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SC Court of Appeals

THE STATE OF SOUTH CAROLINA
In The Court of Appeals

APPEAL FROM SPARTANBURG COUNTY
Appellate Panel of the South Carolina Workers' Compensation Commission

R. Michael Campbell, II; Avery B. Wilkerson, Jr.; Aisha Taylor
South Carolina Workers' Compensation Commissioners

Case No. 1614297
Appellate Case No. 2021-000669

Kenneth D. Christian, Employee,

Appellant,

v.

Sew Eurodrive, Inc., Employer and
Great American Alliance Insurance Company, Carrier,

Respondents.

RECORD ON APPEAL

VOLUME V

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- 2015 Expert Report on the Likelihood of Fungal Eye Infection after Contact with Fertilizer**
Investigated exposure of plaintiff to airborne fertilizer particles during spreading operations resulting in loss of an eye.
- 2015 Expert Opinion on the Toxicity and Health Effects of Synthetic Cannabinoids**
In January, provided a memorandum to the Fairfax County, VA Police Department detailing the health effects of synthetic cannabinoids used in the illegal drugs known as "spice" or "K-2."
- 2014-15 Development of Statistical Background Screening Methods for Use at a Potential Superfund Site**
In December, provided a comparison to background for concentrations of arsenic and polycyclic aromatic hydrocarbons at a site currently going through the Hazard Ranking System.
- 2008-14 Expert Consultation and Deposition on Regulatory Decisions at a Superfund Site**
Provided an expert report to attorneys about how the presence of dioxin-like chemicals and PCBs affected the regulatory activities/decisions at a Superfund site. In 2014, provided deposition in Wash. DC.
- 2014 Report on TSCA Compliance Status of Recent Data and Publications on the Health Effects of Chromium**
Prepared a report on the determinations of whether these data and publications could be considered "new" information. The purpose was to provide attorneys with risk information as indicated in the 1978 TSCA Section 8(e) Policy Statement on Substantial Risk Notifications to EPA.
- 2010 Rebuttal Report on Hexavalent Chromium**
Prepared a report rebutting a report submitted by the expert working for opposing counsel regarding the health and environmental effects of hexavalent chromium.
- 2008-10 Expert Testimony regarding the Effects of Inorganic Mercury**
Provided an expert report to attorneys in a child custody matter regarding the long term neurological and psychological effects of inorganic mercury. Provided expert testimony on this matter in family court in Fulton County, GA regarding the toxicity of inorganic mercury.
- 2009 Consultation and Statistical Modeling regarding the Dose-Response of Perfluorooctanoic Acid (PFOA) in Humans**
PFOA is used in the production of Teflon. Provided consultation about dose-response modeling as a sub-contractor to a consulting firm in Tallahassee, FL to be used in litigation support.
- 2009 Expert Consultation regarding USEPA's Arsenic Toxicity Value**
Provided a memorandum to attorneys and personnel from electric companies on the ramifications of EPA's proposed change in the oral cancer slope factor for Arsenic.
- 2008 Risk Communication and Expert Consultation regarding Aerosol Emissions**
Retained as an expert in toxicology by attorneys for Georgia Power to provide scientific consultation and risk communication regarding emissions of several inorganic chemicals from power plants.
- 2007 Pro Bono Evaluation of Exposure to para-dichlorobenzene (PDB)**
Provided an expert report on exposure and potential liver damage in an individual working in a botany laboratory in which PDB was used as an insect fumigant for plant specimens.
- 2006 Assessment of Possible Drug/Alcohol Impairment in for Workman's Compensation**
Examined quick urine drug screen results showing alcohol and marijuana use and developed an assessment of possible impairment.
- 2006 Expert Consultation on the Recent History of Arsenic Regulation by EPA**
Provided a memorandum detailing the history of arsenic regulation as a soil contaminant by EPA headquarters and by Region 4 EPA (Southeast) since 1988 to support the efforts of attorneys regarding a Superfund site.
- 2006 Consulting Expert regarding Indoor Dampness and Mold**
Served as a consulting expert regarding adverse effects of exposure to indoor dampness, associated mold and bacteria and the disinfectant chemicals used in the cleanup.

- 2003-4 Model of Chemical Release from a Railroad Tank Car**
Developed a mathematical model for the release and dispersion of a dense gas, ethyl acrylate, from a railroad tank car. The gas produced both sensory irritation and toxic effects. Dispersion modeling was performed for dense gas dispersion in complex terrain.
- 2003 Expert Testimony in EPA vs. Norman C. Mayes**
As an EPA toxicologist, provided testimony to Administrative Law Judge Barbara Gunning regarding the health effects of benzene and other fuel components and environmental sampling around underground storage tanks.
- 2002-4 Air and Exposure Modeling and PBPK Model Development of Creosote Exposure at a Wood Treatment Facility**
Developed a comprehensive database of chemicals in wood preservative made with coal tar creosote, a mathematical model of the air concentrations of these chemicals at a wood treatment facility, and a second model for human internal exposure to these chemicals that included ingestion, inhalation and dermal routes.
- 2001-2 Expert Testimony regarding Calibration of the Intoxilyzer 5000**
Developed testimony regarding the calibration procedures of the Intoxilyzer 5000, the "breathalyzer" used in Georgia for DUI testing. Charges in DUI cases were dropped prior to his testimony in the three cases in which Dr. Simon was involved.
- 2000 Chemical Release from a Railroad Tank Car**
Developed a model of release and transport of acrylamide from a railroad tank car for use in litigation.

TEACHING

- 2014 Instructor, Environmental Risk Assessment and Communication, EHSC 8110, University of Georgia**
Taught a graduate level course in the School of Public Health using his textbook, "Environmental Risk Assessment: A Toxicological Approach."
- 2008 Lecture on the Toxicology of PCBs**
Developed and presented a training segment as part of the Toxic Substance Control Act (TSCA) training for electric power company personnel at the Georgia Power Company.
- 2008 Introduction to Risk Assessment, a two-day class for the Ontario Ministry of Environment**
With another scientist, developed and taught a class on risk assessment for newly hired Ministry personnel.
- 2005 Probabilistic Risk Assessment and Statistics, a short course to Michigan Department of Environmental Quality**
With another scientist, presented a 1 ½ day class on probabilistic risk assessment and statistics as part of a workshop sponsored by the Society for Risk Analysis and Interstate Technology Regulatory Council.
- 2003 Graduate Course in Simulation Modeling, Georgia State University**
Taught a graduate level course in Simulation Modeling including statistics, probabilistic methods and time-dynamic differential equation models.
- 2003 Short Course to Ontario Ministry of Environment on Probabilistic Risk Assessment**
With another scientist, developed and taught a class on probabilistic risk assessment, including probabilistic approaches to dose-response to personnel at the Ontario Ministry of Environment in Toronto, Canada
- 2001-06 University of Georgia Graduate Course in Environmental Risk Assessment**
On three separate occasions, taught a graduate-level class on Environmental Risk Assessment lasting 15 weeks, 3 hours per week.
- 2001 Short Course to Texas Natural Resources Conservation Commission on Probability Distributions**
With another scientist, developed and taught a class on statistics and probability distributions to data to TNRCC personnel.

2000 Workshops on Probabilistic Risk Assessment

Performed as an EPA toxicologist. In 1999 and 2000, worked with Dr. Steve Roberts of the University of Florida to organize two workshops on PRA sponsored by EPA, NIEHS and the University of Florida.

1999 Short Course to Texas Natural Resources Conservation Commission on Probabilistic Risk Assessment

With another scientist, developed and taught a class on probabilistic risk assessment to TNRCC personnel.

1997 Short Course to Navy Environmental Health Center personnel on Probabilistic Risk Assessment

With another scientist, developed and taught a class in probabilistic risk assessment Navy personnel in Norfolk, VA.

PRODUCT LIABILITY AND SAFETY EVALUATIONS**2013 Presentation to a French Government Agency on Product Safety**

Provided a report with estimates of both toxicity and exposure to rail workers on the use of a synthetic dielectric compound manufactured by a company in the UK. Met with French government personnel to discuss the report.

2012 Assessment of Risk from Metal Plating Flaking from an Auxiliary Faucet used with a Water Filter

Developed risk estimates for water consumers from dissolved metals and metal flakes from the faucet. This assessment was used internationally and therefore incorporated World Health Organization methodology.

REGULATORY TOXICOLOGY**2019 Expert Panel on Quantitative Mode of Action Scoring for Carcinogenesis**

Participated with 15 other experts in a questionnaire and in-person two-day meeting to develop a methodology for determining measurable events predictive of cancer occurrence.

2019 Review of Teaching Materials for the Predictive Analytic Toolkit, a web-based platform for inferential statistics

This toolkit provides a range of multivariate methods for use in predictive models. The work was sponsored by a chemical industry trade group and the materials included both videos and written materials.

2018 Comments to California's Office of Environmental Health Hazard Assessment (OEHHA) on Reference Exposure Levels for Toluene

The comments were developed for submission by a chemical industry trade group and dealt specifically with the application of safety/uncertainty factors for human variability.

2018 Lead Author of a Document Developing Toxicity Reference Values for Inorganic Arsenic

The report was developed for Health Canada, the Canadian equivalent of the US EPA. Data from many large epidemiologic studies were used for exposure-response modeling and development of TRVs such as reference doses and cancer slope factor. Custom software to perform the modeling was developed in the R software language.

2017 Report to Chemical Industry Trade Group on Perfluorinated Compounds

These compounds have been used for stain resistance and waterproofing for many years. They are ubiquitous in the environment and human body burden. The report provides advice about which compounds bear the least risk to human health.

2016-17 Lead Author of a Toxicological Review of Inorganic Arsenic and Organic Arsenicals

The review was developed for Health Canada, the Canadian equivalent of the US EPA and the purpose was to examine the feasibility of the integrating human, animal and In vitro laboratory data to provide an updated toxicity evaluation of arsenic.

2016 Publication titled "How Well Do HTS Carcinogen Characteristics Predict Carcinogenicity?"

Provided statistical analysis, graphics and narrative development for this paper in collaboration with scientists from universities and industry trade groups.

