## Darin Dux, P.E., NAFI-CFEI, NAFI-CVFI

he/him/his
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## Background

Mr. Darin Dux holds an M.S. in Agricultural and Biological Systems Engineering with a focus on Machine Design, Metallurgical Engineering and Materials, and Mechanical Failure Analysis, and a B.S. in Agricultural Engineering with an emphasis on Power and Machinery.

Mr. Dux has over 30 years of design experience in the areas of agricultural equipment, arboriculture and tree service machinery, mulch and compost production machines, water reclamation equipment, trenching and boring machines, surface mining and milling equipment, utility installation machinery, landscape equipment and attachments, and construction/industrial equipment. Mr. Dux has experience in light and heavy machine structural systems, hydraulic and electro-hydraulic systems, internal combustion and electrically powered machines, analog and digital control systems, sensors and sensor suites, and stationary and mobile on-road and off-highway equipment. He holds 16 U.S. and international patents.

Mr. Dux has extensive experience in product safety and product compliance. He has contributed to national and international standards including SAE, ANSI, and ISO standards, and has served as a subject matter expert to national, state, provincial, and regional regulatory governmental bodies in the areas of machine and worker safety. Mr. Dux has worked with products across the globe including North and South America, Europe, Middle East, Africa, Asia, Australia, and the Pacific Rim.

Mr. Dux has performed many investigations of jobsite machinery accidents and vehicle accidents involving injuries and fatalities. He has modeled and recreated machine accidents and performed extensive testing and analysis. Mr. Dux is both a Certified Fire and Explosion Investigator (CFEI) and a Certified Vehicle Fire Investigator (CVFI) and has performed fire investigations involving partial loss, total loss, structures, industrial facilities, warehouses, equipment, construction activity, multiple machines, and multiple vehicle losses.

Mr. Dux has experience in human factors and ergonomics, warnings and instructions, operator manuals and technical documentation, machine NVH, worksite OSHA and MSHA regulations, and right-of-way safety.

Mr. Dux has been engaged in multiple matters involving classic, antique, specialty, muscle and collector cars, motorcycles, and other vehicles and memorabilia. Mr. Dux restores vehicles, motorcycles, tractors, equipment, and vintage timepieces including classic and collector watches.

## Professional Engagements

- **Product Safety and Product Compliance**
  - Designed and evaluated multiple safety features and safety systems including machine vision, IR and RF directional operator sensing, operator presence systems, access and fall protection systems, hazard detection systems, guards and guarding, warnings, training resources, and instructions.
  - Pella, IA; Griswold, IA; Freeman, SD; Greenville, SC; Opahumpka, FL; Goes, Netherlands; and Tianjin, China (2017-2021), Created a multi-module safety, compliance, and product liability training for product development teams, management, marketing, service, dealer training, operator training, and field support. Performed safety and compliance training across the US, EU, and China.
  - Pella, IA; Griswold, IA; Freeman, SD; Greenville, SC; Opahumpka, FL; Goes, Netherlands; and Tianjin, China (2016-2021), Responsible for the safety and compliance program for agricultural, construction, earthmoving, and industrial equipment across multiple design and manufacturing locations worldwide. Led an international team of engineers and specialists to ensure safety and compliance of earthmoving, agricultural, arboriculture, landscape, utility, mining, pipeline, reclamation, drilling, excavation, recycling, material handling, and locating equipment.
  - Pella, IA; Greenville, SC; Opahumpka, FL; Goes, Netherlands; and Tianjin, China (2016-2021), Responsible for investigation and determination of product recalls and field campaigns, including NHTSA, EU, and Australian procedures and interaction.
  - Pella, IA; Griswold, IA; Freeman, SD; Greenville, SC; Opahumpka, FL; Goes, Netherlands; and Tianjin, China (2014-2021), Created and constantly updated product safety and compliance resources based on standards, regulations, industry state of the art, and internally developed best practices.
  - Pella, IA; Griswold, IA; Freeman, SD; Greenville, SC; Opahumpka, FL; Goes, Netherlands; and Tianjin, China (2014-2021), Developed operator's manuals, warnings and messages, and multiple operator safety training modules in various forms including video, print, and social media.
  - Pella, IA; Greenville, SC; Opahumpka, FL; and Tianjin, China (2014-2016), Responsible for product safety and compliance of horizontal directional drilling (HDD) machines and support equipment, drilling fluid reclaimers, auger and pneumatic boring equipment, and bore planning software.

