



ASARCO
GRUPO MEXICO

Ray Operations

**Achieving Quantifiable Results Through:
Targeted Training**

Haulage and Loading Conference 2015

Today's Discussion



- ASARCO RAY:
 - Brief Overview
- Review ASARCO RAY Training Philosophy and Training Program
- Review of Targeted Training Programs and Results
- Q&A



Simulation Delivering Safety and Productivity



ASARCO Ray Overview

ASARCO Ray Mine:

–Mine ~ 250,000 TPD (Sulfide Ore, Leach, Waste)

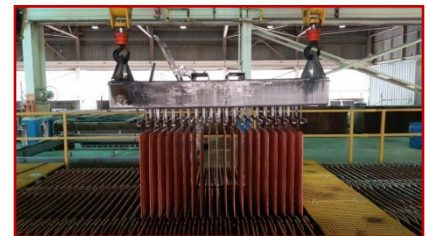
–Crush and Mill ~ 50 K TPD

- 30,000 TPD @ RAY
- 20,000 TPD Crushed and Railed to Hayden Concentrator

–15,000 gpm of Pls @ > 1.0 g/l to SXEW

–Copper Production of ~ +100 MM #/yr.

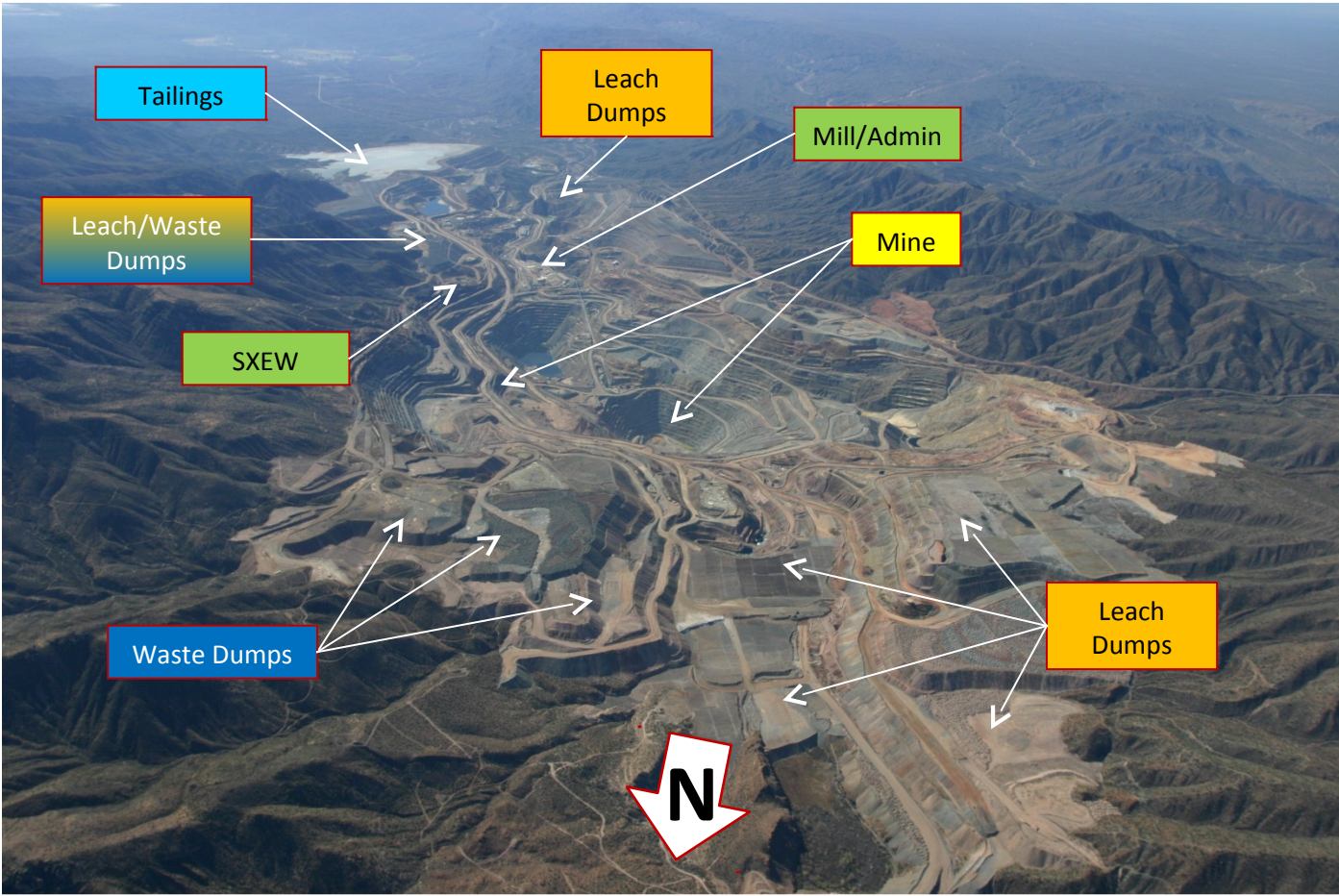
- Concentrate to Hayden Smelter
- Cathodes to Amarillo Refinery in Tx.



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Ray Operations



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ASARCO Ray Training Philosophy

- **Question:** What approach/technology should we invest in to improve Safety and Operational performance ?
 - Proximity Detection/Collision Avoidance
 - Operator Fatigue Detection
 - Other “Gadgets and Gizmo’s”
 - Simulation and Operator Training



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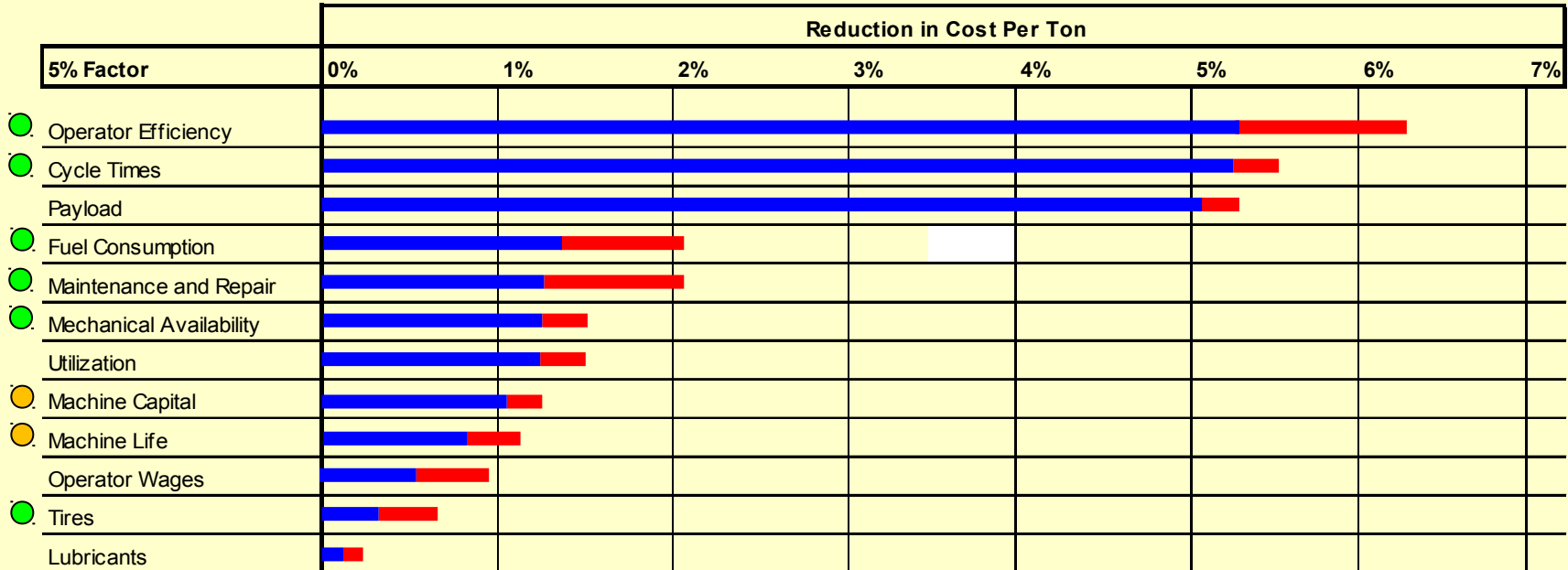


ASARCO Ray: Something to Remember



MineEIA Sensitivity Analysis- -Hauling

A 5% Change in Each of the Listed Factors Cause the Following % Reduction in Cost Per Ton



Approximate range of final results, based on analyses to date.

