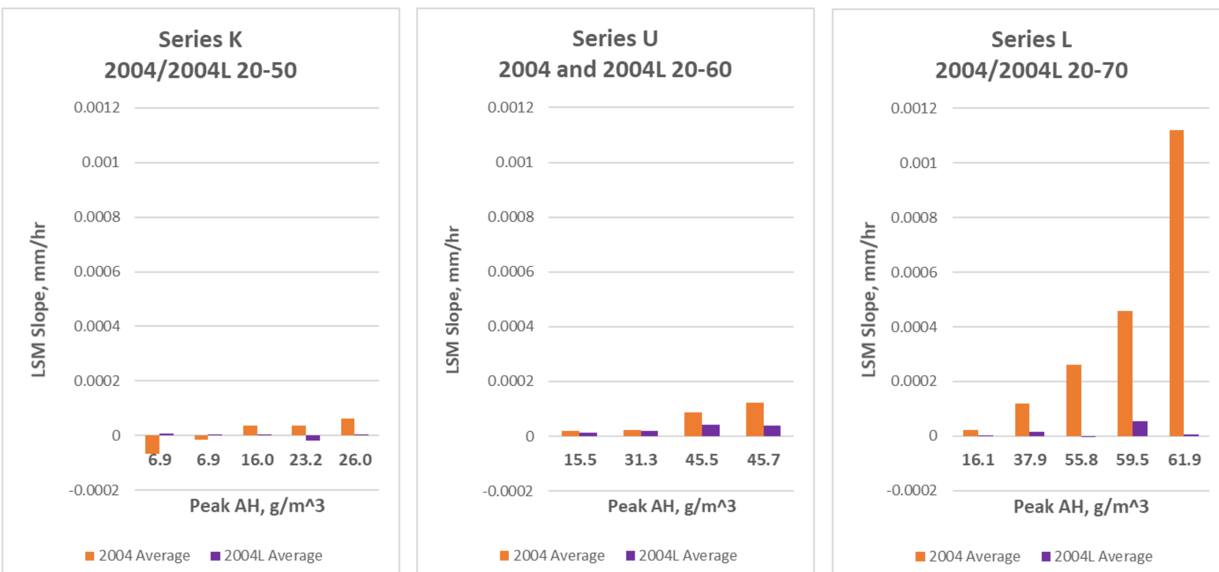

Figure 3 LSM Slopes for the Noted Environments

5.1 Cumulative Damage Model

5.1.1 Background

TK Global has developed a Cumulative Damage Model (CDM) for use in calculating the safe service life of inflators in the field. Our CDM relies on:

- The observation of a strong correlation of propellant growth rates with peak test cycle AH.

- The ability of the Moisture Transfer Simulation Model to predict the peak daily inflator headspace AH given the vehicle and climate environmental profiles along with inflator variables.

- The availability of T-test results, field return and cycling data to anchor the models.

By setting a critical density using lab and field data and using the observed time-to-field-rupture characteristics as a calibration point, we are able to forecast a safe service life for the inflators and environments modeled.
Initial CDM calculations for the T3[2] 1st percentile usage[3] indicates:

- An improved service life for desiccated 2004 inflators over their non-desiccated counterparts.
- A substantial improvement in service life for inflators using 2004L propellant.
- Climate, including the influence of vehicle interior temperatures, is a major factor in the safe service life.

The initial Service Life Assessments for a variety of inflators in five cities is summarized in Table 4.

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[2] There are three vehicle classes used in the analysis which correspond to peak vehicle interior temperatures in the Miami environment – T1 (vehicles with peak cabin temperatures that do not exceed 60 °C), T2 (vehicles with peak cabin temperatures between 60 °C and 65 °C) and T3 (vehicles with peak cabin temperatures that exceed 65 °C) The classes are generally associated with vehicle size, with the largest vehicles in the T1 class and the smallest in the T3 class.

[3] The vehicle environment is further subdivided by a usage factor, denoted as a percentile, which relates to the storage and usage characteristics of the vehicle. 50th percentile would represent a vehicle generally garaged or parked in the shade and frequently driven, while the 1st percentile would represent a vehicle always parked in full sun and rarely operated.