- **Machine Design and Product Development**
  - Pella, IA, and Maassluis, Netherlands (2013-2014), Bale wrapping and bagging attachments for a bale collection implement.
  - Pella, IA, and Maassluis, Netherlands (2012-2014), Autonomous agricultural machine to locate, pick, collect, and deliver bales from the field to the fieldside.
  - Pella, IA, and Maassluis, Netherlands (2012-2013), Self-propelled bale gathering machine.
  - Pella, IA, and Maassluis, Netherlands (2012), Bale positioning attachment for round baler.
  - Pella, IA (2011-2012), Conditioning apparatus for forage disc mowers.
  - Pella, IA, and Maassluis, Netherlands (2011-2012), Self-guided bale retrieval implement.
  - Pella, IA (2010-2011), Track-mounted self-propelled 630 hp HG6000TX whole-tree horizontal grinder.
  - Pella, IA (2009-2010), Semi-trailer-mounted, tridem-axle 630 hp HG6000 whole-tree horizontal grinder.
  - Pella, IA (2008-2009), Track-mounted, self-propelled 1050 hp HG8000TX whole-tree horizontal grinder.
  - Pella, IA (2005-2008), Semi-trailer-mounted, tridem-axle 1050 hp HG8000 whole-tree horizontal grinder.
  - Pella, IA (2004-2005), Track-mounted, self-propelled 630/525 hp HG6000TX whole-tree horizontal grinder.
  - Pella, IA (2002-2003), Semi-trailer-mounted, tridem-axle 630/525 hp HG6000 whole-tree horizontal grinder.
  - Pella, IA (2001-2002), Towed 122 hp BC1400 14-inch brush chipper.
  - Pella, IA (2000-2001), Semi-trailer-mounted, quad-axle 800 hp TG800 tub grinder.

- Pella, IA (2000), Towed 126 hp BC1800 18-inch brush chipper.
- Pella, IA (2000), Towed 80-104 hp BC1000XL 12-inch brush chipper.
- Pella, IA (1999-2000), Towed 80-104 hp BC1000 10-inch brush chipper.
- Pella, IA (1997-1999), Self-propelled 50 hp tracked SC505 stump cutter.
- Pella, IA (1997-1998), Towed 120-126 hp SC1102A stump cutter.
- Pella, IA (1996-1997), Towed 75 hp SC752 stump cutter.

## Selected Forensic Engagements

- **Mechanical Evaluations**
  - Iowa (2024), Evaluation of repair costs and processes used to repair watermain damage done by underground directional boring activity.
  - Washington (2024), Investigation into the cause of underground fuel storage tank heaving and damage to property infrastructure.
  - Iowa (2024), Investigation into a staged vehicle theft involving a known easy-to-steal car with a failing engine.
  - Oklahoma (2024), Inspection and engine operation troubleshooting of a 25-ton haul truck reportedly damaged in an overturn accident while being hauled.
  - Iowa (2024), Investigation of the failure of multiple systems related to a microbrewery, including an external wort boiler and plumbing fixtures.
  - Florida (2024), Metallurgical evaluation of weld repairs to a high-manganese steel antique safe that was damaged in transport. Review of estimated cost of repairs to timing mechanism, paint, and plated parts.
  - Iowa and Nebraska (2024), Investigation of industrial machinery failures including loss of use costs and proposed repair costs in manufacturing operations.
  - Indiana and South Carolina (2023, 2024), Evaluation of potential steering gear manufacturing defects in heavy trucks involved in traffic collisions.
  - Nebraska (2023), Investigation into the rollover loss of a wind turbine blade hauling truck and trailer being steered by remote from an escort vehicle.
  - Colorado (2023), Evaluation of a commercial greenhouse complex with hundreds of miles of damaged heating pipes and irrigation lines due to improper operation of the facility heating system.
  - Washington (2023), Investigation of claimed loss-of-use and insufficient capacity of a grain milling system for a craft distillery operation.
  - Iowa (2023), Inspection of engine compartment fire in the area of a recalled brake pressure switch, revealing evidence consistent with the known fire ignition cause.
  - Nebraska (2023), Investigation into the mechanical fracture failure of an aftermarket suspension component installed on a performance automobile, revealing design and manufacturing defects.
  - Washington (2023), Evaluation of claimed damages and salvage value for a shipyard gantry crane festoon.
  - California (2023), Implosion of a vacuum tank truck due to improper refitting of vacuum pump assemblies.
  - Iowa (2023), Inspection of a large industrial printing machine for damage reportedly caused by improper ink.
  - Washington (2023), Inspection of claimed damaged fuel dispensers at a convenience store adjacent to a property where a structure fire had occurred.
  - Florida (2023), Review of diminished value claim on a vehicle after a repairable vehicle accident.
  - Nebraska (2023), Mechanical and metallurgical evaluation of a failed dump truck dump body hinge assembly.
  - Florida (2023), Review of repairs, repair charges, and diminished value of a collector supercar.
  - Texas (2023), Investigation into the crushing failures of grain aeration flooring slat systems discovered upon emptying the bins. Evaluated the effects of the grain sweep auger systems and grain deterioration, along with improper installation of the sweeps.