- 2016 Analysis of Chemical Similarity for Abuse Liability of Candidate Drug Molecules**
Conducted a statistical analysis of chemical similarity between two candidate drugs and substances on the DEA Controlled Substance List to address the issue of potential abuse liability.
- 2015-16 Whitepaper on Causal Associations between Flame Retardant Exposure and Firefighters' Diseases**
Developed for the Flame Retardants Alliance.
- 2015 Adverse Outcome Summary Pathways for Chemicals with Uncertainty about the Mode of Action**
Adverse outcome pathways (AOPs) are being used by EPA and OECD to form a data wiki for eventual interpretation of high-throughput in vitro data. Developed separate summaries of AOPs for four chemicals carcinogenic in animals using the assumption of mutagenicity as mode of action and hyperplasia/cell proliferation as the mode of action.
- 2015 Revision of the Toxicity Factor for the Pesticide Toxaphene for use at the Hercules site in Brunswick, GA**
Developed a revised estimate of the toxicity criterion (Reference Dose) for the pesticide toxaphene for use in a new risk assessment for the Hercules site in Brunswick, Georgia.
- 2014-15 Report on Bayesian Statistical Methods used in the NRC (2014) Review of IRIS**
Developed a report examining 24 toxicity factors from EPA's Integrated Risk Information System database, the subject of a recent review by the National Research Council. The report compared EPA's methods with those recommended in the NRC report.
- 2014 Presentation on arsenic and chromium at EPA's Integrated Risk Information System (IRIS) Bimonthly Meeting**
In June, presented mode of action information for arsenic and hexavalent chromium at EPA's IRIS meeting. The purpose of these meetings is to seek input from stakeholders for development of IRIS risk assessments.
- 2013 Presentation on Quantitative Methods for Mode of Action Analysis to EPA's Bimonthly IRIS Meeting**
In December, presented slides and discussion to EPA and other stakeholders based on the paper written with ILSI/HESI titled "The Use of Mode of Action Information in Risk Assessment: Quantitative Key Events / Dose-Response Framework (Q-KEDRF) for Modeling the Dose-Response for Key Events."
- 2013-16 Development of Wiki files on the Adverse Outcome Pathway for the Organisation for Economic Cooperation and Development (OECD)**
Wrote and edited webpages for use in the new AOP Wiki sponsored by OECD, EPA and others. The purpose of the collection of AOPs and the Wiki is to contextualize in vitro data for use in risk assessment.
- 2013 Preparation of a Report Providing Derived LD50 Values for Metals in Fly Ash**
Doses of fly ash representing the LD50 for metals were developed for fly ash produced by an incinerator operated by a large county government in southern California.
- 2013 Development of Evidence Tables for EPA's Integrated Risk Information System (IRIS) Assessments**
Developed tabular format for presenting mode of action and toxicity information consistent with the National Academy of Sciences' Review of the Environmental Protection Agency's Draft IRIS Assessment of Formaldehyde. Presented the tables and accompanying rationale to EPA IRIS staff using hexavalent chromium as an example.
- 2013 Development and Presentation of Responses to Charge Questions for EPA's Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Scientific Advisory Panel**
Wrote responses on physico-chemical screening and the rainbow trout Expert System for estrogenic effects; presented the responses at the FIFRA/SAP meeting at EPA Headquarters.
- 2012 Review of EPA's Toxicological Review of Ammonia**
Reviewed the EPA draft document for ammonia to determine consistency with recommendations from the National Academy of Sciences. Presented results at EPA's IRIS listening session on Ammonia.

- 2012 Review of 2012 Texas Commission on Environmental Quality (TCEQ) "Guidelines to Develop Toxicity Factors"**
TCEQ develops its own toxicity criteria and does not depend on EPA's IRIS database. Prepared comments on the guidance for submission to TCEQ.
- 2012 Preparation of a White Paper and manuscript for publication on Validation of EPA's ToxCast™ Suite of High Throughput In Vitro Assays**
Wrote narrative paper and manuscript for a chemical industry trade group on issues with validation of these assays for chemical screening and prioritization.
- 2011 Development of Physiologically-based Pharmacokinetic Models for Dioxin, PCBs, DDT, Hexachlorobenzene and Organophosphate Pesticides for use as teaching tools at the Agency for Toxic Substances and Disease Registry (ATSDR)**
Developed PBPK models in Berkeley Madonna software for use as teaching aids for personnel at ATSDR.
- 2011 Review of EPA's Physiologically Based Pharmacokinetic Model for Acrylonitrile Used in the IRIS Risk Assessment**
Reviewed the MATLAB computer code and output for optimization of parameters used in this model.
- TOXICOLOGY AND REGULATORY ANALYSIS OF DIOXIN-LIKE CHEMICALS INCLUDING POLYCHLORINATED BIPHENYLS**
- 2012-15 Modeling of Dioxin-induced Gene Expression in Breast Cancer Cells**
Developed a model of gene expression using stochastic simulation methods that reproduced several phenomena such as non-monotonic dose response curves.
- 2012 Development of a Margin of Exposure for Enzyme Induction from Dioxin Exposure for Comparison with Recent EPA Toxicity Factors for a Weight-of-Analysis**
Using data from both humans and laboratory test species, determined the dose at which an increase in thyroid hormone metabolism could be expected and compared this dose with the current EPA reference dose based on thyroid effects in newborns.
- 2011 Inclusion of 2009 Reference Dose for 2,3,7,8-Tetrachlorodibenzodioxin (TCDD) in the ITER and TOXNET databases**
Presented conclusions from a 2009 publication to a peer review panel convened by Toxicology Excellence in Risk Assessment (TERA) for placement in the International Toxicity Estimates for Risk Assessment (ITER) database and linked to the TOXNET database at the National Library of Medicine.
- 2011 Developed a Revised Toxic Equivalence Factor (TEF) for 2,3,7,8-Tetrachlorodibenzofuran (TCDF)**
TCDF is a dioxin-like chemical that is metabolized and eliminated within hours in contrast to other dioxin-like chemicals that persist in the body for many years; developed an estimate of the TCDF TEF that incorporates this rapid metabolism for presentation at an international conference in Brussels, Belgium.
- 2011 Alliance for Risk Assessment Presentation on Dioxin using Science and Decisions Conceptual Models**
Presented results from the application of dose response methods described National Research Council's 2009 Report "Science and Decisions: Advancing Risk Assessment" to dioxin. The audience was an expert panel that included several of the authors of the NRC report.
- 2010 Report on Biota-Sediment Accumulation Factor (BSAF) for Aroclor 1260, a Commercial PCB Mixture**
Provided a review and commentary on the development of a BSAF for Aroclor 1260 (PCB mixture) and its general applicability to PCB contaminated sites.
- 2010 Rapporteur at a Workshop on Dose-Response Approaches for Nuclear Receptor-Mediated Modes of Action**
Led panel discussion and provided the presentation of the report for the panel examining the mode of action of the aryl hydrocarbon receptor that mediates gene expression from dioxin-like chemicals.
- 2010 Risk Assessment for Dioxin based on the Occurrence of Chloracne in Humans**
Developed a risk assessment for 2,3,7,8-tetrachlorodibenzo-p-dioxin based solely on data from humans and presented the work at the Dioxin 2010 meeting in San Antonio, TX.

- 2010 Analysis of Responses of Human and Rodent Liver Cells to Dioxin-Like Chemicals**
Conducted statistical analysis of genomic and proteomic data in response to three dioxin-like chemicals from human and rodent tissues *in vitro*.
- 2010 Cancer Slope Factors and Toxicity Equivalence Factors for Dioxin-Like Chemicals based on Internal Doses**
Developed a comparison of the toxicity of four dioxin-like chemicals based on tissue concentrations from National Toxicology Program bioassays using physiologically-based pharmacokinetic modeling and dose response models.
- 2009 Evaluation of Toxicity Equivalence Factors for Dioxin-like Chemicals based on external doses**
Developed a comparison of methods used to develop values for TEFs used in risk assessments of dioxin-like chemicals.
- 2009 EPA Federal Advisory Committee Act (FACA) Workshop on Dioxin**
Attended workshop on the risk assessment of 2,3,7,8-tetrachlorodibenzodioxin (TCDD); provided public commentary on EPA's proposed methods for revising the 2003 dioxin reassessment.
- 2008 Review of PCB Ecotoxicology Information in the Baseline Ecological Risk Assessment for the LCP Chemical Superfund Site, Brunswick, GA**
Reviewed the toxicity assessment for PCBs for the ecological risk assessment for this site to ensure consistency with the values and approach used in the human health risk assessment.
- 2007 Comparison between Blood Levels of Dioxin in residents of Midland, MI and those in rats associated with Adverse Effects**
Conducted a comparison between human blood levels of 2,3,7,8-TCDD and 2,3,4,7,8-PeCDF measured in humans in the University of Michigan Dioxin Exposure Study and estimated blood levels in rats from bioassays published by the National Toxicology Program in 2006.
- 2007 Development of a Risk Assessment Methodology Based on Changes in Gene Expression**
With very recent information on dioxin-related gene expression changes in the liver, developed a method for using these changes as a biomarker for the progression to type 2 diabetes.
- 2007 Whitepaper on the Non-cancer effects on humans of Dioxin-like Chemicals**
Collected scientific information related to potential and actual human health effects from published studies of the Yu-Cheng/Yusho poisoning, the Seveso exposure, the BASF plant exposure and the Viet Nam Ranchhands (Agent Orange handlers) and others to assess the likelihood of various health outcomes from dioxin exposure.
- 2007 Soil Cleanup Standards for Dioxin related to the Georgia Hazardous Substances Response Act for a secondary copper smelter**
Develop a dioxin cleanup level in soil for consideration by the Georgia EPD that included an epidemiological study of dioxin in the blood of workers at the smelter.
- 2005 Development of Surrogate Values for Reported Dioxin Concentrations Below the Analytical Detection Limit**
Performed as an EPA toxicologist; the use of contract-specified reporting limits as nondetect surrogates for dioxin analysis leads to large overestimates of soil concentrations; identified a more accurate nondetect surrogate value based on the actual chemical analysis.
- 2005 Reassessment for the Need for PCB Congener Analysis at the Anniston/Solutia PCB Site**
Performed as an EPA toxicologist; compared results from PCB cancer bioassays of their cancer potency.
- 2004-5 Geostatistical modeling of dioxin concentrations in soil at Superfund Sites in Florida**
Performed as an EPA toxicologist; these analyses demonstrated that cleanup at these sites had been successful and appropriate for the predicted land use; the analyses also showed that dioxin occurring off-site was unrelated to on-site contamination.

HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT AND RISK COMMUNICATION

- 2014 Development of a Probabilistic Risk Assessment for Nellis Dunes Recreation Area, Nevada**
Worked in conjunction with academic scientists at the University of Nevada, Montana State University and the University of South Carolina to use newly developed information of the geology of Nellis Dunes and site-specific toxicity bioassays of dust to complete a risk assessment for exposure to dust at this recreation area.
- 2012 Participation on a Risk Assessment Team developing methodology to assess a Superfund site consisting of a large area floodplain**
Evaluated risk assessment options and land use to support cleanup decisions at an impacted area comprising several square miles and many river miles.
- 2010 Screening Level Ecological Risk Assessment (SLERA) for a site in Flowery Branch in Hall County, Georgia**
At an industrial park near an interstate highway, the area of potential ecological concern consisted of a storm-water retention pond and a stream. Investigated the site and developed the SLERA document for submission to the Georgia Environmental Protection Division.
- 2009 Streamlined Human Health and Ecological Risk Assessments to support Removal Action at the Nabesna Mine Site in Nabesna, Alaska**
This site is located in the Wrangell-St. Elias National Park and was a functioning gold mine in the early 20th century with high concentrations of metals associated with mine tailings and acid mine drainage; developed both risk assessments to support a non-time-critical action at the site.
- 2009 Development of Georgia Risk Reduction Standards (RRS) for Drexel Chemical Company in Cordele, GA and another site in North Georgia**
Calculated Georgia RRS values for this site; negotiated in person and by teleconference with Georgia Environmental Protection Division personnel regarding the appropriate use of toxicity criteria.
- 2009 Risk Communication and Regulatory Review related to the TVA Coal Ash Spill in Kingston, TN**
Provided risk communication at public availability session for both the American Coal Ash Association and TVA; reviewed submissions to EPA developed by TVA.
- 2008 Quality Assurance for Fish Consumption Risk Assessment on the Passaic River**
Reviewed and provided comments on both the accuracy and conceptualization of the risk assessment.
- 2008 Development of Georgia Risk Reduction Standards for Trivalent and Hexavalent Chromium and several Volatile Organic Chemicals**
Calculated numerical standards under Georgia's Hazardous Site Response Rule 391-3-19 as a subcontractor in support of a property sale and transfer.
- 2008 Evaluation of Soil Concentrations of Arsenic with an Emphasis on Local Background at a Power Plant**
Developed a report for submission to the Georgia Environmental Protection Division regarding a release of waste material containing arsenic that occurred by storm water runoff; the report considered the geology and local background concentration and included a statistical analysis.
- 2008 Statistical Evaluation of Solvent Data in Groundwater and Critique of ATSDR Health Assessment of a Superfund Site**
Provided a report that included suggestions and comments on the ATSDR Report. Performed a statistical analysis to refine the conclusions reached and critiqued the methodology for the Health Assessment.
- 2008 Investigation into the Scientific Basis of Land Disposal Limit of 50 parts per million for PCBs**
Under the 1979 Toxic Substances and Control Act (TSCA), EPA has placed an upper limit of 50 ppm for land disposal of PCBs. Investigated the scientific basis of this value for application at a former chlor-alkali plant.
- 2008 Review of Cleanup Target Levels of Florida Department of Environmental Protection**
Provided a review of the Cleanup Target Levels used for regulation by Florida Department of Environmental Protection.

- 2007 Evaluation of Calculation Methods for the Georgia Risk Reduction Standards of the Georgia HSRA Program**
Examined RRS values for soil and groundwater developed for a site in north Georgia and provided an explanation of the rationale underlying discrepancies in the calculated values.
- 2007-9 Risk Assessment for the Exposure to Mercury and PCBs from contact with Marsh Sediment and Consumption of Fish and Game Birds at the LCP Chemical Superfund Site, Brunswick, GA.**
Conducted a risk evaluation for sediment exposure and, fish consumption with development of site-specific fish consumption estimates and a site-specific sediment exposure estimate for an updated Remedial Investigation Report for submission to the US Environmental Protection Agency.
- 2007 Pro Bono Evaluation of Georgia DNR Fish Advisories for PCBs and Mercury**
Evaluated current fish advisories near Brunswick, GA for Dr. Randy Manning, the Georgia state toxicologist.
- 2007 Georgia Risk Reduction Standards for PCBs, mercury and other chemicals in Soil and Groundwater at the LCP Chemical Superfund Site**
Prepared detailed calculations of soil and groundwater screening values based both on direct exposure and transfer of chemicals from soil to groundwater.
- 2006-10 Risk Assessment for the Residential Exposure Scenario for PCBs and mercury in Upland Soils at the LCP Chemical Superfund Site, Brunswick, GA.**
Conducted a risk evaluation for residential exposure. The original risk assessment for the LCP site did not include an estimate of risk to on-site residents or other human receptors with a small exposure unit (ca. 0.5 acres). This risk evaluation will be part of an updated remedial investigation to submit to USEPA.
- 2006-7 Risk Assessment for Consumption of Estuarine Fish containing Toxaphene Residues by Coastal Georgia Residents related the Hercules Chemical Superfund Site in Brunswick, GA**
Developed fish consumption estimates for coastal Georgia residents based on the previous surveys in the Brunswick area used along with published work on the toxicity of toxaphene to support a probabilistic risk assessment for fish consumption prepared for USEPA.
- 2006 Development of a Physiologically-based Pharmacokinetic Model for Copper in Migratory Birds for Ecological Risk Assessment of Mine-Associated Tailings Ponds**
High copper concentrations in water associated with acid mine drainage may be toxic to birds; developed of a PBPK model of copper absorption, distribution, metabolism and excretion (ADME) in juvenile ducks and adult geese; conducted a feasibility study of incorporating the physiological changes associated with migration into the model.
- 2006 Development of a Preliminary Risk Assessment for Selenium as part of a Proposal to Address Overall Effects of Selenium In a River System**
Developed human health and ecological risk estimates for selenium migrating from coal piles into a river. These estimates included consumption of fish and water by humans.
- 2006 Evaluation of Georgia DNR Fish Advisories near Brunswick, GA**
Conducted an evaluation of fish advisories for Toxaphene and PCBs published by the Georgia Department of Natural Resources.
- 2006 Development of a white paper presenting the history of Probabilistic Risk Assessment (PRA) at EPA**
Reviewed EPA guidance documents and scientific literature and produced a document that detailed this complete history of PRA at EPA and suggested likely uses of PRA in the future.
- 2005 Risk Communication regarding solvents in groundwater at Augusta, Georgia**
As an EPA toxicologist, provided information to citizens at a public meeting regarding the possible health effects of tetrachloroethylene and trichloroethylene in groundwater relating to a RCRA site.
- 2005 Review of Proposed Arsenic Toxicity Assessment to be placed on EPA's IRIS Database**
As an EPA toxicologist and consensus reviewer for EPA's IRIS database, reviewed and provided comment on proposed changes to the arsenic toxicity assessment.

- 2004-5 Risk Communication to Community Against Pollution (CAP), a citizens group in Anniston, AL**
As an EPA toxicologist, developed a relationship with CAP and presented information on the health effects of PCBs at several public and community meetings.
- 2004 Providence Park Ecological Risk Assessment**
Conducted a screening ecological risk assessment (SLERA) for a site in Fulton County, GA
- 2004 Risk Communication regarding Trichloroethylene**
As an EPA toxicologist, provided information to the Citizen's Advisory Group (CAG) at Anniston Army Depot and a group of concerned citizens about the health effects of trichloroethylene.
- 2003-5 Development of EPA's *Guidance on Surface Soil Cleanup at Hazardous Waste Sites: Implementing Cleanup Levels***
As an EPA toxicologist, developed a guidance document that presented methods for applying risk-based cleanup levels as area averages rather than not-to-exceed levels.
- 2003 Soil Cleanup Strategy for a Skeet Range at Naval Air Station Cecil Field in Jacksonville, FL.**
As an EPA toxicologist, used both geostatistics and exposure assessment to refine the size of the area needing remediation.
- 2000 Discussion of Florida's Secondary Drinking Water Standards based on Organoleptic Effects**
As an EPA toxicologist, investigated the biological basis of Florida's secondary drinking water criteria for aluminum, iron, manganese and silver for which secondary standards based on esthetics (smell and taste) were below health-based criteria.
- 2000 Memorandum presenting *Amended Guidance on Ecological Risk Assessment at Military Bases: Process Considerations, Timing of Activities, and Inclusion of Stakeholders***
As an EPA toxicologist, authored a memo that enabled ecological risk assessments at DOD facilities to be completed in a timely manner and ensures that risk assessment activities occur at times consistent with DOD funding schedules.
- 1996-9 Development of *Risk Assessment Guidance for Superfund, Part 3. Process for Conducting Probabilistic Risk Assessment***
As an EPA toxicologist, made significant contributions to this guidance, which received EPA's Science Achievement Award in 2001.
- 1995 Region 4 Bulletins: Regional Risk Assessment Guidance**
As an EPA toxicologist, authored Region 4 risk bulletins on Toxicity Assessment and on Development of Remedial Goal Options.

ADDITIONAL WORK IN TOXICOLOGY

- 2014-16 Development of an Adverse Outcome Pathway Document for a Mutagenic Mode of Action for Cancer**
Worked with individuals from both government and the private sector, collaborated on a manuscript detailing the mode of action / adverse outcome pathway for liver tumorigenesis in animals and humans by aflatoxin B1, a toxin produced by fungi and ubiquitous in grains and ground nuts.
- 2009-16 Ongoing Scientific Consultation on the Health Effects of Hexavalent Chromium**
Provides ongoing support for toxicological and risk assessment information for toxicological issues related to hexavalent chromium for a Fortune 100 company.
- 2010 Statistical Analysis of Reproductive Endpoints in Rats Exposed to Flame Retardant Chemical**
Performed statistical analysis of dichotomous data for reproductive endpoints to inform a European consortium about the most appropriate methods for data analysis.
- 2009 Responses to EPA Charge Questions for Review of the 2009 Toxicological Review of 1,4-Dioxane**
Wrote responses to EPA's "Charge to External Reviewers for the Toxicological Review of 1,4-Dioxane" related to uncertainty analysis, physiologically-based pharmacokinetic (PBPK) modeling and Benchmark Dose modeling.

- 2009 Physiologically-based Pharmacokinetic Models for Methylmercury, Arsenic, Cadmium and Bisphenol-A for use as teaching tools**
Translated existing models into the Berkeley Madonna computer software for use as teaching aids for personnel at the Agency for Toxic Substances and Disease Registry,
- 2008 Whitepaper on the Ethics of Environmental Regulation and Compounding Conservatism in Risk Assessment for the Ontario Ministry of the Environment**
Used historical sources, philosophical literature and modern scientific publications to provide an understanding of the extent to which environmental regulations and standards are based on the precautionary principle.
- 2008 Assessment of Conservatism of Soil and Groundwater Standards for the Ontario Ministry of the Environment**
Assessed the level of conservatism of proposed environmental media standards using statistical methods.
- 2007 Expert Panel Developing a Protocol for Toxicity Testing of a Legacy Pesticide Mixture**
Served on a panel to refine a protocol for toxicity testing of soil considering both individual pesticide isomers and mixtures.
- 2004 Consultation with EPA Region 4 Mercury Study Group**
As an EPA toxicologist, provided information to a group of Region 4 personnel to address a newspaper editorial regarding human health and mercury.