Table 4 CDM Time -to-Critical-Density for the Five Cities

City	PSPI-L 2004 Non-Desiccated 3110	PSPI-LD 2004 Desiccated AIB	PSPI-X 2004L Desiccated AIB	SDI 2004 Non-Desiccated 3110	SDI-D 2004 Desiccated (0.5g 13X) AIB	PSDI-5D 2004 Desiccated (1.0g 13X) 3110	SDI-X 2004L Desiccated AIB
Miami	9.3	14.6	28.4	10.3	12.4	17.8	>30
Atlanta	13.3	24.4	>30	14.5	-	-	>30
Phoenix	28.7	>30	>30	20.6	-	-	>30
Detroit	18.6	>30	>30	21.7	-	-	>30
Seattle	>30	>30	>30	>30	-	-	>30

Model Calibration Points

Comparing the forecast time-to-critical-density for the small car (T3) and large car (T1) (Table 5) shows a dramatic difference in outcomes. The larger cars, characterized by lower temperatures, are forecast to exhibit a dramatically longer service life.

Table 5 Influence of Vehicle Size (T3 vs T1)

	PSPI-L (Non-Desiccated)		PSPI-LD (Desiccated)		SDI (Non-Desiccated)		SDI-D (Desiccated 0.5g 13X)	
City	Small Car (T3)	Large Car (T1)	Small Car (T3)	Large Car (T1)	Small Car (T3)	Large Car (T1)	Small Car (T3)	Mid-size Car (T2)
Maimi	9.3	>30	14.6	>30	10.3	>30	12.4	22.8
Atlanta	13.3	>30	24.4	-	14.5	>30	-	-
Phoenix	28.7	>30	>30	-	20.6	>30	-	-
Detroit	18.6	>30	>30	-	21.7	>30	-	-
Seattle	>30	>30	>30	-	>30	>30	-	-

The test results summary from field returned inflators (Table 6) supports the forecast time-to-critical-density from Table 5 and reinforces the significance of vehicle cabin temperatures. The Zone 1 small car tests experienced 201 ruptures in 3174 tests (6.3%) while the full-sized pickup truck experienced zero ruptures in 6058 tests[4].

Table 6 PSPI-L FD Test Rupture Frequency for Small Car and Full-Sized Pickup in Zone 1

PSPI-L FD	Small Car		Full Size Pickup	
Zone 1	Zone 1 Tests	Test Ruptures	Zone 1 Tests	Test Ruptures
Total Tests	3174	201	6058	0

There is a similar contrast in test outcomes tied to the absolute humidity zone in which the car resided. Examining the results for all years for the small car and inflator noted above, we find one rupture for

[4] The number of tests reported here for the small car subset is lower than that reported in the original report. A sorting error in the original report included all vehicles from all zones with the particular class of inflator in the small car totals, rather than a single inflator prefix common to the small car and large truck from Zone 1. The conclusions are unaltered, but the numbers have changed from the original report.

every 25 tests (3.98%) from Zone 1, and one rupture for every 389 tests (0.26%) from Zones 2, 3 and 4 combined.

6 Final Statements

In response to our Consent Order obligation, TK Global has made an assessment of the safety and service life of desiccated PSAN inflators.

The assessment presented concludes:

- Inflators with 2004L propellant will last substantially longer than inflators with 2004 propellant regardless of the presence of desiccant in the 2004 system. The 2004L propellant binder system is superior to the 2004 binder and is the principle source of the longer service life.
- Inflators with 2004 propellant and desiccant will provide an extended service life as compared to the non-desiccated counterparts, but not as long as inflators containing 2004L propellant.
- Climate, including the influence of vehicle size, is a major factor in the safe service life.
- The moisture modeling, LSM and Cumulative Damage models are proving a useful tool in the exploration of factors that may influence service life. TK Global will continue to refine the model in the future.
- A program of field monitoring should be considered to confirm the forecast trends.