- Colorado (2023), Investigation into a sewage lift pump station pipe burst blamed on damage done to the pipe by a directional drill boring head.
- Illinois (2023), Investigation of an engine failure caused by overfilling of the engine oil during an oil change.
- Iowa, Missouri, Nebraska, and Washington (2022-2024), Evaluation of recently rebuilt engines with low-hours catastrophic failures.
- Iowa (2022), Investigation and internal inspection of failure of reel motor and gearbox on 150-ton crawler crane.
- Wyoming (2022), Evaluation of the construction, operation, and maintenance of an irrigation canal system in operation continuously since 1922.
- Florida (2022), Evaluation of a 1000 kW commercial backup generator for failure due to long-turn ingress of water and contaminants into fuel storage system.
- Iowa (2022), Slip form paver main frame failure during loading for transport.
- South Dakota (2022), Inspection of reported 20 miles of agricultural manure hose damaged in a storm event. Evaluation of multiple pieces of agricultural equipment and tractors for storm-related damage.
- Iowa (2022), Repair analysis for heavy truck engine that failed after improper engine timing procedure was used.
- Texas (2022), A large earthmoving machine rolled down an incline and collided with a residential home. Inspection and evaluation of machine controls and components and operator training and instruction.
- Minnesota (2022), Tanker rail car unloading molasses erupted, causing property damage and depositing residue on nearby houses and vehicles.
- Missouri (2022), Transmission failure on a semi-truck investigated to determine cause. Multiple parties had been involved with various service involving the transmission system.
- South Dakota (2022), 250-ton crawler crane buckled the main boom heel section while positioning a 40,000-pound building panel. Investigation of crane setup, controls, and operation.
- Iowa (2020), Supplier of on-highway trailer wheels informed that their manufacturer had changed and wheels may be faulty. Investigated and performed SAE and other engineering tests on wheels to determine reliability of the wheel and axle hub retention system. Determined recall was needed on several product lines and performed these recalls with NHTSA, EU, and Australian procedures.
- Iowa (2020), Brush chipper fuel ejection from a modified fuel tank. Tested and determined that expansion volume was not sufficient.
- Belgium and Netherlands (2019-2020), Investigation of frame and tongue failures on Euro model brush chippers. Manufacturing defect identified and a multi-phase recall was issued following EU transportation rules to keep machines operating while a complete fix was determined.
- Dublin, Ireland (2019), Towed machine separated at the hitch tongue and exited roadway.
- Australia (2019), Towed machine lost the axle connecting fasteners and axle separated from machine striking parked vehicle. Improper machine maintenance and inspections.
- Iowa (2018-2021), Evaluation and design of ultra-wideband triangulation and sensing of operator and personnel around a machine to detect when worker enters prohibited zone(s).
- Michigan (2018-2019), Directional drilling equipment electrical strike systems were giving alerts of ground voltage. Testing determined that the Michigan state electrical grid had extensive earth return currents due to the construction of the grid. This was confirmed by previous and ongoing research by other organizations. Altered the current sensing system for machines operating in this area while maintaining operator safety.
- Iowa (2018), Testing of stump cutter in multiple configurations and conditions to evaluate the claim of machine jumping and bucking causing injury. Proved that no such condition could occur.
- Massachusetts (2017), Evaluation of functionality of modified stump cutter cutterwheel guard and clutching belt drive system.