Peer Reviews and Peer Consultations

- 2019 Regulatory Toxicology and Pharmacology, Gio Bata Gori, Editor, "Derivation of Biomonitoring Equivalents (BE values) for Zinc"**
- 2019 Environment International, Lesa Aylward, Associate Editor, "Prediction of maternal and foetal exposures to perfluoroalkyl compounds in a Spanish birth cohort using toxicokinetic modelling"**
- 2018 Journal of Forensic, Legal and Investigative Sciences, Katherine Chelsea, "Drunk Drivers"**
- 2018 Environment International, Heather Stapleton, Associate Editor, "High concentrations of PCBs in breast milk among Czech women: interpretation of biomonitoring data using a Physiologically Based Pharmacokinetic Model"**
- 2018 Environment International, Lesa Aylward, Associate Editor, "Age-dependent Human Elimination of Dioxin-like Polychlorinated Biphenyls Derived from Cross-Sectional Biomonitoring Data in the General Population."**
- 2018 Current Pharmaceutical Biotechnology, Davide Prosperi, Editor, "A microplate-based platform with immobilized human glutathione transferase A1-1 for high-throughput inhibitor screening"**
- 2018 Agency for Toxic Substances and Disease Registry (CDC) "Comparative Analysis of Blood/Gas Partition Coefficients across Species."**
- 2018 Science of the Total Environment, Pavlos Kassomenos, Associate Editor, "Comparing Apples to Oranges: Interpreting Ozone Concentrations from Observational Studies in the Context of the United States Ozone Regulatory Standard"**
- 2018 Regulatory Toxicology and Pharmacology, Gio B. Gori, Editor, "Residual behaviors and risk assessment of prochloraz in bayberries and bayberry wine for Chinese population"**
- 2018 Environment International, Lesa Aylward, Associate Editor, "Age-Based and Time Trends of Chemical Exposure Biomarkers in the US Population 1999-2014"**
- 2018 EClinicalMedicine, Derek Anane, Senior Editor, "Remote alcohol monitoring to facilitate incentive-based treatment for alcohol use disorder: A randomized trial"**
- 2018 Regulatory Toxicology and Pharmacology, Gio B. Gori, Editor, "Biomonitoring Equivalents for Cyanide"**
- 2017 Environment International, Lesa Aylward, Editor, "An analysis of cumulative risks based on biomonitoring data for six phthalates using the Maximum Cumulative Ratio"**
- 2017 Toxicological Sciences, William H. Farland, Assoc. Editor, "Identification of novel uncertainty factors for health hazard and risk assessment: Application to cleaning product ingredients"**

- 2097** *Environment International*, Lesa Aylward, Editor, "Excretion of Di-2-ethylhexyl Phthalate (DEHP) Metabolites in Urine Is Related to Body Mass Index Because of Reverse Causality"
- 2017** *Risk Analysis*, L. Anthony Cox, Editor, "Cumulative Low-Dose Response Assessment: An Emergent Model For Carcinogens, Noncarcinogens, And Mixtures"
- 2017** *Regulatory Toxicology and Pharmacology*, Gio Bata Gori, Editor-in-Chief, "Guidelines for Performing Systematic Reviews in the Development of Toxicity Factors"
- 2017** *Risk Analysis*, Tony Cox, Editor-in-chief, "Cumulative Low-Dose Response Assessment: An Autocorrelated First-Order Model"
- 2017** *Chemical Research in Toxicology*, F. Peter Guengerich, Associate Editor, "Identification of potential aryl hydrocarbon receptor ligands by virtual screening of industrial chemicals"
- 2016** *Combinatorial Chemistry & High Throughput Screening*, Rathnam Chaguturu, Editor, "A Big Data Approach with Artificial Neural Network and Molecular Similarity for Chemical Data Mining and In-Silico Toxicity Prediction"
- 2016** *Science of the Total Environment*, Dr. Jay Gan, Editor, "Occurrence, Sources and Estimation of Air-Soil Exchange of Polychlorinated biphenyls in Indian cities"
- 2016** *Scientific Research and Essays*, Dr. N. J. Tonukari, Editor, "Bayesian Analysis to Detect Change-point in Two-Phase Laplace Model"
- 2016** *Environmental Science and Technology*, Dr. Beate Escher, Assoc. Editor, "Toxicogenomics of Developmental Toxicity of 6-OH-BDE47 in Chicken Embryo"
- 2016** *Environmental Health Perspectives*, Dr. Martin Van den Berg, Assoc. Editor, "Defining the neurotoxic potential of nondioxin-like polychlorinated biphenyls present in fish from US lakes using a ryanodine receptor-based equivalency scheme"
- 2016** *Science of the Total Environment*, Dr. Jay Gan, Editor, "Occurrence, Sources and Estimation of Air-Soil Exchange of Polychlorinated biphenyls in Indian cities"
- 2015** **Structured peer review of a comparison between the effects of tobacco smoke and nicotine vapor from modified risk tobacco products on the lungs of mice**
Answered a series of charge questions and also provided suggestion for future research.
- 2015** *IUMB Life*, Dr. Angelo Azzi, Editor, "Identification of differentially expressed three novel transcript variants of mouse Arnt gene."
- 2015** *Environmental Research*, Dr. Jose L. Domingo, Editor, "Antioxidant activity as a potential mechanism explaining the negative Influence of lead and cadmium on working memory during aging."
- 2015** *Toxicological and Environmental Chemistry*, Dr. Sam Kacew, Editor, "Headspace and small chamber studies of airborne diacetyl release from selected food flavoring mixtures: Activity coefficients and air modeling implications"
- 2015** *Environmental Research*, Dr. Jose L. Domingo, Editor, "Transcriptomic and visual gene-network analysis of silver nanoparticles potentially induced Alzheimer's disease progression in mouse brain neural cells"
- 2015** *Environmental Research*, Dr. Jose L. Domingo, Editor, "Identification of Free Phthalate Metabolites in Human Cerebrospinal Fluid."
- 2014** *Critical Reviews In Toxicology*, Dr. Roger O. McClellan, Editor, "Risk assessments for chronic exposure of children and prospective parents to ethylbenzene (CAS No. 100-41-4)"
- 2014** *Environmental Research*, Dr. Jose L. Domingo, Editor, "Impact of early-life bisphenol A exposure on precortical dopamine and serotonin systems in juvenile and adult male rats."
- 2014** *Environmental Research*, Dr. Jose L. Domingo, Editor, "Bisphenol A is associated with insulin resistance and modulates adipokines gene expression in obese children."
- 2014** *Human and Experimental Toxicology*, Dr. Kai Savolainen, Assoc. Editor, "Global Methaemoglobinaemia Research Output (1940–2013): A Bibliometric Analysis Based on Scopus Database."

- 2014 **Human and Experimental Toxicology**, Dr. A. Wallace Hayes, Assoc. Editor, "Pharmacokinetic Study of Omeprazole and its Metabolites in Males and Females, Females Exposed to Higher Levels of Omeprazole."
- 2013 **Consultation to a Water Utility Regarding the Quality of Water Provided to a Community** Provided initial consultation and coordinated a peer review of a risk assessment of the pesticide toxaphene occurring in trace amounts in the water.
- 2013 **Human and Ecological Risk Assessment**, Dr. Barry Johnson, Editor, "Assessment of Soil Screening Levels due to Accidental Ingestion of Chrysene and Benzo[k]fluoranthene at Iran's TOR Site."
- 2012 **Human and Experimental Toxicology**, Dr. A. Wallace Hayes, Editor. "Effect of nicotine pre-treatment on arsenic induced oxidative stress in Wistar rats."
- 2012 **Human and Experimental Toxicology**, Dr. A. Wallace Hayes, Editor, "Elemental impurities in Nigerian pediatric syrups: Mercury in violation of standard guidelines."
- 2011 **Journal of Toxicology and Environmental Health**, Dr. Sam Kacew, Editor, "Screening Level Risk Assessment for SAN Trimer Detected in Soil and Groundwater"
- 2011 **Human and Ecological Risk Assessment**, Dr. Barry Johnson, Ed. "Monte Carlo Simulation-based Health Risk Assessment of Heavy Metal Pollution - A Case Study in the Qixia Mining Area, China"
- 2011 **Risk Analysis**, Dr. Tony Cox, Editor, "A Gradient Markov Chain Monte Carlo Algorithm for Computing Multivariate Maximum Likelihood Estimates and Posterior Distributions: Mixture Dose Response Assessment"
- 2010 **Environmental Research**, Ellen Silbergeld, Ed. "Structural Neuroimaging Evaluation of Adults with Childhood Lead Exposure"
- 2010 **Human and Experimental Toxicology**, Prof. Kai Savolainen, Editor in Chief. "The World Library of Toxicology, Chemical Safety and Environmental Health (WLT)"
- 2010 **Journal of Exposure Science and Environmental Epidemiology**, Dr. Natalie Freeman, Assoc. Ed. "Comparison of a toxicokinetic and a questionnaire-based approach to assess methylmercury intake in exposed individuals"
- 2010 **Environmental Research**, Dr. Ellen Silbergeld, Ed. "Varying coefficient function models to explore interactions between maternal nutritional status and prenatal methylmercury toxicity in the Seychelles Child Development Nutrition Study"
- 2009 **Regulatory Toxicology and Pharmacology**, Gio Batta Gori, Ed. "Derived Reference Doses (RfDs) for the Environmental Degradates of the Herbicides Alachlor and Acetochlor: Results of an Independent Expert Panel Deliberation"
- 2009 **Environmental Research**, Ellen Silbergeld, Ed. "Environmental Policy and Children's Health in Mexico"
- 2009 **Toxicological Sciences**, Dr. John Lipscomb, Assoc. Editor, "Age-, Dose- and Time-Dependency of Plasma and Tissue Distribution of Deltamethrin in Immature Rats."
- 2009 **Chemosphere**, Heidelore Fiedler, Ed. "Quantitative structure-activity relationship (QSAR) studies for predicting activation of the ryanodine receptor type 1 channel complex (RyR1) by polychlorinated biphenyl (PCB) congeners"
- 2009 **Environmental Research**, Ellen Silbergeld, Ed. "Determination of bromadiolone residues in fox faeces by LC/ESI-MS in relationship with toxicological data and clinical signs after repeated exposure."
- 2008 **Chemosphere**, Heidelore Fiedler, Ed. "Tissue Distribution of Polychlorinated Biphenyls and Effects on Alaskan Northern Fur Seals Assessed with Five Congener Classification Schemes"
- 2008 **Chemosphere**, Heidelore Fiedler, Ed. "Levels of Polychlorinated Dibenzo-p-dioxins, Dibenzofurans, and Biphenyls in Southern Mississippi Catfish and Estimation of Potential Health Risks"
- 2007 **Critical Reviews in Toxicology**, Roger O. McClellan, Ed. "Risk Assessment of Toxaphene and its Breakdown Products: Time for a Change"