Cost parameters, including fuel, may vary greatly by location and application



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ASARCO Ray Training Philosophy

- **Question:** What approach/technology should we invest in to improve Safety and Operational performance ?
- **Answer:** Invest in and begin with: The **BASICS!** Re-train all of our operators on base level equipment operational techniques to improve:
 - Safety (The Goal: **REDUCED** Property Damage due to operator error)
 - Machine Health (The Goal: **REDUCED** Maintenance Costs related to operator abuse)
 - Increased Operational Efficiency (The Goal: **INCREASED** Productivity/**REDUCED** Costs)

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Training Systems
Integration

ASARCO Ray Training Program Foundation

- Purchased Immersive Pro_3 Simulator – AND – Office trailer for Training Office
- Trainers: Two (2) per Mine Operations crew
 - One (1) Haul Truck Trainer/One (1) Back-up Haul Truck Trainer per crew
 - One (1) Training Supervisor
- Trainer Training –
 - “Train the Trainer” course partnering with Liebherr
 - Immersive “Trainers Advantage” course:
 - Trainers Received: TA Level 1 – TA Level 3 Training



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ASARCO Ray Targeted Training Modules

Targeted Training-1: Apr – Jun 2013

Machine Health and Maintenance

***Specialized Evaluation
New Hire Aptitude

Targeted Training-2: Oct – Dec 2013

Improving Spotting Times

Targeted Training-3: Feb – Mar 2014

Improving Dumping Times

Targeted Training-4: May – Jul 2014

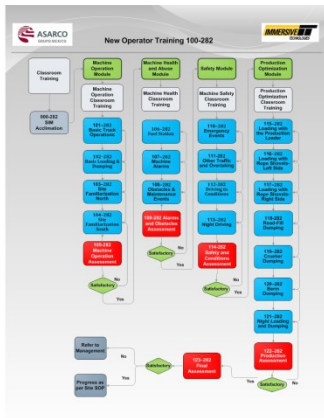
Increasing Brake Life

Targeted Training-5: Aug – Sep 2014

Increasing Tire Life

Targeted Training-6: Oct – Dec 2014

Improving Fuel Economy



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Targeted Training_1: Machine Health & Maintenance

Training Objectives:

Practice handling faults and alarms and effectively responding to emergency situations:

- Engine Fire
- Grid Box Fire
- Brake Failure
- Steering Failure



Training Scenarios:

Baseline Assessment

Practice Scenarios:

- ✓ Alarms and Obstacles
- ✓ Emergency Events
- ✓ Overtaking and Re-Fueling

Re-Measure Assessment



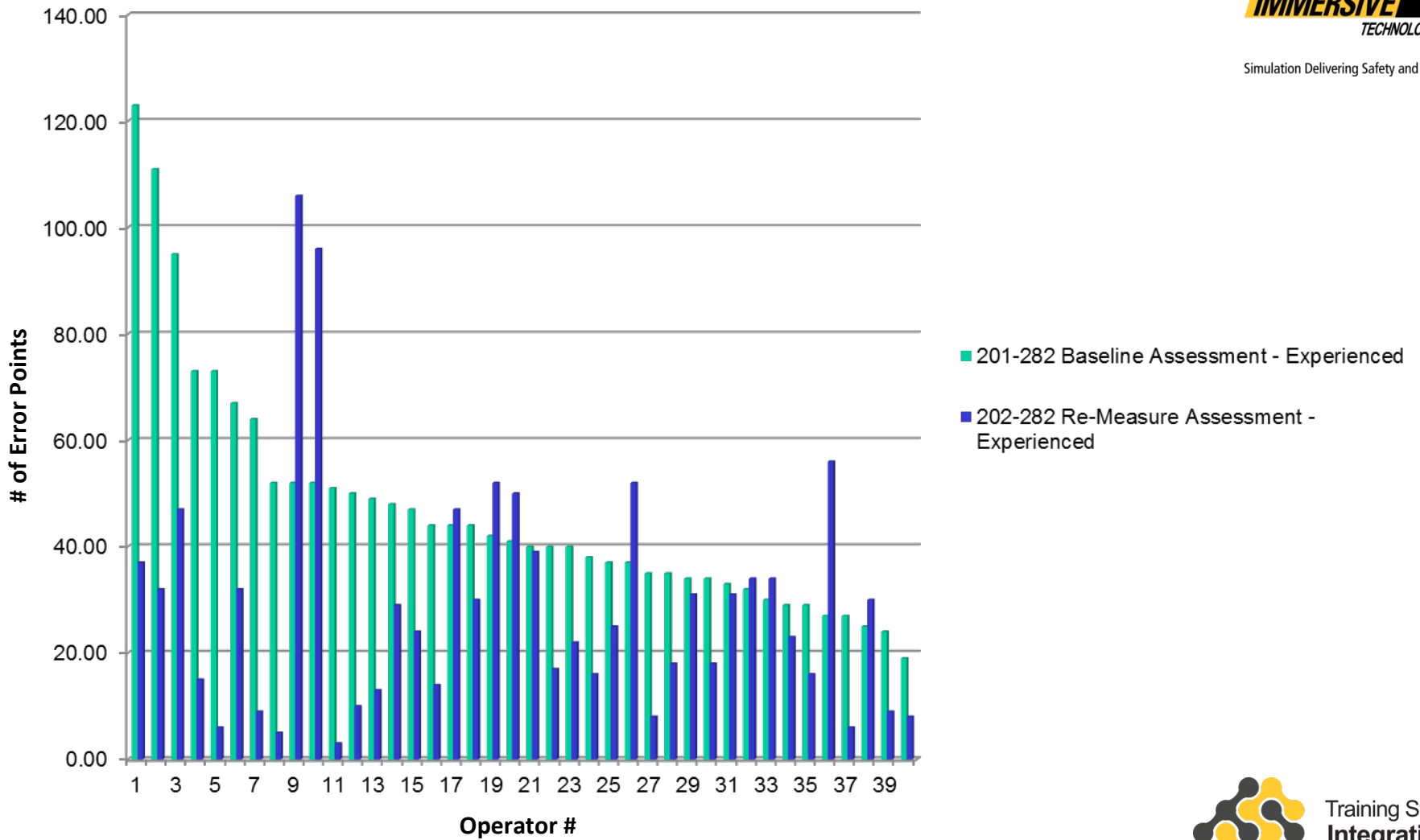
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Machine Health and Maintenance Module

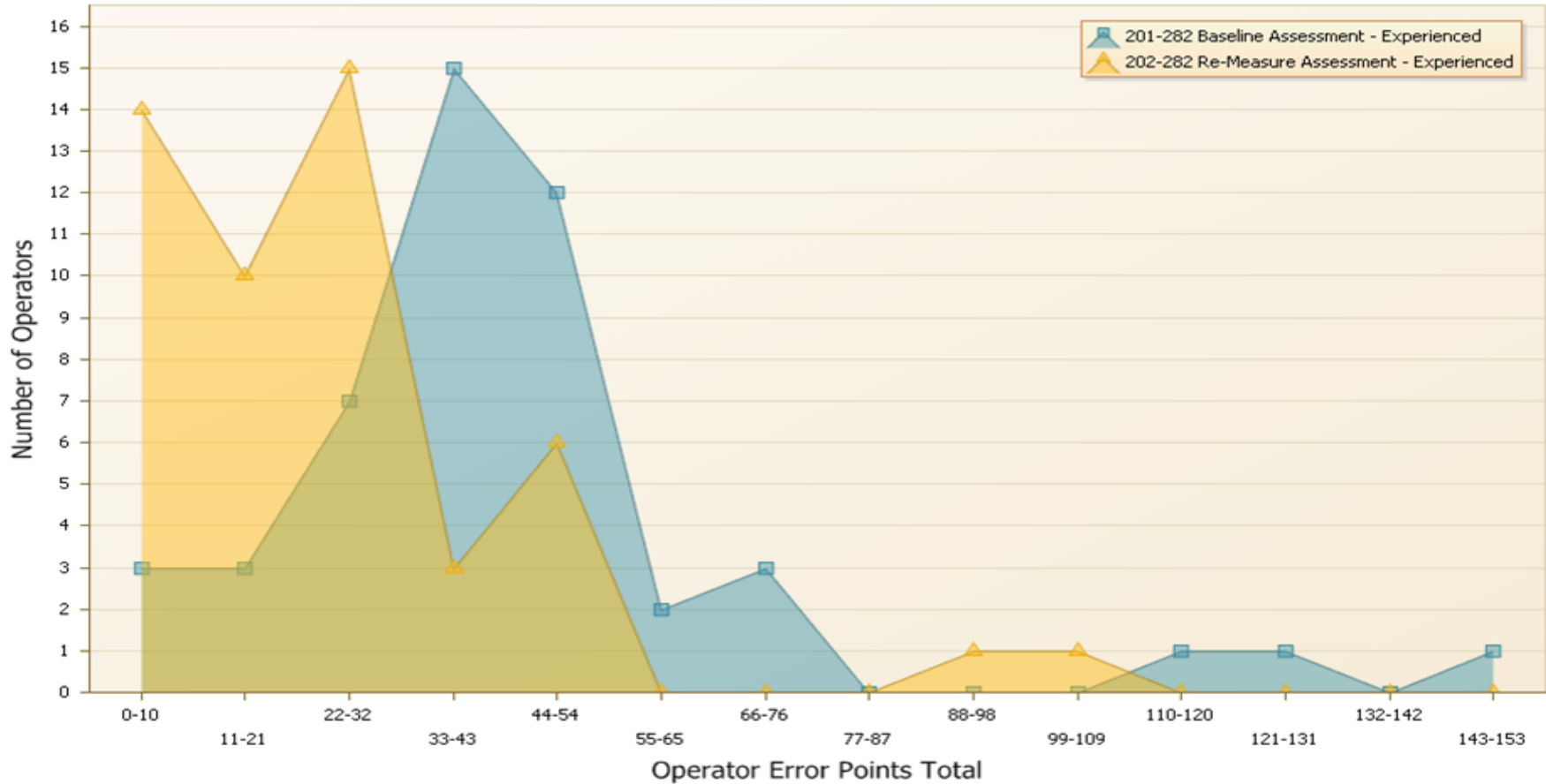


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Machine Health and Maintenance Module

Operator Risk Profile



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Targeted Training_2: Improving Spotting Times

Training Objectives:

Practice behaviors that help to reduce time for spotting under a loading implement:

- Efficiently Loading Under a Rope Shovel
- Efficiently Loading Under a Wheel Loader



Training Scenarios:

Baseline Assessment

Practice Scenarios:

- ✓ Loading Rope Shovel – Left
- ✓ Loading Rope Shovel – Right
- ✓ Loading Rope Shovel – Night
- ✓ Loading Loader