- Iowa (2016-2019), Testing and evaluation of apparatus and systems to address rope accidentally fed into brush chippers. Evaluated forces produced and dynamics of incidents. Included biomedical and human factors evaluations.
- Iowa (2015-2016), Extensive testing of fueling of pedestrian equipment to trace vapor flows possibly leading to ignition. Evaluation of fuel tank venting and small engine fuel injection systems that can result in excess intake fuel buildup causing engine backfires and fire.
- Iowa (2014-2021), Investigated multiple matters involving machine controls, lighting and marking, warnings and instructions, product and component integrity, and alignment with industry state of the art. Performed extensive testing and analysis of machines and machine systems for compliance with national and international standards and regulations.
- Florida (2014), Defect claim of stump cutter guard and controls. Created 3D solid models using site data to show workers violated warnings and had modified the machine.

- **Fire and Thermal Events**
  - Iowa (2024), Investigation of fire in the basement of an old downtown structure claimed due to sidewalk sawing operations near the front of the building. Discovered that improper repairs done to the foundation wall structure created unknown openings in the sidewalk subbase to improper wooden rim/sill spacers.
  - Washington (2024), Fire involving multiple fields ignited by a failed bearing in the header of a swather.
  - Nebraska, South Dakota, Wisconsin, and Florida (2023, 2024), Fires in the engine compartment of a common make and model of vehicle involving the electric power steering pump with known performance issues.
  - Iowa and Tennessee (2023), Investigation into the cause of fires in small consumer thermoelectric cooling devices used in kids' rooms, dormitories, bedrooms, bathrooms, and spas.
  - Iowa (2023), Kitchen fire ignited when a house pet actuated the gas burner controls while attempting to retrieve food materials left on the range top.
  - Minnesota (2023), Fire caused by faulty component in a common household microwave.
  - Iowa (2023), Kitchen and townhouse fire during move-out of tenant and unoccupied structure.
  - California (2023), Fire ignited and destroyed three CNG-powered municipal busses while they were attempting to be de-fueled.
  - Iowa (2023), Fire in the engine area of a large articulated loader in the area of a recent modification.
  - Iowa (2023), Truck fire originating from an area of recent fuel system service work and a known maintenance problem area.
  - Iowa (2023), Thermal event in the starter wiring harness area of a mid-size pickup. Investigation of product manufacturing defect.
  - Iowa (2023), Mechanical inspection of a domestic freezer to determine if it caused a house fire.
  - Iowa (2023), Fire occurred on a large tree tub grinder operating at a city facility.
  - Nebraska (2023), Fire in a round hay baler baling cornstalks.
  - Iowa (2023), Mechanical evaluation of a pickup truck that had recent engine work to determine if the work caused an engine area fire.
  - Iowa (2023), Fire on a tractor originating in the exhaust area in a known area of chaff buildup. Manufacturer had changed the exhaust design in this area on subsequent models.
  - Minnesota (2023), Fire in a dust collection system for a steel fabrication facility.
  - Iowa (2023), House fire caused by an overheated dehumidifier in a basement laundry room.
  - Nebraska (2023), Fire occurred in an RV containing eight large propane tanks and multiple gas and electric appliances.
  - South Carolina (2023), Explosion and fire in a CNG-powered service van.

- Iowa (2022), Fire that destroyed a newly designed and newly installed large grain dryer at an elevator.
- Investigation of the origin and cause, and detailed examination of the new design only used in this installation.
- Nebraska (2022), Fire in a semi-truck engine area caused by an improperly remanufactured air conditioning compressor.
- Iowa (2022), House fire blamed on recently installed engine in a vehicle parked in the garage. Mechanical evaluation of the vehicle to determine if it could have caused the fire.
- Missouri (2022), Solar roof array and battery storage system blamed for agricultural building fire.
- Iowa (2022), Combine engine area fire and engine runaway event.
- Iowa (2022), Cattle trailer experienced a brake failure on one axle resulting in a fire at the hub, wheel, and tire, which continued to melt the aluminum structure of the trailer.
- Iowa (2022), Flexible gas connector tubing fatigued and cracked, causing a gas leak and resultant fire that damaged a range and kitchen.
- Wisconsin (2022), Complete loss of two-story home due to placement of space heater in a fuel-dense closed space. Fire progression included many mechanical systems, which initial investigators identified as possible sources.
- Ohio (2021), Stump cutter fire at intake area of engine under control panel.
- Tennessee (2021), Brush chipper fire at hydraulic pump. Installation of pump coupler was incorrect resulting in friction and ignition of oil and organic material.
- Norman, OK (2020), Tub grinder fire on municipal jobsite. Lack of maintenance and lack of basic cleaning caused friction heating of built-up material which ignited and spread to leaked hydraulic fluid.
- Alabama (2019), Baler fire caused by operator becoming entangled in the baler when attempting service without stopping the PTO.
- Paris, TX (2019), Horizontal grinder fire on jobsite due to ignitable material buildup under engine area.
- Iowa (2019), Brush chipper fuel tank fire during refueling.
- Sherman, TX (2019), Directional drill, compact excavator, trailers, and building damaged by extensive fire after thunderstorm. Machines had been sitting for some time and battery charger was in use, although charger was not present or available at inspection.
- Illinois (2018), Directional drill engine fire from starter overheating igniting a fuel line.
- Wichita Falls, TX (2018), Directional drill engine fire at starter.
- Peterborough, ON, Canada (2017), Brush chipper engine fire. Organic material buildup and engine exhaust manifold redesign by manufacturer caused ignition of material.
- Iowa (2017), Brush chipper fires caused by faulty exhaust expansion joint.
- Iowa (2016), Stump cutter and pedestrian trencher refueling fires due to fuel tank and engine intake design. Recall and field campaign issued.
- Investigated origin and cause as principle or consulting investigator on over 60 matters involving machinery, vehicles, engines, fuel systems, electrical, hydraulic, and drivelines.