- 2006 ***Environmental Forensics***, Ioana Petrisor, Ed. "Identifying Metals Contamination in Groundwater Using Geochemical Correlation Evaluation"
- 2002 ***Environmental Science and Technology***, Mitchell J. Small, Ed. "Why and how should we assess occupational health impacts in integrated product policy?"
- 2001 **Ohio Environmental Protection Agency**, "Human Health Risk Assessment Concept Paper"
- 2000 **Toxicology Excellence in Risk Assessment**, "Lifetime Estimate of Skin Cancer Risk from use of Coal Tar Containing Shampoos"
- 1999 ***Environmental Science and Technology***, Mitchell J. Small, Ed. "Chlordane Uptake and its Translocation in Food Crops"
- 1997 **Agency for Toxic Substances and Disease Registry**, "Public Health Interventions to Prevent or Mitigate Possible Adverse Health Effects Related to Methyl Parathion Pesticide Exposure"
- 1995 **National Research Council**, "Human Health Preliminary Risk Evaluation of the Jinkampo Incinerator Complex Activities in the Naval Air Facility, Atsugi, Japan"

Second Expert Report of Ted W. Simon, Ph.D., DABT Re: Kenneth Christian v. Sew Eurodrive, Inc.
SCWCC No. 1614297
ATTORNEY-CLIENT PRIVILEGED/CONFIDENTIAL WORK PRODUCT

SECOND EXPERT REPORT OF TED W. SIMON, PH.D., DABT

Prepared for: Mr. Thomas S. Phillips
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P.O. Box 1207
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Kenneth Christian v. Sew-Eurodrive, Inc.
SCWCC No. 1614297

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June 22, 2019

Second Expert Report of Ted W. Simon, Ph.D., DABT Re: Kenneth Christian v. Sew Eurodrive, Inc.
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EXECUTIVE SUMMARY

My opinions, as presented in this report, were made to a reasonable degree of scientific certainty. I reserve the right to alter or amend these opinions based on new information.

Scope of work

For use in this report, I have considered: 1) my knowledge of the exposure to and adverse health effects of various substances in humans, this knowledge gained from reading the scientific literature both recently and during my twenty plus years of experience as a toxicologist; and 2) a report of industrial hygiene sampling dated March 1, 2017 prepared for Sew Eurodrive by Palmetto EHS.

Based on these materials, this report consists of my independent expert opinion as a toxicologist regarding whether any of these substances could have contributed to Mr. Christian's medical condition.

Summary of opinions

It is my professional opinion that

- Assuming the IH report is representative of Mr. Christian's working conditions at Sew Eurodrive, the concentrations of VOCs and metals sampled are too low to have caused his lung damage; and,
- By eliminating these alternate causes, the findings of the IH report provide support for my opinion presented in my March 26, 2019 report that the pulmonary injury suffered by Mr. Christian during his years of work exposure to rosin/colophony in solder.

1. BACKGROUND

I was first contacted by Mr. Thomas Phillips by telephone early in March 2019 and wrote a report for him regarding the cause of Mr. Christian's interstitial lung disease. This report was requested during a phone call with Mr. Phillips in early June 2019. On June 6, 2019, he had provided the industrial hygiene sampling report.

1.1. Qualifications

I am currently self-employed as a consulting toxicologist. I have provided expert consultations and testimony regarding the effects of legal pharmaceutical products, illegal drugs, and alcohol since 2001. Between 1994 and 2006, I was employed by the US Environmental Protection Agency as a regional toxicologist. I worked in the Region 4 office in Atlanta, GA that serves the southeastern US – North Carolina, South Carolina, Tennessee, Kentucky, Alabama, Mississippi, Georgia, and Florida. After leaving EPA in 2006, I continued working as a consulting toxicologist.

I have been a Diplomate of the American Board of Toxicology since 1994. In 2001, I developed testimony about the calibration of the Intoxilyzer 5000, the "breathalyzer" used in Georgia for onsite alcohol testing and in several instances, my appearance in court resulted in dismissal of charges. In 2003 as an EPA employee, I was admitted as an expert and testified before federal administrative law judge Barbara A. Gunning about environmental conditions around a leaking underground storage tank. In 2008, I testified in Fulton County Family Court regarding poisoning with inorganic mercury. In 2014, I provided a deposition to the U.S. Department of Justice regarding chemicals at a Superfund site. In 2015, I provided advice to the Fairfax County Police Department in Virginia about synthetic cannabinoids, toxic chemicals that mimic the effects of cannabis. In 2016, I provided an opinion about the effect of weight loss on marijuana urine test results. In 2017, I provided testimony in a Workman's Compensation case about the significance of THC in cannabis as a causal factor in a traffic accident. In 2018, I testified in Jersey City, NJ about the recognition of alcohol intoxication. In 2018, I provided a written expert opinion on the interpretation of blood levels of cannabis metabolite and cannabis use as a factor in a traffic accident with two fatalities. In 2018, I testified in Family Court in Gwinnett County, GA, on whether hair analysis results indicated a woman used methamphetamine during her pregnancy. Recently, I was invited to serve on the Chemical Assessment Advisory Committee that is part of EPA's Science Advisory Board and the editorial board of the journal *Regulatory Toxicology and Pharmacology*.

My Curriculum vitae and other professional information as of February 2019 are provided in Appendix C.

1.2. Materials Reviewed and Examined

Materials provided by Mr. Thomas Phillips

Report of Industrial Hygiene Sampling, Palmetto EHS Report No. 2017020 dated March 17, 2017 in regard to sampling conducted on March 1, 2017.

Peer-Reviewed Journal Articles from the Scientific Literature and Government Documents

1. Agency for Toxic Substances and Disease Registry, (CDC/ATSDR) (2011). Addendum to the Toxicological Profile for Acetone. Atlanta: DHHS. Retrieved from https://www.atsdr.cdc.gov/toxprofiles/acetone_addendum.pdf
2. Agency for Toxic Substances and Disease Registry, (CDC/ATSDR). (1999). Toxicological Profile for n-Hexane. Atlanta: DHHS. Retrieved from <https://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=393&tid=68>
3. Agency for Toxic Substances and Disease Registry, (CDC/ATSDR) (2004). Toxicological Profile for Copper. Atlanta: DHHS. Retrieved from <https://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=206&tid=37>
4. Agency for Toxic Substances and Disease Registry, (CDC/ATSDR) (2005). Toxicological Profile for Tin. Atlanta: DHHS. Retrieved from <https://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=543&tid=98>
5. Agency for Toxic Substances and Disease Registry, (CDC/ATSDR). (1990). Toxicological Profile for Silver. Atlanta: DHHS. Retrieved from <https://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=539&tid=97>
6. Agency for Toxic Substances and Disease Registry, (CDC/ATSDR) (2017). Toxicological Profile for Antimony (Draft for public comment). Atlanta: DHHS. Retrieved from <https://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=332&tid=58>
7. Hautemanière, A., Ahmed-Lecheheb, D., Cunat, L., & Hartemann, P. (2013). Assessment of transpulmonary absorption of ethanol from alcohol-based hand rub. *Am J Infect Control*, 41(3), e15-9. doi:10.1016/j.ajic.2012.09.004

2. SUBSTANCES CONSIDERED IN THE IH SAMPLING

Palmetto EHS used personal exposure monitoring of a single Sew Eurodrive employee, Garrett Cheek, to obtain time-weighted average concentrations of volatile organic compounds (VOCs) and metals. The VOCs sampled included:

- Acetone
- Ethanol
- 2,3-dimethylbutane
- 2-methylpentane
- 3-methylpentane
- Isopropyl alcohol
- n-Hexane
- n-Propyl acetate
- pentane
- Methanol
- 1-methoxy-2-propanol

The metals sampled included antimony, copper, silver and tin.

Sampling was conducted for two durations: 420 minutes for comparison with the 8-hour permissible exposure limit (PEL) and threshold limit value (TLV) from Occupational Safety and Health Administration (OSHA) and the American Conference of Government Industrial Hygienists (ACGIH); 15 minutes for comparison with the ACGIH short-term exposure limit (STEL).

3. RESPIRATORY HEALTH EFFECTS OF EXPOSURE AT THE MEASURED CONCENTRATIONS

Summaries of respiratory health effects were obtained from the set of Toxicological Profiles published by the Agency for Toxic Substances and Disease Registry (ATSDR), part of the Centers for Disease Control (CDC). These documents provide compilations of published studies on health effects. When a Toxicological Profile was not available for a substance, the Hazardous Substances Data Bank (HSDB) at the National Library of Medicine was used (<https://toxnet.nlm.nih.gov/newtoxnet/hsdb.htm>). The table on the next page shows the sample results, the comparison values, summaries of observed respiratory health effects and the source.

The abbreviation "<" indicates the measured concentration was less than analytical limit of detection, which is the value shown. The substances that produced respiratory tract irritation or pulmonary effects are shown in boldface.

Several of the values in Appendix I are inconsistent with those from the Organic Vapors Personal Monitoring Badge Laboratory Analysis Report in Appendix III. The reason is the 7-hour values were corrected to represent 8 hours. The actual values of the LCL are shown here from Appendix III.

The values of the ACGIH TLC and STEL were used as comparators because these tend to be updated more regularly than OSHA PEL values. I could not verify some of the values in Appendix 1 of the IH report using the HSDB. These are acetone, pentane and copper. The table provides the values from HSDB provided ACGIH (first choice) or OSHA (alternate choice).