Re-Measure Assessment

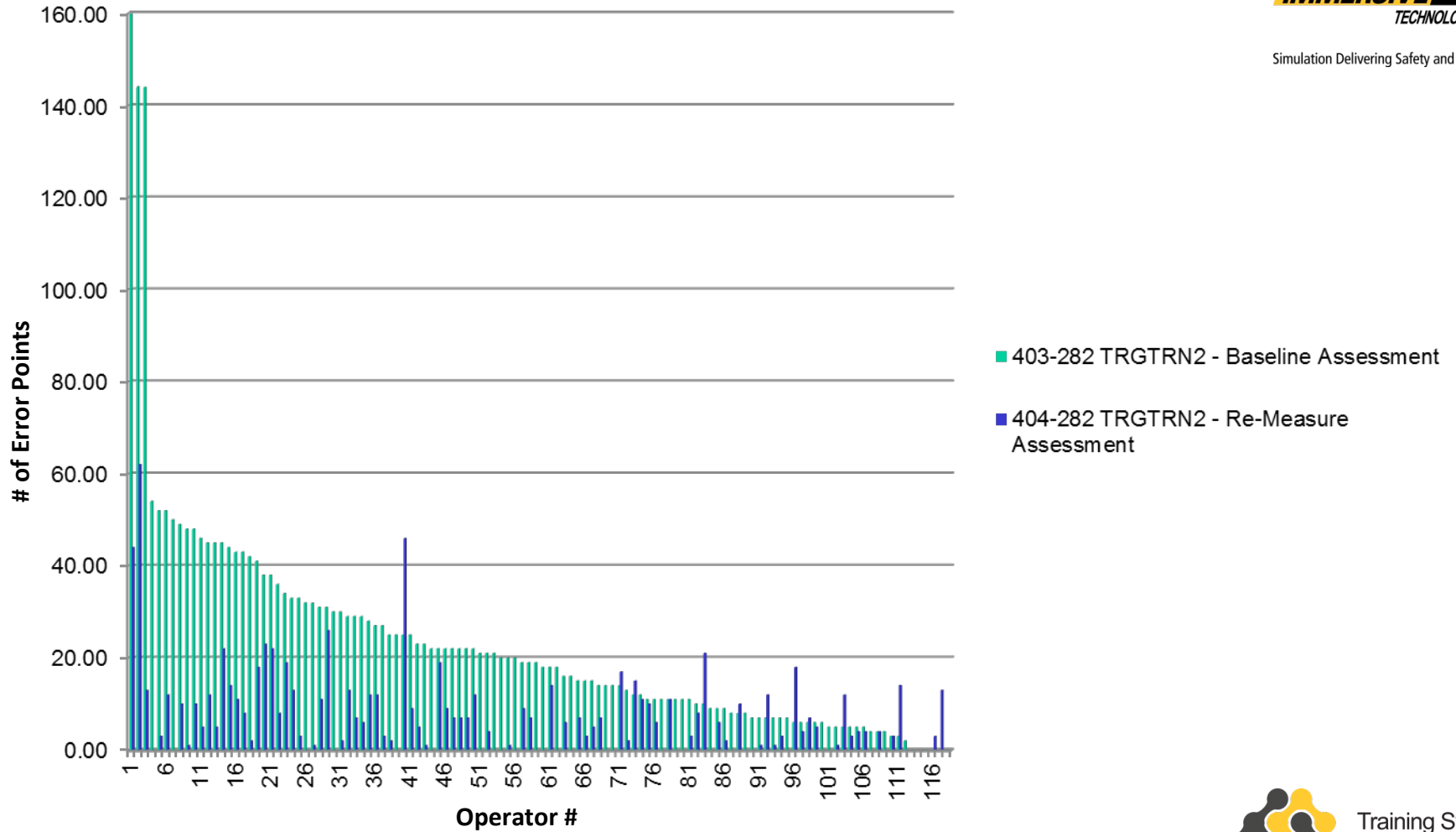


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Improving Spotting Times

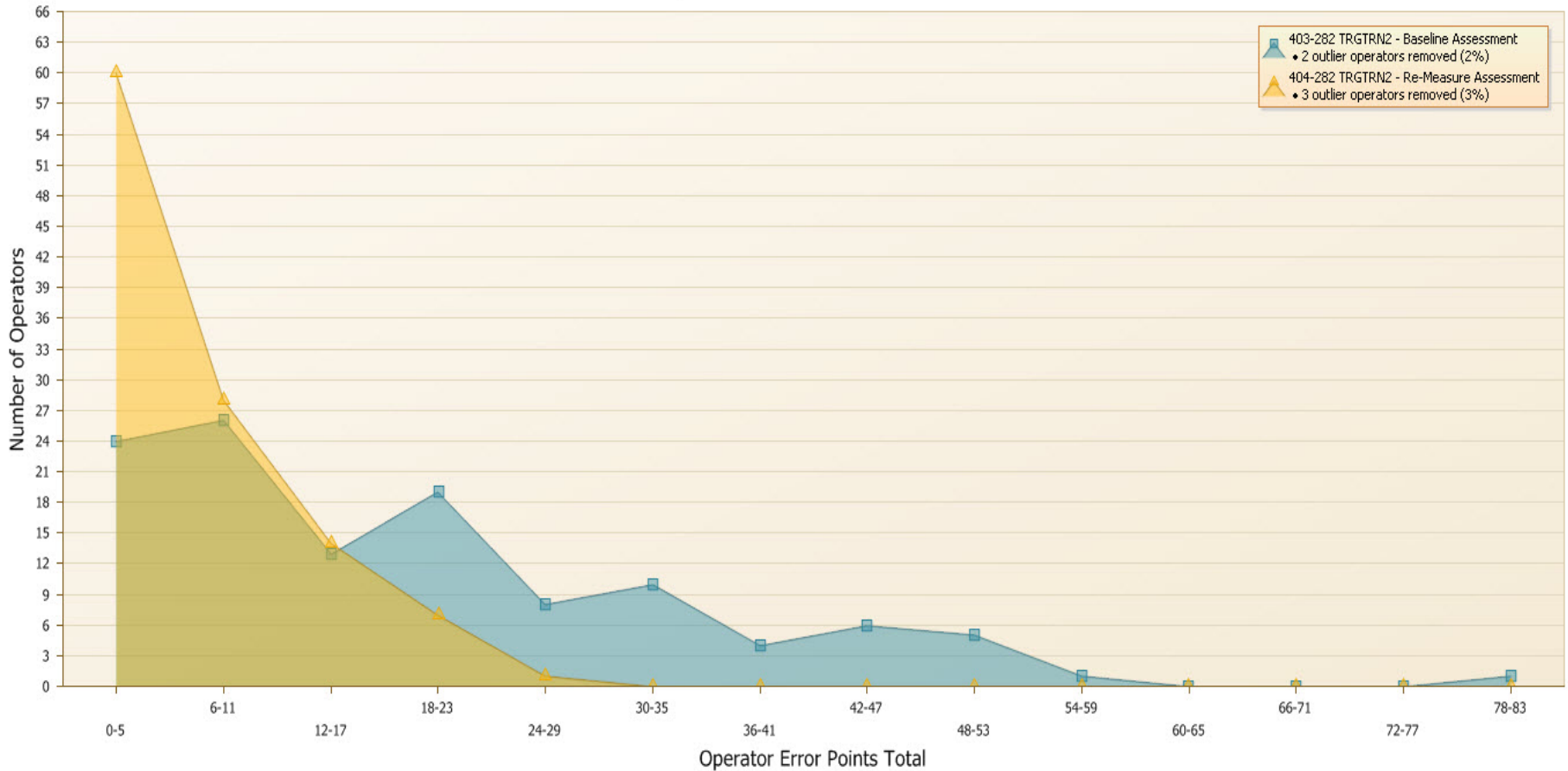


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Improving Spotting Times

Operator Risk Profile



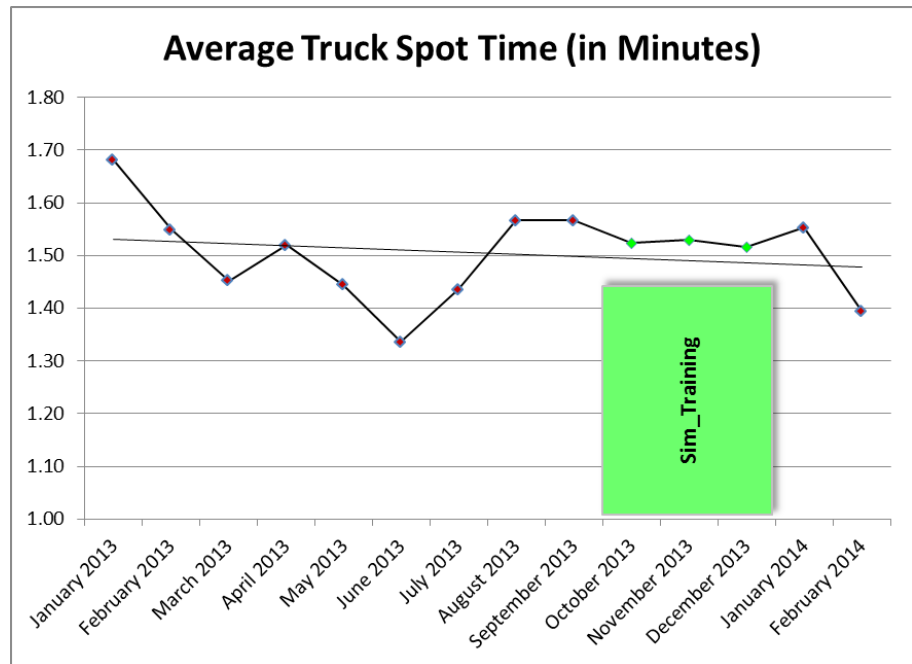
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Ray – Average Truck Spot Time