- **Jobsite Accidents**
  - New York (2023), Evaluation of an injury reportedly sustained during operation of a fifth wheel hitch release.
  - Iowa (2023), Worker burned while using a new tarpot just received from the manufacturer. Determination of a manufacturing defect that led to an inadvertent ignition of the heated product.
  - Nebraska (2023), Struck-by fatality of a worker operating a foundation pier installation apparatus.
  - North Dakota (2023), Back-over fatality of road worker in a work zone by an asphalt delivery truck.
  - Iowa (2023), Anhydrous ammonia burn to a juvenile while changing hoses on the injector apparatus.
  - Vermont (2022), Operator's hand was amputated when he reached into the running rotor area of a harvesting machine. Performed an evaluation of the drive, braking, and warning systems of the machine.

- Mississippi (2022), Worker's arm was amputated when it was pulled into a forage harvesting machine. Shields had been removed and safety signs were missing. Worker did not follow machine shut down instructions per the Operator's Manual before working on machine.
- Iowa (2022), Inspection and evaluation of a fall protection device in use when a worker fell and was injured.
- Texas (2022), End-dump dump truck overturned when operator was attempting to dislodge a stuck load. The operator did not follow the instructions, warnings, and his training to properly operate the dump.
- Nebraska (2022), Rollaway and overturn of a rented personnel lift resulting in property and lift damage.
- Florida (2022), Worker injured while unloading trusses from a semi-trailer with a forklift. Forklift tipped and worker was thrown and injured.
- Florida (2021), Worker killed when he became entangled in a gas line being installed by a directional drill. Improper tooling, improper work procedures, safety violations, and lack of training caused the accident.
- Riverside, CA (2021), Two workers, including one working aloft, seriously injured when a rope was fed into a brush chipper.
- Florida (2021), New worker crushed when operating an improperly modified machine. Lack of proper training and removal of safety interlock contributed to fatality.
- Ohio (2021), Worker suffered ankle and leg injuries after improperly crawling onto machine during operation and was crushed.
- Illinois (2020), Worker killed when he struck machine due to being entangled in a rope he fed into the brush chipper.
- Tennessee (2020), Worker suffered leg injury when he became entangled in a winch line accidentally fed into a brush chipper. Later died of a heart attack.
- Ohio (2020), Worker killed when a rope fed into a brush chipper struck him in the head.
- South Carolina (2020), Engine service technician hurt when he inserted his hand into the engine fan while the engine was running and the machine hood was opened.
- Ohio (2019), Worker seriously hurt when operating a stand-on skid steer and backed under a semi-trailer, causing neck, head, and back injuries. Worker was operating in the rain with an obstructed view with a rain jacket. Attachment used on the machine was not an OEM attachment with any instructions or warnings.
- Orlando, FL (2019), Worker seriously hurt while operating a brush chipper with a damaged safety system. Workers had devised a way to bypass the safety system using tools and a specially-made device.
- Alabama (2019), Directional drill operator hurt when improperly servicing machine while the machine was running.
- South Carolina (2018), Machine operator hurt when he was ejected from a machine due to overturning of the machine. Operator violated setup instructions and was operating machine improperly.
- Mississippi (2018), Worker crushed and killed when caught between the drill rod adder system and the machine. Worker and crew failed to follow instructions and warnings on the machine.
- Illinois (2018), Worker killed when crushed between directional drilling machine and a parked vehicle while controlling the machine with the remote control on a crowded residential front yard.
- California (2018), Worker suffered hand and arm injuries when ground crew fed his rope into chipper.
- Georgia (2018), Explosion at coffee shop injuring several people due to gas line rupture during directional drilling. Confusion of utility locates due to re-routing of roadway and miscommunication between contractor and utility led to gas line rupture during fiberoptic installation. Gas entered coffee shop through a sewer line that was also breached.
- Oregon (2018), Worker aloft in bucket was seriously hurt when ground crew fed his rope into chipper.
- Iowa (2018), Worker operating a directional drill was struck by an ejected rod causing a head injury. Evaluation revealed that rushing to complete the job resulted in wear and damage to the machine, and then