Second Expert Report of Ted W. Simon, Ph.D., DABT Re: Kenneth Christian v. Sew Eurodrive, Inc.
SCWCC No. 1614297

ATTORNEY-CLIENT PRIVILEGED/CONFIDENTIAL WORK PRODUCT

Chemical	Sampled Conc. (Duration)	8 hr TLV and STEL as listed on HSDB	Health Effects concentrations	Reference
Volatile Organic Chemicals				
Acetone	0.74 ppm (7 hr)	500 ppm (8 hr)	416-890 ppm (8hr) upper respiratory tract irritation	[1], HSDB
	12.4 ppm (15 min)	750 ppm (15 min)		
Ethanol	0.18 ppm (7 hr)	1000 ppm (8 hr)	5.5-75 ppm observed form hand sanitizer use in health care workers. No direct pulmonary effects.	[7], HSDB
	<3.2 ppm	1000 ppm (15 min)		
2,3- dimethylbutane	0.34 ppm (7 hr)	500 ppm (8 hr)	0.37 ppm in service station attendants. No direct pulmonary effects.	HSDB
	4.3 ppm (15 min)	1000 ppm (15 min)		
2- Methylpentane	2.0 ppm (7 hr)	500 ppm (8 hr)	0.37 ppm in service station attendants. No direct pulmonary effects.	HSDB
	23.6 ppm (15 min)	1000 ppm (15 min)		
3- methylpentane	0.33 ppm (7hr)	500 ppm (8 hr)	0.7 ppm in service station attendants. No direct pulmonary effects	HSDB
	3.9 ppm (15 min)	1000 ppm (15 min)		
Isopropyl alcohol	<0.1 ppm	200 ppm (8 hr)	No direct pulmonary effects	HSDB
	<3.2 ppm	400 ppm (15 min)		
Methanol	<0.7 ppm	200 ppm (8 hr)	No direct pulmonary effects	HSDB
	<23 ppm	250 ppm (15 min)		
1-Methoxy-2- propanol	<0.1 ppm	100 ppm (8 hr)	No direct pulmonary effects	HSDB
	<3.2 ppm	150 ppm (15 min)		
n-Hexane	<0.1 ppm	50 ppm (8 hr)	No respiratory irritation at 500 ppm. No direct pulmonary effects.	[2]
	<3.2 ppm	NA		
n-Propyl acetate	<0.05 ppm	200 ppm (8 hr)	Irritation of throat and larynx	HSDB
	<1.6 ppm	250 ppm (15 min)		
Pentane	<0.1 ppm	1000 ppm (8 hr)	Respiratory and dermal irritant	HSDB
	<3.2 ppm	NA		
Metals				
Antimony compounds	<0.0009	0.5 mg/m³ (8 hr)	Significant lung effects including bronchitis and emphysema with occupational exposure	[6], HSDB
Copper compounds	<0.0003	0.2 mg/m³ (8 hr)	Significant lung effects including pulmonary fibrosis with occupational exposure	[3], HSDB
Silver compounds	<0.0003	0.01 mg/m³ (8 hr)	Respiratory irritant	[5], HSDB
Tin	<0.003	2 mg/m³ (8 hr)	Appearance on x-ray without impaired pulmonary function	[4], HSDB

The abbreviation "<" indicates the measured concentration was less than the value shown, which is the analytical limit of detection. The substance that produced respiratory tract irritation of pulmonary effects are shown in boldface.

Acetone, n-propyl acetate, pentane and the four metals were associated with pulmonary effects. The concentrations of acetone were 40-fold lower than the TLV values and lower than those reported for pulmonary effects. The concentrations of the other four substance were all below the limit of detection.

Second Expert Report of Ted W. Simon, Ph.D., DABT Re: Kenneth Christian v. Sew Eurodrive, Inc.
SCWCC No. 1614297
ATTORNEY-CLIENT PRIVILEGED/CONFIDENTIAL WORK PRODUCT

Assuming the industrial hygiene sampling in the Palmetto EHS report to Sew Eurodrive is representative of Mr. Christian's working conditions, these findings actually reinforce the opinion I advanced in my earlier report dated March 26, 2019 that Mr. Christian's hypersensitivity pneumonitis was caused by his exposure to rosin/colophony in the solder used at Sew Eurodrive.

4. SUMMARY AND CONCLUSIONS

I advance two opinions in this report:

- Assuming the IH report is representative of Mr. Christian's working conditions at Sew Eurodrive, the VOCs and metals sampled in this report were unlikely to be the cause of his pulmonary hypersensitivity; the concentrations are too low to have caused his lung damage;
- the findings of the IH report provide support for my opinion presented in my March 26, 2019 report that the pulmonary injury suffered by Mr. Christian during his years of work exposure to rosin/colophony in solder.

Second Expert Report of Ted W. Simon, Ph.D., DABT Re: Kenneth Christian v. Sew Eurodrive, Inc.
SCWCC No. 1614297

ATTORNEY-CLIENT PRIVILEGED/CONFIDENTIAL WORK PRODUCT

PROFESSIONAL INFORMATION FOR TED W. SIMON

Previous Testimony

Details of any testimony is provided in his Curriculum Vitae.

Compensation

Ted W. Simon is self-employed and a principal of TedSimon LCC. For this report, he received \$1750.

Exhibits for use in Deposition and Testimony

Ted W Simon may use as exhibits any document contained in or referred to in this report, summaries of the contents of or supplements to this report, any document listed as a trial exhibit or provided in discovery by the parties, any documents considered by the parties' experts, or any document needed to respond to or rebut testimony given on behalf of any party. Ted W. Simon reserves the right to provide lists of exhibits as permitted by the Federal Rules of Civil Procedure and the Scheduling Order in this case.

Reservation of Rights

As noted in the Background section of the main report, Ted W. Simon reserves the right to modify, change or supplement his opinions based on additional information that may be produced following submittal of this report, as well as for use as exhibits for use in deposition and/or court testimony. Also, he reserves the right to obtain and review additional information and incorporate such information into additional analyses or reports. Additional analyses may be conducted as necessary for any of the following reasons: 1) to respond to new or newly acquired information; 2) to respond to expert reports, including but not limited to rebuttal reports; 3) to respond to deposition testimony as it is provided; and 4) as permitted by the Federal Rules of Civil Procedure.

Curriculum Vitae

The most recent CV of Ted W. Simon is attached.

Ted W. Simon, Ph.D., DABT

**Contact**

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Winston, GA USA 30187

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website: <http://www.tedsimon-toxicology.com>
mobile: +01 (770)359-9807

Summary

Award winning toxicologist and scientist. 10+ years' experience as a toxicologist employed by the Environmental Protection Agency (EPA). 10+ years consulting and expert witness experience. Served as EPA's senior toxicologist in the waste management division working on risk and soil cleanup. Experienced expert witness on issues including alcohol and cannabis, DUI and dram shop issues, environmental risk, illegal drugs, pharmaceuticals, accidental poisoning, and intellectual property. Well published, including author of textbook on toxicology and environmental risk assessment and a reference work on pesticides. Expertise in toxicology, risk assessment, mathematical modeling, statistics, neuroscience, and environmental/ecological health issues. Interest and expertise in the effects and testing of alcohol, cannabis and pharmaceuticals, per- and poly-fluorinated chemicals, arsenic, chromium, benzene and other solvents. Extensive national and international public speaking experience. 15+ years teaching experience.

Professional Certifications

1994 - Diplomate of the American Board of Toxicology (DABT)

Invited Service

2019 - Member, Chemical Assessment Advisory Committee of EPA's Science Advisory Board
2019 - Editorial Board Member, *Regulatory Toxicology and Pharmacology*, Elsevier

Employment History

2004 - present Principal, Ted Simon, LLC, Winston, GA
2006 - present Adjunct Professor, Environmental Health Science, College of Public Health, University of Georgia, Athens, GA
1996 - 2006 Toxicologist, US Environmental Protection Agency, Region 4, Atlanta, GA
2003 Instructor, Department of Biology, Georgia State University, Atlanta, GA
2001 - present Instructor, Department of Environmental Health Science, University of Georgia, Athens, GA
1996 Environmental Health Scientist, Agency for Toxic Substances and Disease Registry/Centers for Disease Control, Atlanta, GA
1994 - 1996 Toxicologist, US Environmental Protection Agency, Region 4, Atlanta, GA
1993 - 1994 Project Scientist, ManTech Environmental Inc., USEPA Region 4, Atlanta, GA
1993 Assistant Professor of Biology, Life College, Marietta, GA
1991 - 1993 Georgia State University, Postdoctoral Research Associate, Atlanta, GA
1989 - 1991 Emory University, Postdoctoral Research Fellow, Atlanta, GA
1982 - 1988 Georgia State University, Research/Teaching Assistant, Atlanta, GA

Editorial Activities

Editor, SciPinion Peer Reviews: SciPinion, Inc. provides a service for managing peer reviews with paid reviewers that collects both their scientific opinions and demographic data. Charge questions require editing so that they are clear and unbiased.

Peer Reviewer, Health Canada: provides this Canadian National Health Agency with peer reviews of documents when requested.

Education

1989 Ph.D. Neurobiology & Behavior, Georgia State University, Atlanta, GA
1971 B.A. Biology, Middlebury College, Middlebury, VT

Books Published

- Simon TW, *Environmental Risk Assessment: A Toxicological Approach, 2nd Edition*. Expected 2020. Textbook for Graduate Risk Assessment Courses.

- Anderson SA, Simon TW. (2018) *Defending Pesticides in Litigation 2018 Edition*. Thompson Reuters. ISBN: 978-0-314-84654-9
- Simon TW. *Environmental Risk Assessment: A Toxicological Approach*. (2014) Textbook for Graduate Risk Assessment Courses, CRC Press ISBN 978-1466598294

Scientific Publications

PEER-REVIEWED JOURNAL ARTICLES

- Kirman CR, Simon TW, Hays SM (2019) Science peer review for the 21st century: Assessing scientific consensus for decision-making while managing conflict on interests, reviewer and process bias. *Regul Toxicol Pharmacol* pii: S0273-2300(19)30003-0. doi: 10.1016/j.yrtph.2019.01.003
- Patlewicz G, Wambaugh JF, Felter SP, Simon TW, Becker RA (2018) Utilizing Threshold of Toxicological Concern (TTC) with high throughput exposure predictions (HTE) as a risk-based prioritization approach for thousands of chemicals. *Computational Toxicology* 7:58-67.
- Simon TW (2018) Providing context for phosphatidylethanol as a biomarker of alcohol consumption with a pharmacokinetic model. *Regul Toxicol Pharmacol* 94:163-171.
- Bell SM, Chang X, Wambaugh JF, Allen DG, Bartels M, Brouwer KLR, Casey WM, Choksi N, Ferguson SS, Fraczkievicz G, Jarabek AM, Ke A, Lumen A, Lynn SG, Paini A, Price PS, Ring C, Simon TW, Sipes NS, Sprinkle CS, Strickland J, Troutman J, Wetmore BA, Kleinstreuer NC. (2017) In vitro to in vivo extrapolation for high throughput prioritization and decision making. *Toxicol In Vitro* 47:213-227.
- Becker RA, Dreier DA, Manibusan MK, Cox LA, Simon TW, Bus JS. (2017) How Well Can Carcinogenicity Be Predicted by High Throughput "Characteristics of Carcinogens" Mechanistic Data? *Regul Toxicol Pharmacol* 80:185-196
- Simon TW, Zhu Y, Dourson ML, Beck N. (2016) Bayesian Methods for Uncertainty Factor Application for Derivation of Reference Values. *Regul Toxicol Pharmacol* 80:9-24.
- Beck NB, Becker RA, Erraguntla N, Farland WH, Grant RL, Gray G, Kirman C, Lakind JS, Lewis RJ, Nance P, Pottenger LH, Santos SL, Shirley S, Simon T, Dourson ML. (2016) Approaches for describing and communicating overall uncertainty in toxicity characterizations: U.S. Environmental Protection Agency's Integrated Risk Information System (IRIS) as a case study. *Environ Int* 89-90:110-128.
- Becker RT, Patlewicz G, Simon TW, Rowlands JC, Budinsky RA (2015) The adverse outcome pathway for rodent liver tumor promotion by sustained activation of the aryl hydrocarbon receptor. *Regul Toxicol Pharmacol* 73:172-90.
- Simon TW, Budinsky RA, Rowlands JC. (2015) A Model for Aryl Hydrocarbon Receptor-Activated Gene Expression Shows Potency and Efficacy Changes and Predicts Squelching due to Competition for Transcription Co-activators. *PLOS ONE*, 10(6):e0127952
- Becker RA, Friedman KP, Simon TW, Marty MS, Patlewicz G, Rowlands JC. (2014) An exposure:activity profiling method for interpreting high-throughput screening data for estrogenic activity-Proof of concept. *Regul Toxicol Pharmacol* 71:398-408.
- Patlewicz G, Simon TW, Rowlands JC, Budinsky RA, Becker RA. (2015) Proposing a scientific confidence framework to help support the application of adverse outcome pathways for regulatory purposes. *Regul Toxicol Pharmacol* 71:463-477.
- Simon TW, Simons SS Jr., Preston RJ, Boobis AR, Cohen SM, Doerrer NG, Fenner-Crisp PA, McMullin T, McQueen CA, Rowlands JC (2014) The Use of Mode of Action Information in Risk Assessment: Quantitative Key Events / Dose-Response Framework (Q-KEDRF) for Modeling the Dose-Response for Key Events. *Crit Rev Toxicol* 44 Suppl 3:17-43.
- Budinsky, RA, Schrenk D, Simon T, Van den Berg M, Reichard JF, Silkworth JB, Aylward LL, Brix A, Kaminski N, Perdew G, Starr TB, Walker NJ, Rowlands JC (2014) Mode of action and dose-response framework analysis for receptor-mediated toxicity: the aryl hydrocarbon receptor as a case study. *Crit Rev Toxicol* 44(1):83-119