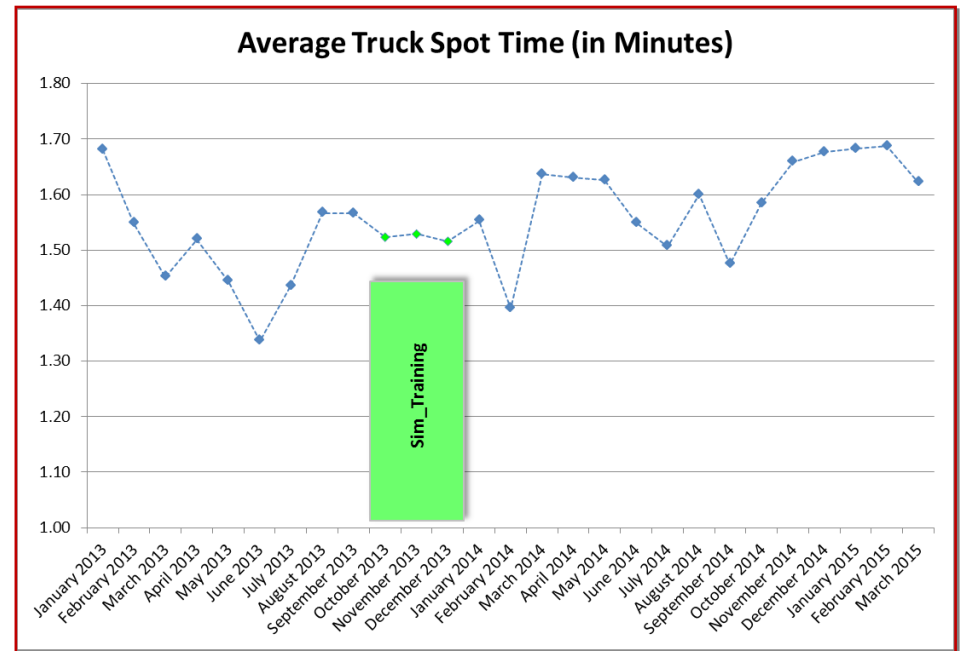
Avg. Truck Spot Tim					
Month	CREW 1	CREW 2			
January 2013	1.74	1.65			
February 2013	1.58	1.51			
March 2013	1.46	1.49			
April 2013	1.54	1.50			
May 2013	1.48	1.41			



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Ray – Average Truck Spot Time

Avg. Truck Spot Time (Min)					
Month	CREW 1	CREW 2	CREW 3	CREW 4	CREW Avg.
January 2013	1.74	1.65	1.66	1.67	1.68
February 2013	1.58	1.51	1.54	1.56	1.55
March 2013	1.46	1.49	1.46	1.40	1.45
April 2013	1.54	1.50	1.51	1.53	1.52
May 2013	1.48	1.41	1.43	1.46	1.44
June 2013	1.37	1.35	1.30	1.33	1.34
July 2013	1.43	1.44	1.32	1.55	1.44
August 2013	1.58	1.58	1.54	1.57	1.57
September 2013	1.75	1.55	1.39	1.61	1.57
October 2013	1.55	1.54	1.51	1.50	1.52
November 2013	1.64	1.40	1.50	1.58	1.53
December 2013	1.60	1.53	1.48	1.44	1.52
January 2014	1.64	1.63	1.35	1.61	1.55
February 2014	1.47	1.47	1.30	1.33	1.40
March 2014	1.71	1.60	1.61	1.61	1.64
April 2014	1.73	1.58	1.58	1.63	1.63
May 2014	1.62	1.59	1.60	1.69	1.63
June 2014	1.59	1.52	1.50	1.60	1.55
July 2014	1.48	1.52	1.46	1.57	1.51
August 2014	1.58	1.57	1.53	1.73	1.60
September 2014	1.46	1.56	1.38	1.51	1.47
October 2014	1.55	1.67	1.48	1.64	1.58
November 2014	1.61	1.68	1.60	1.75	1.66
December 2014	1.71	1.78	1.55	1.68	1.68
January 2015	1.67	1.82	1.54	1.73	1.68
February 2015	1.76	1.79	1.55	1.66	1.69
March 2015	1.62	1.66	1.59	1.63	1.62
Grand Total	1.59	1.57	1.49	1.58	1.55



Targeted Training_3: Improving Dumping Times

Training Objectives:

Practice behaviors that help to reduce time for dumping:

- Efficiently Dumping at the Dump
- Efficiently Dumping at the Crusher
- Efficiently Dumping at Night
- Accurately spotting at the Dozer



Training Scenarios:

Baseline Assessment

Practice Scenarios:

- ✓ Dumping at the Dump
- ✓ Dumping at the Crusher
- ✓ Spotting at the Dozer
- ✓ Dumping at Night