caused the rod to eject when the operator was rushing the rod changeout. Reviewed the operation instructions with the contractor and maintenance procedures to eliminate this possibility. Reviewed the warnings against using damaged drill rods.
- Massachusetts (2017), Worker servicing engine injured leg due to improperly modifying and operating the machine. Machine had also been heavily modified previously and suffered from extreme lack of service and maintenance.
- Anchorage, AK (2017), Improperly stowed winch line fed into chipper wrapped around workers leg resulting in amputation.
- Wisconsin (2017), Worker hurt when he violated warnings and operation instructions and crushed his leg on a directional drill.
- Maryland (2016), Operator of machine broke led by backing machine into himself and a concrete wall.
- Missouri (2016), Worker seriously hurt while operating a modified brush chipper that was found along the roadway.
- Oregon (2016), Distracted worker on phone was hurt when he fed a rope into a brush chipper and became entangled, striking chipper.
- Charlotte, NC (2015), 17 year old was killed when operating a brush chipper without any training. Machine had a critical safety system disabled, and feed system was not operating properly forcing workers to push material in manually.
- Iowa (2015), Jobsite visit revealed dangerous work conditions being employed by a pipeline contractor. Worked with jobsite foreman to correct these issues following the procedures in the machine operator's manual and industry best practices.
- Chandler, AZ (2015), Worker killed when he fed a rope into a brush chipper that had been hidden under a large bundle of branches and became entangled.
- Florida (2014), Coworker foot amputation when stump cutter operator cut the stump worker was standing on.

- **Vehicle Accidents**
  - South Carolina (2022), Automobile veered off highway and collided with a mower and tractor combination, and then struck another vehicle.
  - South Dakota (2022), High-speed boat collision during a fishing tournament. Retrieval of GPS data from broken chart plotter.
  - Nebraska (2022), Box truck traveling at highway speed collided with a stopped-to-turn grain truck resulting in fatality of box truck passenger.
  - Iowa (2022), Truck and dual trailer rollover accident. Inspections of truck, trailers, and dolly system in use.
  - South Carolina (2021), Towed trailer loss of control and rollover due to tire failure. Axle and hitch tongue were out of alignment, and suspension wear had caused uneven and excess tire wear and blowout.
  - Georgia (2020), Vehicle fatality due to high-speed loss of control and striking parked equipment on road shoulder.
  - Massachusetts (2019), Truck struck equipment parked in the road median when driver veered while texting.
  - Virginia (2019), Vehicle struck slowed equipment turning onto side road due to distracted driving.
  - North Carolina (2018), Worker hurt when OHV towing a machine skidded downhill and crashed. Resulting fire injured worker. Brakes on OHV were faulty, and vehicle was not rated for the towed load.
  - Los Angeles, CA (2015), Vehicle fatality when car struck a trailer that had become detached from the tow vehicle and came to a stop in the traffic lane.

- **Human Factors Engagements**
  - Missouri (2023), Product manuals, product reviews, and warnings development for a product line intended for the domestic market and eventual international market.
  - Iowa (2014-2021), Multiple projects involving extensive human factors analyses for machines and equipment sold in the US and over 100 other countries. Included were product design, product safety, guarding, and warnings. Extensive development and application of product safety and compliance considerations.
  - Development of guidance and standards for operators manuals, training materials, and training programs. Production of product instructional, operation, and safety videos and materials.