- Patlewicz G, Simon T, Goyak K, Phillips RD, Rowlands JC, Seidel SD, Becker RA. (2013) Use and Validation of HT/HC Assays to support 21st century toxicity evaluations. *Regul Toxicol Pharmacol* 65(2):259-68.
- Stephens ML, Andersen M, Becker RA, Betts K, Boekleheide K, Carney E, Chapin R, Devlin D, Fitzpatrick S, Fowle JR, Harlow P, Hartung T, Hoffmann S, Holsapple M, Jacobs A, Judson R, Naidenko O, Pastoor T, Patlewicz G, Rowan A, Scherer R, Shakh R, Simon T, Wolf D, Zurlo J. (2013) Workshop Report: Evidence-based Toxicology for the 21st Century: Opportunities and Challenges. *ALTEX* 30:74-103.
- Patlewicz G, Simon T, Goyak K, Phillips RD, Rowlands JC, Seidel S and Becker RA (2013) Use and Validation of HT/HC Assays to Support 21st Century Toxicity Evaluations. *Regul Toxicol Pharmacol* 5:1-7.
- Kirman C, Budinsky RA, Yost L, Baker BF, Zabik JM, Rowlands JC, Long TF, Simon T (2011) Derivation of Soil Clean-Up Levels for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) Toxicity Equivalence (TEQ_{D/F}) in Soil Through Deterministic and Probabilistic Risk Assessment of Exposure and Toxicity. *Human and Ecological Risk Assessment* 17(1): 125-158.
- Budinsky RA, LeCluyse EL, Ferguson SS, Rowlands JC, Simon T (2010) Human and Rat Primary Hepatocyte CYP1A1 and 1A2 Induction with 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), 2,3,7,8-Tetrachlorodibenzofuran (TCDF) and 2,3,4,7,8-Pentachlorodibenzofuran (4-PeCDF). *Toxicol Sci* 118(1):224-235.
- Simon T (2010) Just Who is at Risk? The Ethics of Environmental Regulation. *Hum Exp Toxicol* 30(8):795-819.
- Simon T, Kirman, CR, Aylward LL, Budinsky RA, Rowlands JC (2009) Estimates of Cancer Potency of 2,3,7,8-Tetrachlorodibenzo(p)dioxin using Linear and Non-linear Dose-Response Modeling and Toxicokinetics. *Toxicol Sci* 112(2):490-506.
- Simon T, Kirman, CR, Aylward LL, Budinsky RA, Rowlands JC, Long T (2008) Estimates of Cancer Potency For 2, 3, 4, 7, 8-Pentachlorodibenzofuran Using Both Nonlinear and Linear Approaches. *Toxicol Sci* 106(2):519-537.
- Simon T, Britt JK, James RC (2007) Development of a Neurotoxic Equivalence Scheme of Relative Potency for Assessing the Risk of PCB Mixtures. *Regul Toxicol Pharmacol* 48:148-170.
- Simon T and Manning R (2006) Development of a Reference Dose for the Persistent Congeners of Weathered Toxaphene based on *in vivo* and *in vitro* effects Related to Tumor Promotion. *Regul Toxicol Pharmacol* 44:268-281.
- Simon T (2000) In Defense of Risk Assessment: a Reply to the Environmental Justice Movement's Critique. *Human and Ecological Risk Assessment* 6(4):556-560.
- Englehardt JD, Simon T (1999) Order Amid Uncertainty. *Civil Engineering*, American Society of Civil Engineers, 69(6):8A-13A.
- Simon T (1999) Two-Dimensional Monte Carlo Simulation and Beyond: A Comparison of Several Probabilistic Risk Assessment Methods applied to a Superfund Site. *Human and Ecological Risk Assessment* 5(4):823-843.
- Simon T (1997) Combining Physiologically Based Pharmacokinetic Modeling with Monte Carlo Simulation to Derive an Acute Inhalation Guidance Value for Trichloroethylene. *Regul Toxicol Pharmacol* 26:257-270.
- Simon T, Barnes K (1995) Olfaction and Prey Search in the carnivorous leech, *Haemaphys marmorata*. *J Exp Biol* 199:2041-2051.
- Simon T, Derby CD (1995) Mixture Suppression with inhibition for binary mixtures from whole cell patch clamp studies of *in situ* olfactory receptor neurons of the spiny lobster. *Brain Res* 678(1-2):213-224.
- Simon T, Schmidt, J, Calabrese RL (1994) Modulation of High Threshold Transmission Between Heart Interneurons of the Medicinal Leech by FMRF-NH₂. *J Neurophysiol* 71:454-466.
- Simon T, Opdyke CA, Calabrese RL (1992) Modulatory effects of FMRF-NH₂ on the outward currents and oscillatory activity in heart interneurons of the medicinal leech. *J Neurosci* 12(2):525-537.
- Simon T, Edwards DH (1990) Light-evoked walking in crayfish: Behavioral and neuronal responses triggered by the caudal photoreceptor. *J Comp Physiol A* 166:745-755
- Hershey SJ, Simon T, Baste C (1975) Histochemical localization of cytochrome oxidase in gastric mucosa. *J Histochem Cytochem* 4:271-282.

ABSTRACTS

- **Simon TW, Janus E (2018)** Driving Impairment from Cannabis Use: Prediction of Δ^9 -Tetrahydrocannabinol (THC) Blood Levels Using Driving Simulator Results and Alcohol Crash Risk Data, Submitted to Society of Risk Analysis Annual Meeting, New Orleans, LA
- **Simon TW, Zhu Y, Dourson ML, Beck NB. (2016)** Bayesian Methods Application: Proof of Concept and Pitfalls. Society of Toxicology Annual Meeting, New Orleans, LA
- **Simon TW, Beck NB (2015)** Bayesian Methods for Uncertainty Factor (UF) Application: Proof of Concept. Society of Risk Analysis Annual Meeting, T2-A.3, Arlington, VA
- **Canady RA, Simon TW. (2015)** Disruptive Arrival of Big Data to Food Intake Assessment. Society of Risk Analysis Annual Meeting, M2-H.1, Arlington, VA
- **Ruiz P, Simon T, Mumtaz M (2014)** Interpreting NHANES Biomonitoring Data: Dioxins. Abstract 96d, The Toxicologist—An official Journal of the Society of Toxicology, Volume 138, Issue 1, March
- **Becker R, Simon T, Patlewicz G, Kennedy S, Farhat A, Budinsky R. (2014)** Improving The Development Of Adverse Outcome Pathways: Lessons Learned From The AHR Rodent Liver Tumor and AHR Avian Teratogenicity/Embryolethality AOPs. Abstract 2253 The Toxicologist—An official Journal of the Society of Toxicology, Volume 138, Issue 1, March
- **Simon T. (2014)** Evidentiary Standards for Neuroactive and Neurotoxic Drug Testing (2014) Abstract 723, The Toxicologist—An official Journal of the Society of Toxicology, Volume 138, Issue 1, March
- **Becker R, Patlewicz G, Simon T, Goyak K, Phillips R, Rowlands JC, Seidel S. (2013)** Validation of High-Throughput and High-Content (HT/HC) Assays to Support 21st Century Toxicity Evaluations. Abstract 2267. The Toxicologist—An official Journal of the Society of Toxicology, Volume 132, Issue 1, March
- **Simon T, Stephens M, Yang Y, Manning R, Rowlands JC, Budinsky RA (2012)** Applying the “Science and Decisions” Conceptual Models” to Dioxin. Abstract 133. The Toxicologist CD—An official Journal of the Society of Toxicology, Volume 126, Issue 1, March
- **Simon, T, Rowlands JC, Budinsky RA (2011)** The Toxic Equivalence Factor for 2,3,7,8-Tetrachlorodibenzofuran (TCDF): Toxicokinetic and Toxicodynamic Considerations. Organohalogen Compounds 73:1003-1006.
- **Simon T (2010)** Using Human In Vivo AHR Activation as a Functional Dose Metric for Risk Assessment based on Chloracne, Effects in Keratinocytes and Background CYP Induction. Organohalogen Compounds 62:582-585.
- **Simon T, Budinsky RA, Rowlands JC, Abel TA (2010)** Linear vs. Nonlinear Extrapolation for Dose-Response Assessment of TCDD. Organohalogen Compounds 72:1418-1421.
- **Haws L, Tachovsky A, Staskal D, Aylward L, Burkhalter B, Urban J, Simon T, Harris M (2010)** An Evaluation of the Influence of Different Soil Cleanup Levels on the Concentration of Dioxin-Like Compounds in Human Serum. Organohalogen Compounds 72:1448-1449.
- **Harris M, Tachovsky A, Staskal D, Aylward L, Burkhalter B, Simon T (2010)** Serum Concentrations of Dioxin-Like Compounds in a Population of Midland Michigan: An Evaluation of the Impact of Soil Exposures. Organohalogen Compounds 72:1442-1443.
- **Simon T, Goodrum PE (2010)** A Comparison of Three Different Methods of Childrens’ Soil Ingestion. The Toxicologist, #1916
- **Haws L, Tachovsky A, Staskal D, Simon T, Burkhalter K, Harris MA (2010)** Evaluation of the Impact of Soil Exposures to Dioxin-Like Compounds on Body Burden in a Population in Midland, Michigan. The Toxicologist, #1871
- **Harris MA, Tachovsky A, Staskal D, Simon T, Burkhalter K, et al. (2010)** Assessment of the Impact of Various Soil Cleanup Levels on Serum Concentrations of Dioxin-Like Compounds in Humans. The Toxicologist, #1872