Re-Measure Assessment



Training Systems
Integration

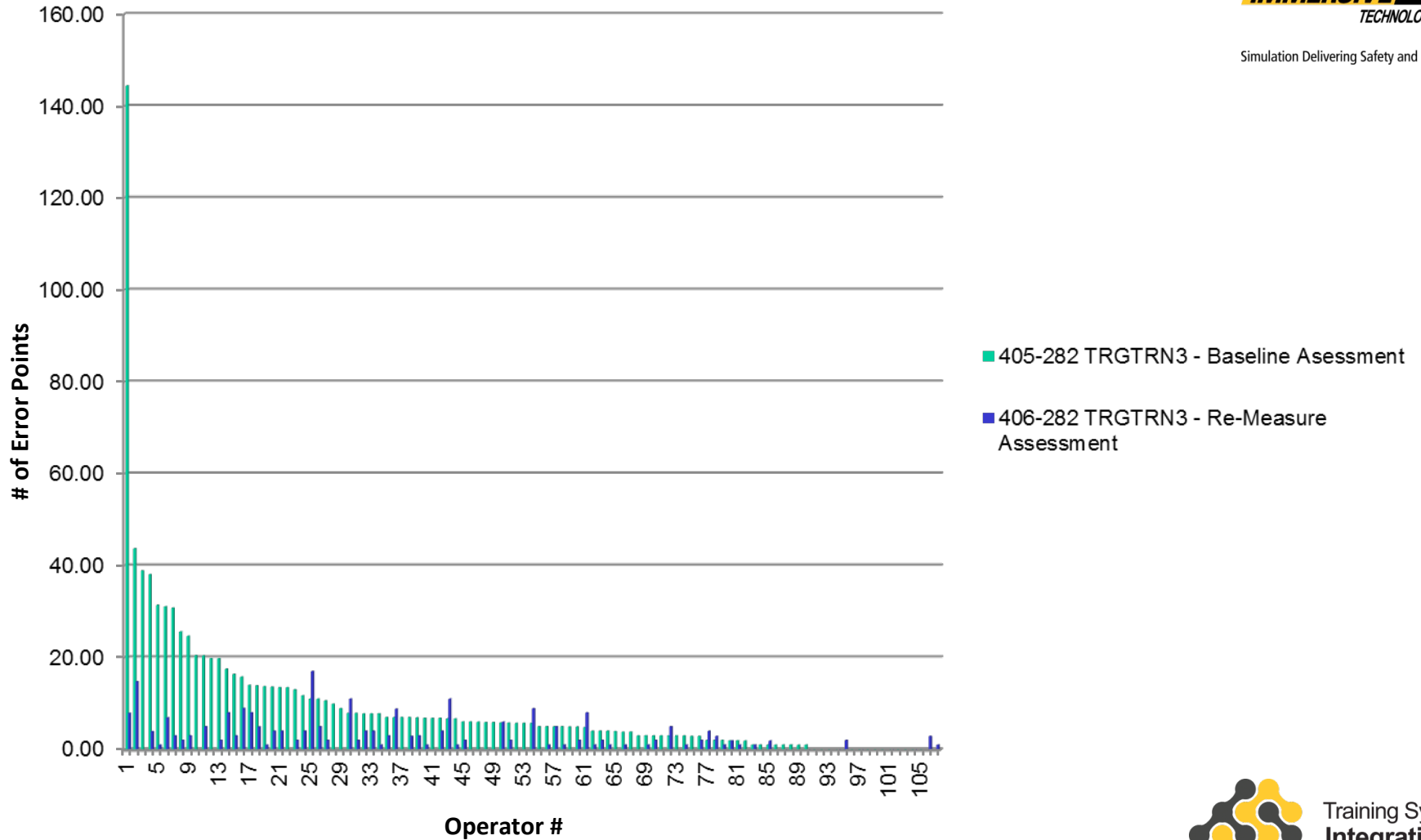


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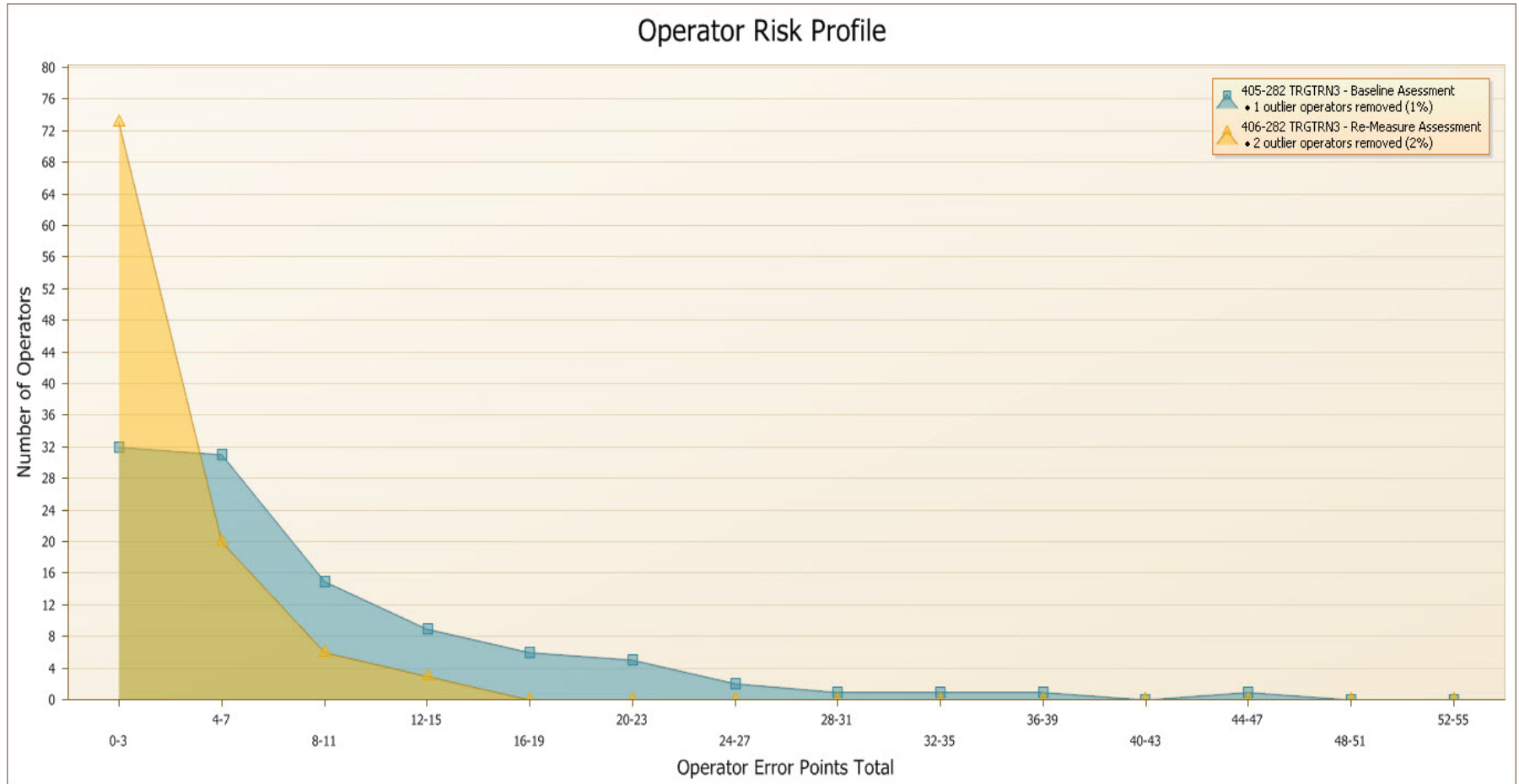
Improving Dumping Times



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Improving Dumping Times

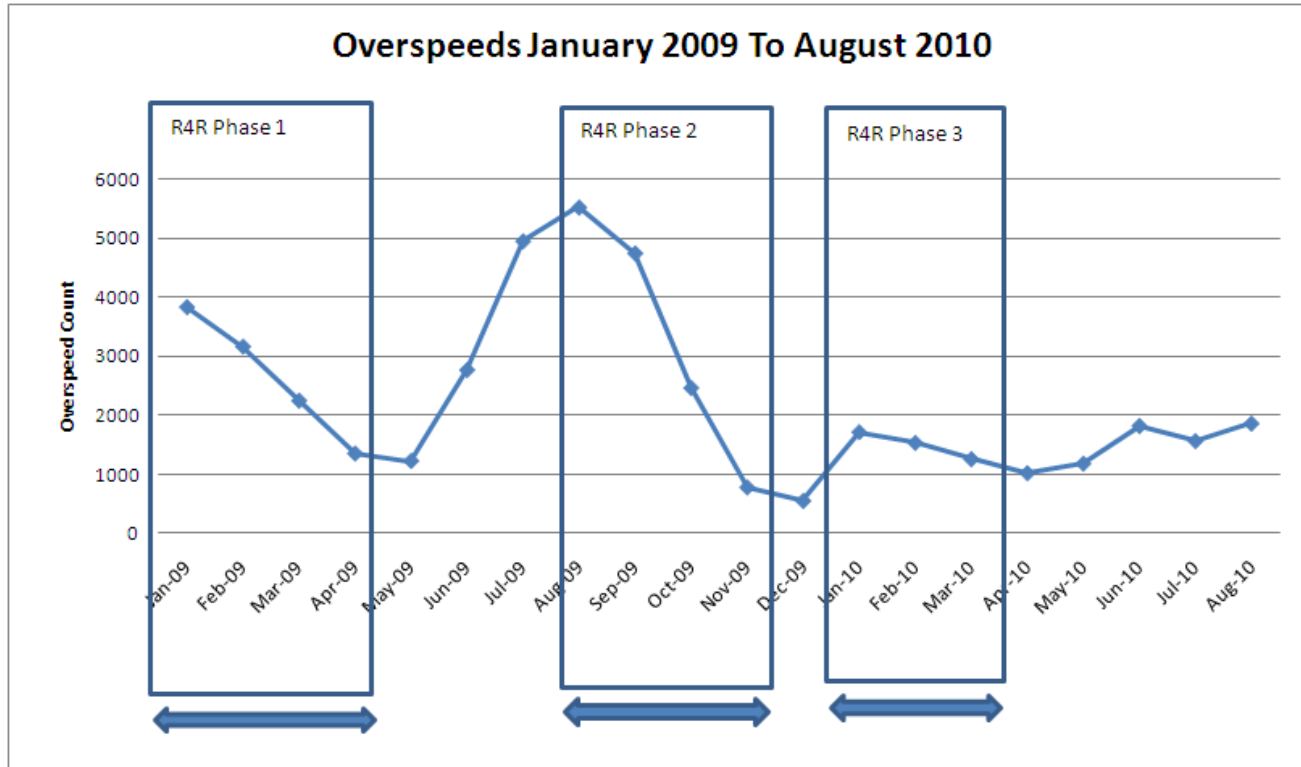


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So What About Sustainability?

Immersive has seen this before!



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Targeted Training_4: Increasing Brake Life

Training Objectives:

Practice behaviors that help to reduce brake wear:

- Proper brake usage while handling machine alarms and avoiding obstacles
- Proper brake usage during emergency events
- Proper brake usage during inclement conditions



Training Scenarios:

Baseline Assessment

Practice Scenarios:

- ✓ Machine Alarms
- ✓ Obstacles and Maintenance Events
- ✓ Emergency Events
- ✓ Driving to Conditions