- **Miscellaneous Engagements**
  - Nebraska (2023), Drone examination and photogrammetric reconstruction of a 100-year-old church steeple.
  - New Hampshire (2023), Development of a program to inspect and service truck trailer hubs in a large fleet to reduce downtime and improve maintenance shop efficiency.
  - Wisconsin (2023), Examination of contamination to a dairy production operation in the brine handling system for the source of reported heavy metals contamination.

## Professional Experience

- **Rimkus** **2022 – Present**
  - Principal Consultant
    Perform investigations related to machines, machinery, equipment, vehicles, trucks, trailers, plants, manufacturing, job sites, farms, utilities, construction, mining, and earthmoving. Perform evaluations for product safety and product compliance issues. Perform analysis of and consultation on instructions and warnings, including technical publications and safety signs. Consult on creating and building product safety programs and product compliance for design and manufacturing companies.

- **Vermeer Corporation** **2014 – 2021**
  - Product Safety and Product Compliance Engineering Manager (2016-2021)
    Responsible for leading and managing the product safety and product compliance program for an international manufacturer with design and manufacturing facilities in multiple countries and distribution worldwide. Performed design engineering consultation, field incident investigations, corporate representative and expert witness testimony, and NHTSA recall investigations and campaigns. Contributed to multiple national and international standards, and state, provincial, and national regulations. Directed technical publications content including operator's manuals, maintenance and parts manuals, and user's guides. Performed training in product safety and product liability, compliance, and best practices.

  - Product Safety Engineer (2014-2016)
    Consulted as a product safety expert for earthmoving equipment, drilling and boring equipment, and foundation equipment. Developed safety features and evaluated state-of-the-art technologies for safety. Performed field investigations of accidents, analysis, and reconstructions. Research into operator ergonomics and human factors.

- **Vermeer-Lely Forage Tech USA** **2011 – 2014**
  - Research and Development Engineer
    Design of machine vision and multi-sensor systems. Worked on highly automated and autonomous machines for harvest. Designed hydrostatic drive systems, electrohydraulic control systems, laser, sonar, and IR light sensing and guidance systems.

- **Vermeer Corporation** **2002 – 2011**
  - Project Engineer
    Managed a multi-disciplinary design team of engineers, technicians, designers, contract engineers, and technical writers. Designed whole-tree grinders for land clearing, storm cleanup, mulch production, and compost facilities. Responsible for large, on-highway vehicle design and commercial vehicle legal compliance. Specialty practice in metallurgical engineering, materials, and heat treating. Performed field failure analysis and field fix campaigns. Performed FEA analyses on structures and parts. Developed combustion engine drive systems for high-hp applications.

- **Vermeer Manufacturing Company** **1996 – 2002**
  - Design Engineer
    Product design of brush chippers, stump grinders/stump cutters, tub grinders, and various accessories and enhancements. Responsible for engineering analysis of structures including stress coat and strain gauging, road simulation, and accelerated testing. Fabricated, machined, and welded parts and structures for prototype builds. Designed and built wiring harnesses and systems. Designed and built hydraulic systems, electro-hydraulics, and designed hose and steel line routings.

## Certifications, Associations, and Notable Positions

- **Licensed Professional Engineer:** California, Colorado, Florida, Iowa, Illinois, Kansas, Minnesota, Missouri, Nebraska, New York, North Carolina, North Dakota, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Vermont, Washington, Wisconsin, and Wyoming
- **International Association of Arson Investigators,** Electrical Aspects of Fire Investigation tested training program
- **Northwestern University Center for Public Safety,** Traffic Crash Investigation I
- **FAA Part 107 Remote Pilot In Command Certification**
- **Human Factors Engineering,** University of Michigan Professional Course
- **Warnings and Instructions, Product Safety & Liability,** University of Wisconsin Seminars
- **NAFI Certified Fire and Explosion Investigator**
- **NAFI Certified Vehicle (and Equipment) Fire Investigator**
- **Midwest Association of Technical Accident Investigators**, CMV Advanced Crash Training 2022
- **AEM Product Safety and Liability Seminar,** 2014-2021
- **Natural Gas Vehicle Institute NGV Essentials and Safety Practices,** 2023
- **Association of Equipment Manufacturers (AEM) Construction Equipment Standards and Regulations Committee:** Multi-Year Chair
- **AEM Underground Equipment Manufacturers Council:** Multi-Year Chair
- **Committees and Councils:** AEM Alternative Power Technical Committee, Attachment Manufacturers Council, Compact Loader/Compact Excavator Council, Earth-moving and Mining Equipment Council, Forestry Equipment Council, Joint Technical Liaison Meeting, Safety & Product Leadership Council, Towed Equipment Technical Committee, Trencher Equipment Committee, Trenchless Equipment Committee, and Vacuum Excavation Equipment Committee.
- **SAE MTC 1 Earthmoving Machinery**
- **SAE MTC 4 Forestry and Logging Equipment**
- **SAE MTC 9 Trenching and Horizontal Earthboring Machines**
- **ISO TC 127 Earth-moving Machinery**