Re-Measure Assessment



Training Systems
Integration

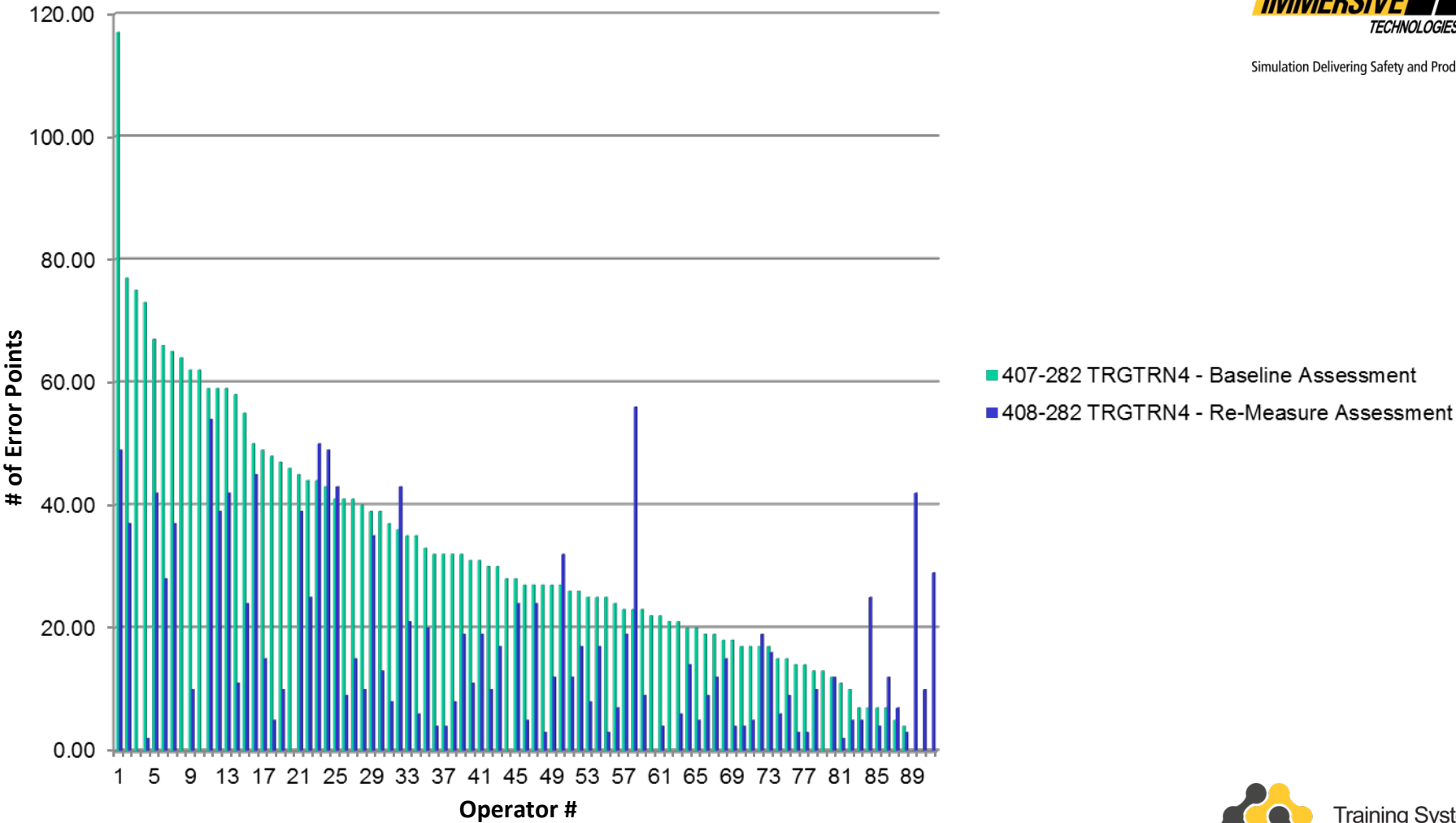


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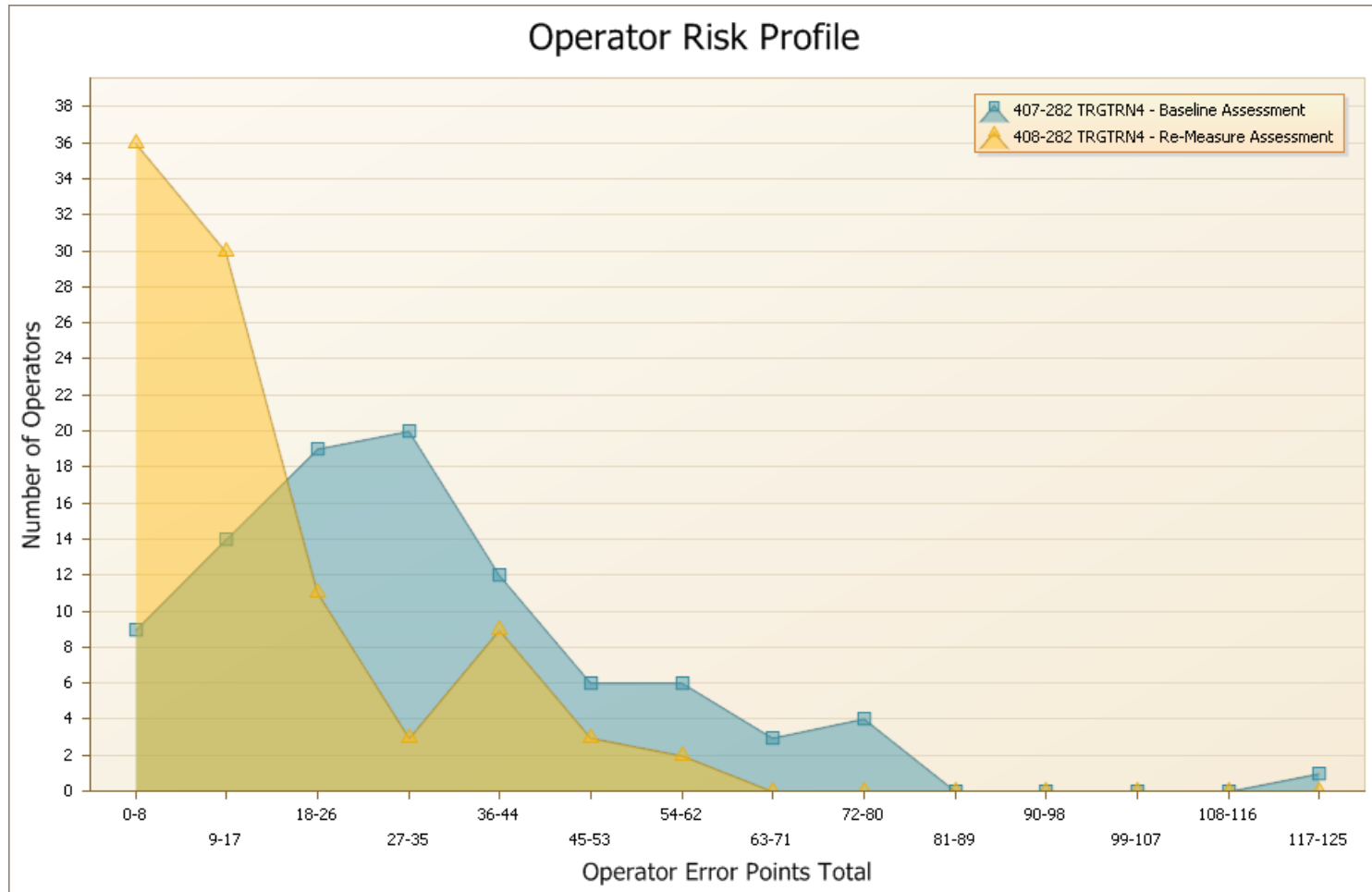
Increasing Brake Life



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Increasing Brake Life



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Targeted Training_5: Increasing Tire Life

Training Objectives:

Practice behaviors that help to reduce tire wear:

- Review ASARCO Tire Manual
- Avoid Dry Steering
- Avoid Obstacles in the Road
- Avoid Aggressive Steering



Training Scenarios:

Baseline Assessment

Practice Scenarios:

- ✓ Tire Wear – Day
- ✓ Tire Wear – Night

Review the ASARCO Tire Manual

Re-Measure Assessment



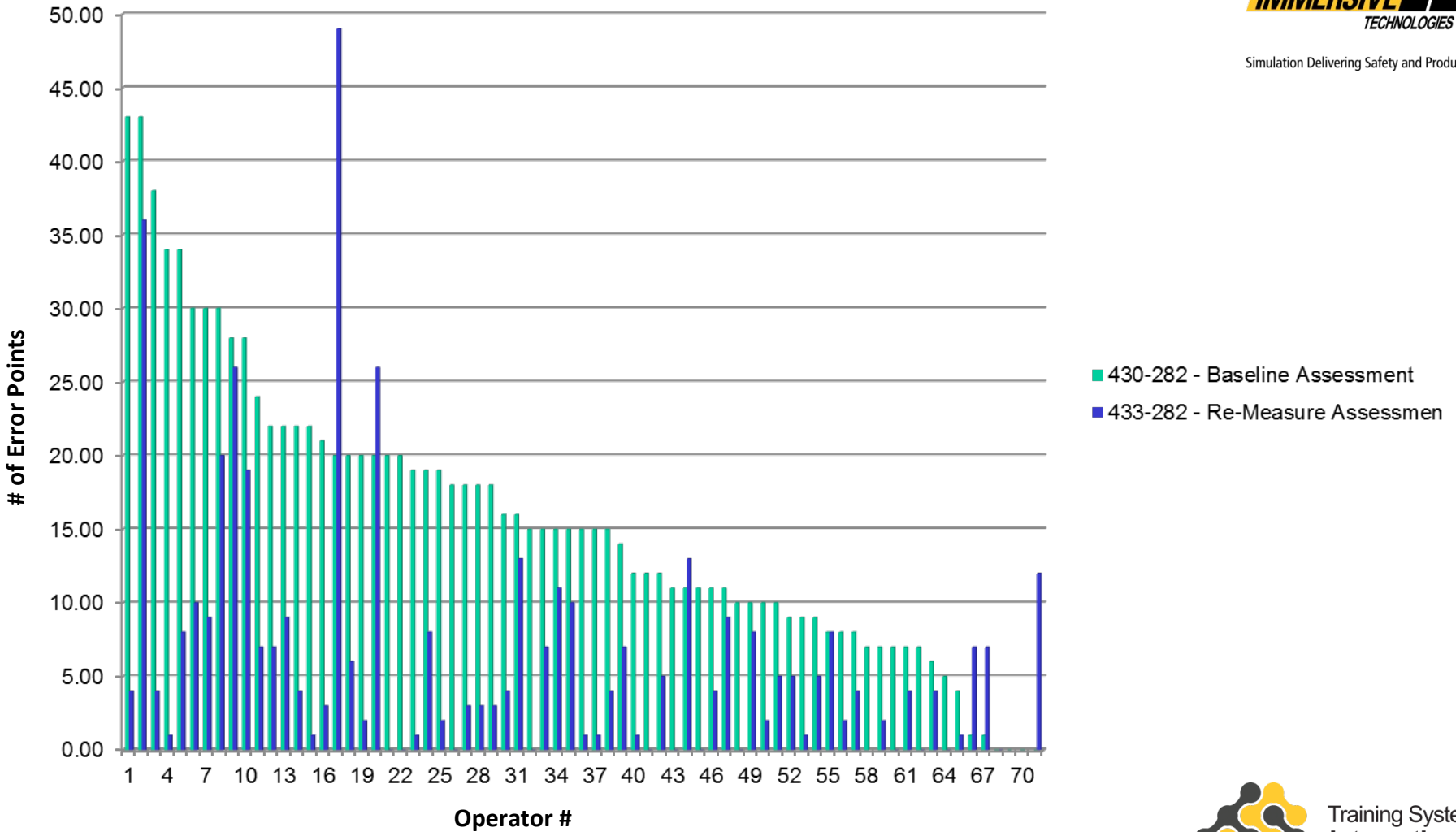
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Increasing Tire Life