- **ISO TC 195 Building Construction Machinery and Equipment**
- **ISO TC 199 Safety of Machinery**
- **ISO TC 82 Mining**
- **ISO TC 10 Technical Product Documentation**
- **ISO TC 23 Tractors and Machinery for Agriculture and Forestry**
- **ISO TC 145 Graphical Symbols (for Safety Signs and Controls)**
- **ANSI Z535 Series – Safety Signs, Product Safety Information for Product Manuals**
- **ANSI Z133 Safety Requirements for Arborculture Operations**
- **Functional Safety Training,** 2016-2021
- **SAE Accident Reconstruction Digital Summit** 2023
- **IAAI Fire Investigation Fundamentals** – DMACC/ International Association of Arson Investigators

## Education

- **Master of Science in Agricultural and Biological Systems Engineering, Emphasis in Machine Design, Metallurgical Engineering, and Failure Analysis:** University of Nebraska – Lincoln, 1998
- **Bachelor of Science in Agricultural Engineering, Emphasis in Power and Machinery:** University of Nebraska – Lincoln, 1994

## Presentations

- **"Investigation and Analysis of Ag-Related Losses"** – Lecture presentation and case studies given to the Iowa Nebraska Chapter of the International Association of Special Investigation Units, 2024 Conference.
- **"Modern Product Safety Management – Lessons Learned"** – Lecture presentation given at University of Wisconsin – Madison 34th Annual Product Liability Conference, 2022.
- **"Identifying and Classifying Arson and Fraudulent Claims"** – Lecture presentation and case study given to the Iowa-Nebraska Chapter of the International Association of Special Investigation Units, 2022 Conference.

## Patents

- US US 20190294914A1 Bale detection and classification using stereo cameras – Darin L. Dux Vermeer Manufacturing Company
- US US20210115739A1 Couplers for connecting a power source to a drilling string - Darin Lyn Dux Vermeer Manufacturing Company
- WO CA EP3458364A4 Systems for encasing articles in a protective wrap - Darin L. Dux Vermeer Manufacturing Company
- WO EP CA EP3459011A1 Bale detection and classification using stereo cameras - Darin L. DUX Vermeer Manufacturing Company
- WO CN US20140003887A1 Hydraulic control systems for regulating transfer of bales - Darin Dux Forage Innovations B.V.
- WO EP US AU CA US9554516B2 Apparatus and methods for gathering bales - Darin Dux Forage Innovations B.V.
- WO US20140369789A1 Apparatus having rotatable skids and methods for gathering bales - Darin Dux Forage Innovations B.V.
- WO EP US AU US20140003888A1 Control of conveyor speed in a bale gathering apparatus - Darin Dux Forage Innovations B.V.

- WO EP US CN AU PL US9271446B2 Self-aligning apparatus and methods for gathering bales - Darin Dux Forage Innovations B.V.
- NZ722078A Baler attachment for optionally changing the orientation of bales being released from a baler - Darin L Dux Forage Innovations B.V.
- WO EP US CN AU CA CA2849906C Baler attachment for optionally changing the orientation of bales being released from a baler - Darin L. Dux Forage Innovations B.V.
- WO US US9254492B2 Grinder with adjustable screens - Darin Lyn Dux Vermeer Manufacturing Company
- WO DE112011104021T5 Table unit for a material crusher - Darin Lyn Dux Vermeer Manufacturing Company
- US20090242677A1 Apparatus and method for supporting a removable anvil - Darin Dux Brian Smidt
- US7461802B2 Apparatus and method for supporting a removable anvil - Darin Dux Vermeer Manufacturing Company
- US5763509A Binder containing plant protein and densified refuse fuel cubes made using same and methods of making them - Darin Dux The Board of Regents of The University of Nebraska