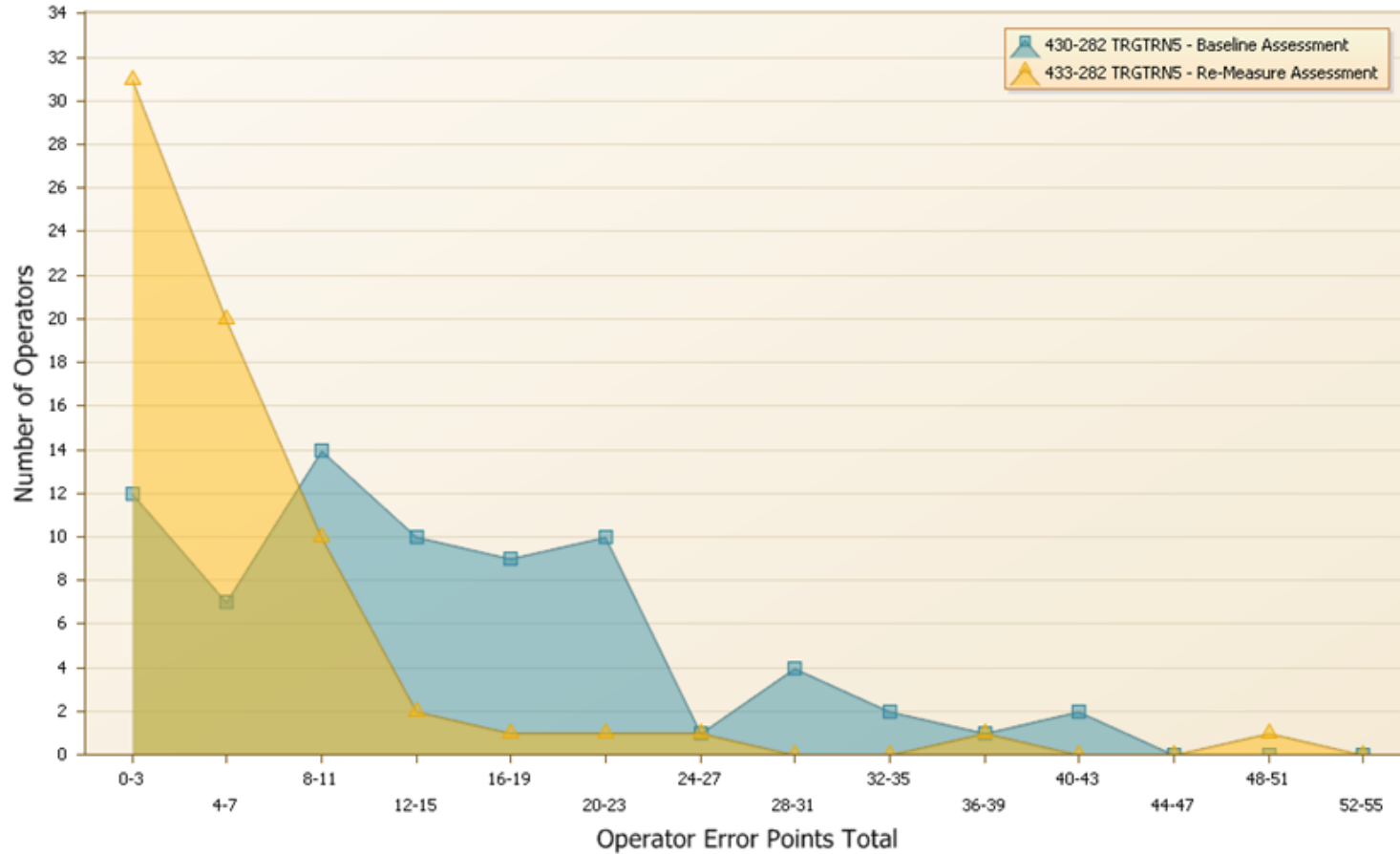


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Increasing Tire Life

Operator Risk Profile



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Training Systems
Integration

Targeted Training_6: Improving Fuel Economy

Training Objectives:

Practice behaviors that help to reduce fuel consumption:

- Proper brake usage
- Proper accelerator usage
- Proper dumping processes



Training Scenarios:

Baseline Assessment

Practice Scenarios:

- ✓ Fuel Economy – Day
- ✓ Fuel Economy – Night

Discussion – Fuel Economy

Re-Measure Assessment



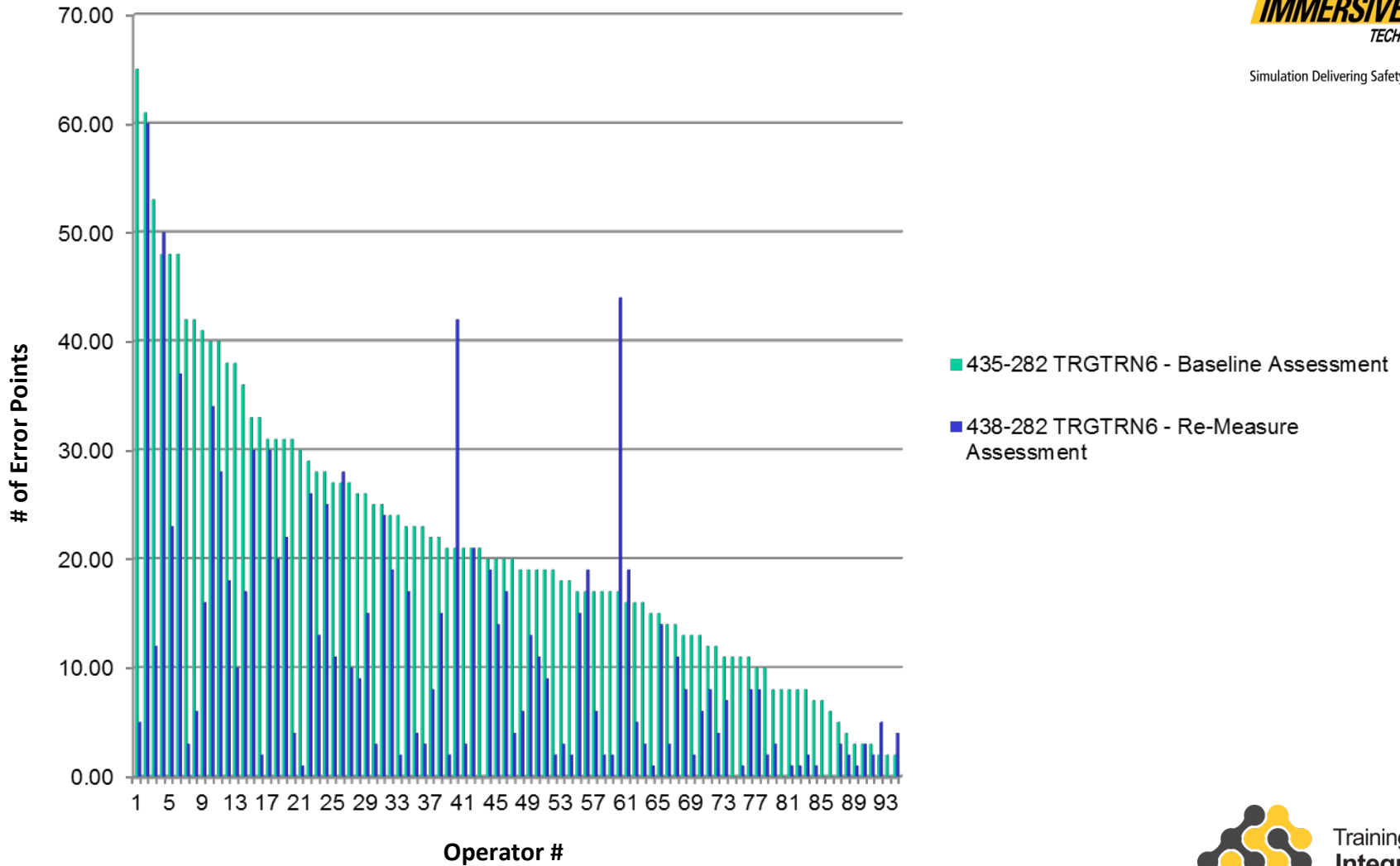
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Improving Fuel Economy

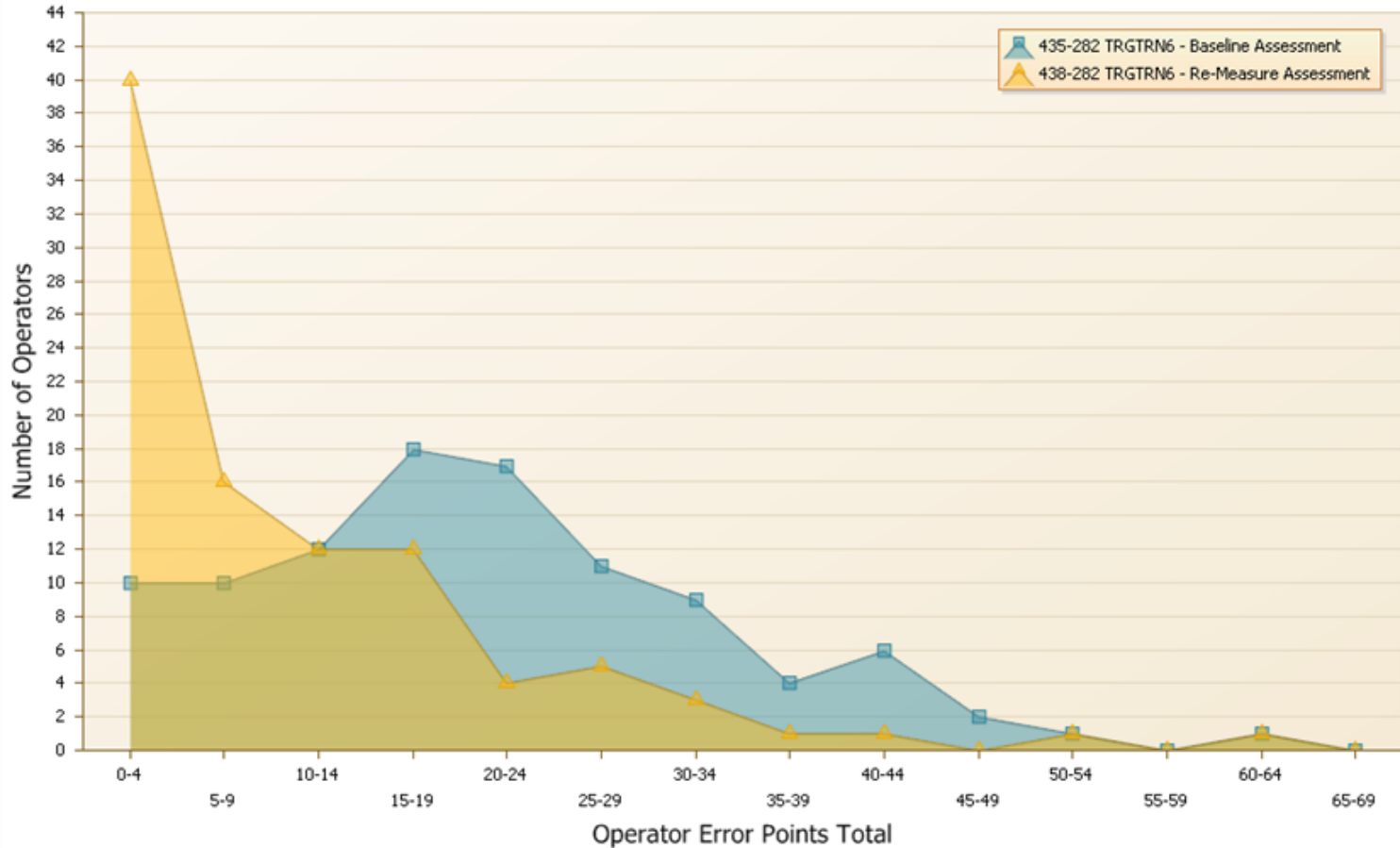


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Improving Fuel Economy

Operator Risk Profile



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New Operator Training

New Operator Training Program Objectives:

Bring an operator with **NO** experience to a point of basic competency, safety, and productivity prior to putting them on a machine.

Four Modules:

- Basic Machine Operation
- Machine Health and Abuse
- Safety
- Production Optimization

New Operator Training Program:

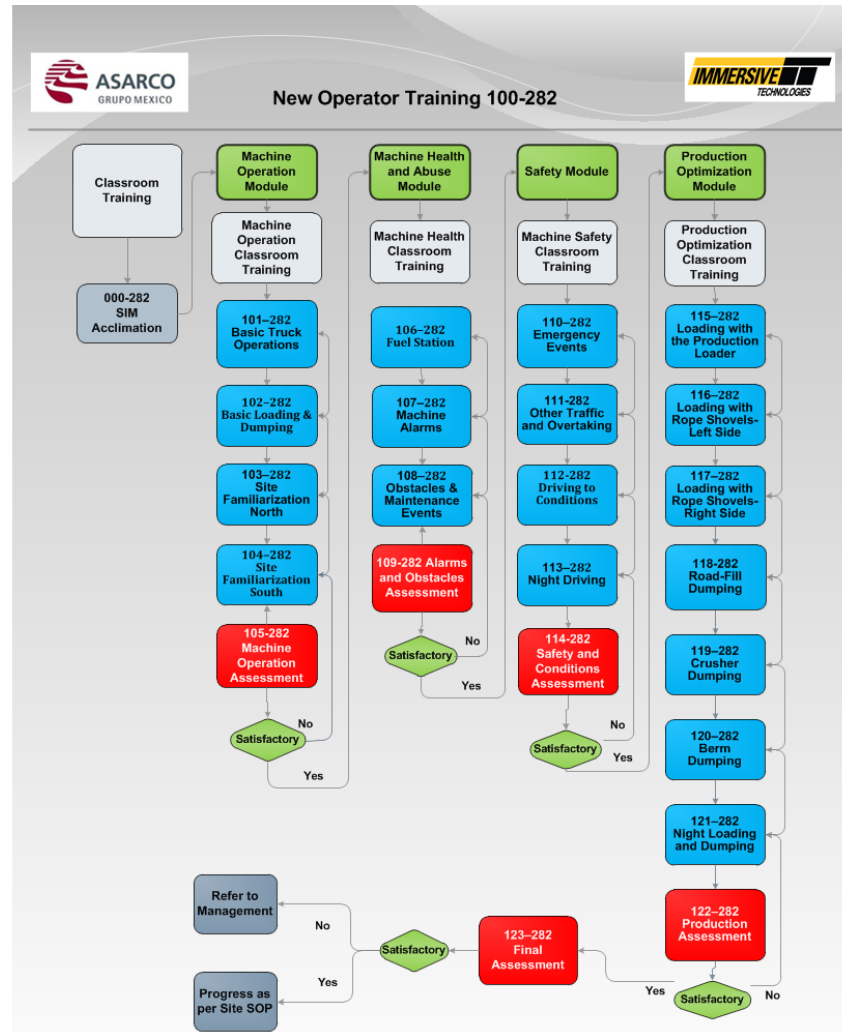
- Each training module includes practice scenarios and a module assessment.
- Once all practice scenarios within each module are completed, a final exam is provided.
- The operator must meet specific requirements before being released to the machine.
- Once on the machine, a trainer rides with the new operator for a period of time.



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New Operator Training Flow Chart



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Operator Pre-Employment Evaluation

Pre-Employment Screening Objectives:

Identify a candidate's basic skill levels –

For candidates **WITH NO** experience operating equipment:

- Assess their ability to handle basic machine operation
- Assess their trainability – their aptitude for listening and following instructions

For candidates **WITH** machine operation experience:

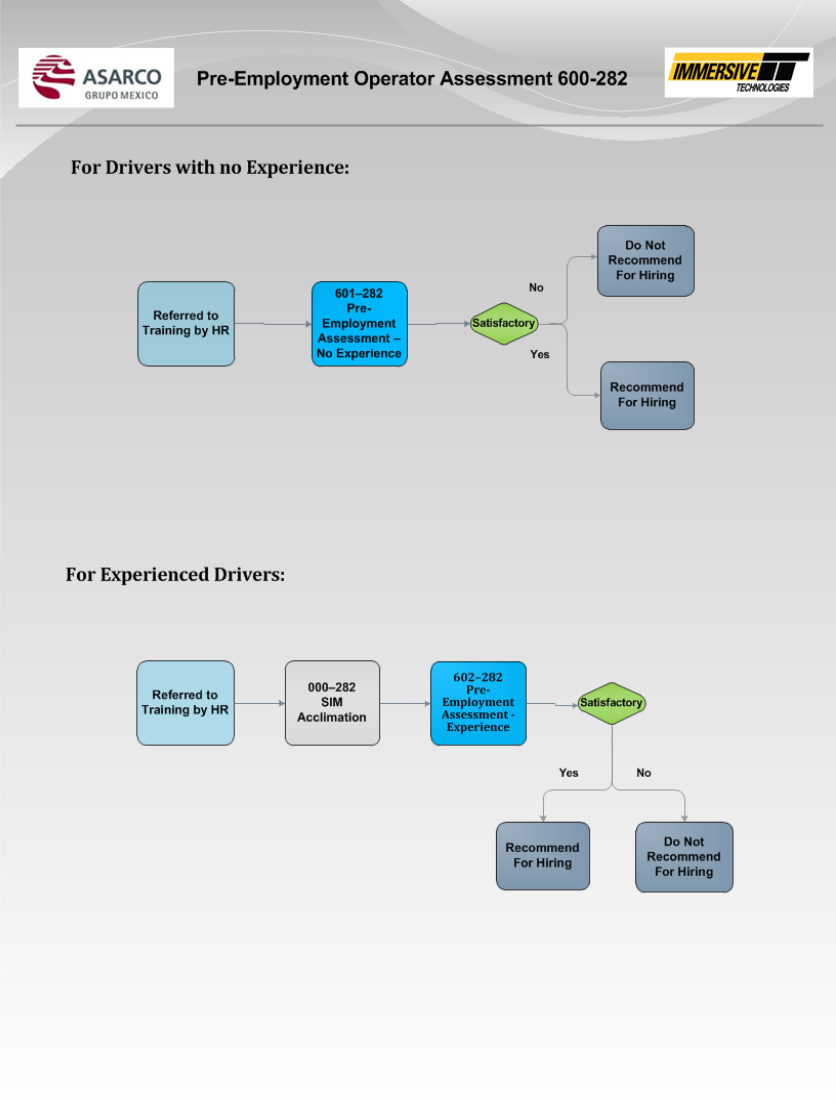
- Assess their machine handling skills
- Assess their honesty in representing said skills
- Assess their trainability



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Operator Pre-Employment Evaluation Flow Chart



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What we DO Know

Many Variables

Haul Profile
Road Conditions
Weather Conditions
Shovel/Loader Set-up
Operator Attitude



Few Distinct Measurement Points

Spot Time
Fuel Burn
Dumper Time
Tire Usage

What we DO know:

- Machine simulation training provides us a way to improve across a significant number of areas at one time – We can “Target-train”
- Baseline vs. Re-assessment (Re-measure) data shows operator improvement
 - There is NO Bias
- Sustainability has not been achieved in several areas so further (follow-up) training in those areas is needed to permanently alter operator behaviors
- Truck related Property Damage has decreased
- Operator handling of EMERGENCY situations has been FLAWLESS
- Truck related Production KPI’s have improved and unit costs are down



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**NO CLEAR
CONCLUSIONS**



Conclusions – A Leap of Faith??

QUESTION: “How do you know whether or not machine simulation training **TRULY** provides a way to improve mine performance across a significant number of areas at one time?”

 **My Perspective:** *Machine Simulation and its ability to impact the overall mining operation is akin to using Fuel additives to positively impact fuel usage*

- Because of the numerous variables involved in the day-in/day-out running of our business it is **VERY DIFFICULT** to know whether or not it truly working!
- Sometimes you need to “Go with your gut” and try something that you think MIGHT work.
- ASARCO Ray is **VERY SATISFIED** with the way our simulation training has progressed
 - We still have work to do with repeating the “Targeted training” in the areas where we **HAVE NOT** established “Sustainable” behaviors to make them “Stick!”



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Questions?



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