- Simon T (2009) Cancer Potency Estimates for 2,3,7,8-TCDD developed from the National Toxicology Program Bioassay Results, *The Toxicologist*, Program #EA1-2251
- Simon T (2009) Why Humans are Less Sensitive to PCBs than Rhesus Monkeys, *The Toxicologist* #EA4-2254
- Kirman C, Budinsky R, Yost L, Rowlands C, Long T, Simon T (2008) Development of a Direct Contact Criterion (DCC) for 2,3,7,8-TCDD in Soil Using Deterministic and Probabilistic Methods. *Organohalogen Compounds* 70:1204-1207.
- Kirman C., Crouch E, Aylward L, Simon T, Budinsky R, Landenberger B, Long T (2007) Cancer Potency Estimate For 2, 3, 4, 7, 8-Pentachlorodibenzo(P)Dioxin (4-PeCDF) *The Toxicologist*, Program #1561, p323.

BOOK CHAPTERS

- Vinas R and Simon TW (2017) Risk Assessment in the 21st Century: New Technologies and Techniques in *History of Risk Assessment in Toxicology, 1st Edition*, Sol Bobst, Ed., Academic Press, ISBN: 9780128095324
- Simon T, Edwards DH (1990) The Caudal Photoreceptor: A Multifunctional Sensory Neuron may select its Outputs by Spike Frequency. In *Frontiers in Crustacean Neurobiology*, Wiese K, Krenz W-D, Tautz J, Reichert H, Mulloney B (eds.) Birkhauser-Verlag, Basel, Boston, Berlin ISBN: 978-3-0348-5691-1

Grants, Awards and Honors

- 2012-15** Grant from the Dow Chemical Company. Development of a model of the effects of the availability of coregulator proteins on gene transcription.
- 2009** Honorable Mention, Risk Assessment Specialty Section of the Society of Toxicology, best paper of the year: Simon T, Kirman, CR, Aylward LL, Budinsky RA, Rowlands JC (2009) Estimates of Cancer Potency of 2,3,7,8-Tetrachlorodibenzo(p)dioxin using Linear and Non-linear Dose-Response Modeling and Toxicokinetics. *Toxicological Sciences* 112(2), 490-506.
- 2005** Recognition from the SouthWire Company for innovative approaches to Environmental Cleanup
- 2005** EPA Bronze Medal for Testimony in the Norman Mayes case in Knoxville, TN that led to additional UST regulations being passed by the State of Tennessee
- 2005** EPA Bronze Medal for Developing Guidance on Monitoring Land Use Controls
- 2002** EPA Science Achievement Award for Probabilistic Risk Assessment Guidance
- 1995** EPA Bronze Medal for Commendable Service; For leadership in setting the example in self-directed work team management and in setting the example in "fast-track" multimedia environmental investigation and cleanup
- 1992** Environmental Education Enterprises Scholarship in Environmental Science, "Principles of Environmental Drilling and Sampling," Association of Engineering Geologists, Atlanta, GA
- 1992** Special Award from the Vice President for Research, Georgia State University, "Evolution of different prey choice and feeding strategy in two related species," \$1000
- 1989** National Research Service Award F32 NS08394-01A1 from NIH-NINCDS "Modulation of Ionic Channels in an Oscillatory Network, Emory University, \$41,000
- 1989** Honorable Mention, Donald B. Lindsley Prize in Behavioral Neuroscience for Ph.D. Thesis, Honorable Mention for Ph.D. thesis, "The Neural Basis of Light Evoked Walking in Crayfish," Society for Neuroscience

Professional Memberships

- 2006 – Roundtable of Toxicology Consultants
- 1995 - Society of Toxicology
- 1997 – Society for Risk Analysis
- 1984 – 1993 Society for Neuroscience
- 2016 - The Toxicology Forum

Invited Lectures	
2019	"Hazard Characterization 101," Global Chemical Regulations Conference, March 6, Washington, DC
2018	"Driving Impairment from Cannabis Use: Prediction of THC Blood Levels Using Driving Simulation Results and Alcohol Crash Risk Data," Society of Risk Analysis Annual Meeting, New Orleans, LA
2017	"Scientific Issues with the "New" TSCA Risk Assessment Process," ACI Toxic Tort and Environmental Litigation Conference, Chicago, IL
2016	"Bayesian Methods for Application of Uncertainty Factors," Society of Toxicology Annual Meeting, New Orleans, LA
2016	"Quantitative Prediction of Phenotypic Change from High Throughput Assay Results," EPA Workshop on In Vitro to In Vivo Extrapolation, February, Research Triangle Park, NC
2015	"Bayesian Methods for Application of Uncertainty Factors," Society for Risk Analysis Annual Meeting, Arlington, VA
2015	"A New Look at Toxicity Factors for Toxaphene related to Fish Consumption in the Great Lakes," Presentation to The Great Lakes Consortium for Fish Advisories
2014	"Quantitative Key Event Relationships in the Adverse Outcome Pathway (AOP) for AHR-Mediated Rodent Liver Tumor Promotion," Invited Speaker at a meeting sponsored by the National Institute of Environmental Health Sciences held in Bethesda, MD
2014	"Evidentiary Standards for Neuroactive and Neurotoxic Drug Testing" Invited Speaker in a workshop at the 2014 meeting of the Society of Toxicology.
2013	"Current Outlook for Improving Uncertainty and Risk Communication." Invited Speaker at Understanding and Communicating Uncertainty in Hazard Assessment, a workshop sponsored by the Center for Advancing Risk Assessment Science and Policy (ARASP) of the American Chemistry Council (ACC).
2013	Four Lectures in Graduate Level Environmental Risk Assessment and Risk Communication, University of Georgia, Athens, GA, Spring 2013
2012	Four Lectures in Graduate Level Environmental Risk Assessment and Risk Communication, University of Georgia, Athens, GA, Spring 2012
2011	"The Toxic Equivalence Factor for 2,3,7,8-Tetrachlorodibenzofuran: Chemical-Adjustment Factors for Addressing TEF Uncertainty." Dioxin 2011, Brussels, Belgium, August 23, 2011
2010	"Linear vs. Nonlinear Extrapolation for Dose-Response Assessment of TCDD," Dioxin 2010, San Antonio, TX, September 15
2010	"Using Human in vivo AHR Activation as a Functional Dose Metric for Risk Assessment Based on Chloracne, Effects in Keratinocytes and Background CYP Induction," Dioxin 2010, San Antonio, TX, September 13
2009	"Dose Thresholds in Cancer Risk Assessment: Yes, they do exist." University of Georgia, Department of Environmental Health Science, Athens, GA, October 26
2008	"Toxaphene – How Bad is this Pesticide?" University of Georgia, Department of Environmental Health Science, Athens, GA, October 9
2008	"Nagging Questions about PCBs" University of Georgia, Department of Environmental Health Science, Athens, GA, October 7
2008	"Toxicology of Polychlorinated Biphenyls (PCBs)," Georgia Power Toxic Substances Control Act Training, Georgia Power Headquarters, Atlanta, GA, July 24.
2008	"Neurotoxic Modes of Action of Polychlorinated Biphenyls and Brominated Flame Retardants: Implications for Environmental Regulation", National Institute of Environmental Health Science 5 th PCB Workshop: New Knowledge gained from old pollutants, May 16-22, Iowa City, IA, invited by Dr. P.R.S. Kodavanti
2007	"Neurotoxic Equivalence Scheme of Relative Potency for Assessing the Risk of PCB Mixtures," Dioxin 2007, Tokyo, Japan, invited by Dr. P.R.S. Kodavanti of EPA, September.

- 2007 "Probabilistic Risk Assessment and Exposure," University of Georgia, Department of Environmental Health Science, Athens, GA
- 2006 "Toxaphene – the World's Most Misunderstood Pesticide," University of Georgia Department of Environmental Health Science Seminar Series, Athens, GA
- 2005 "Regulatory Perspectives on Probabilistic Risk Assessment." Society for Risk Analysis and Interstate Regulatory Council Workshop. Michigan State University, East Lansing, Michigan
- 2004 "New Directions in Environmental Issues: an EPA Perspective." Panel Discussion at the Georgia Environmental Law Seminar, Saint Simons Island, GA
- 2003 "Probabilistic Approaches to Dose-Response Assessment." Lecture to EPA's Risk Assessment Forum, Washington, DC
- 2000 "Probabilistic Risk Assessment: Step by Step," Sponsored by NIEHS, EPA and the University of Florida, Safety Harbor, FL
- 1999 "EPA's New Guidance on Citizen Involvement in Superfund Risk Assessment – What Lawyers and Risk Professionals Need to Know." Panel Discussion at the Society of Risk Analysis Annual Meeting, Atlanta, GA
- 1999 "Calculating Cleanup Levels with Monte Carlo: Regulatory Concerns and Perspective." Within a symposium organized by Scott Ferson, Society for Risk Analysis Annual Meeting, Atlanta, GA
- 1999 "Practical Issues in the Use of Probabilistic Risk Assessment and Its Application to Hazardous Waste Sites," sponsored by NIEHS, EPA and the University of Florida, Sarasota, FL
- 1996 "Evaluating the Risk of Liver Cancer from Occupational Exposure to Trichloroethylene with PBPK Modelling and Monte Carlo Simulation." Chemical Industry Institute of Toxicology, Research Triangle Park, NC

Key Experience

LITIGATION SUPPORT / WORK FOR LEGAL APPLICATION

- 2019 **Pro Bono Expert Opinion and Report about methamphetamine in hair in a child custody matter**
Developed a report on the validity of hair testing for methamphetamine; testimony expected in June.
- 2019 **Expert Opinion and Report on the Respiratory Effects of Inhaling Solder Fumes**
Exposure to rosin in solder has long been associated with lung damage; documented this association confirming biopsy evaluation by medical pathologists. Deposition is being scheduled.
- 2019 **Expert Report and Testimony on Interpretation of Cannabis metabolites in urine resulting from Hemp Oil Use**
Testified before a school board about urine drug screens from an assistant principal who used hemp oil on advice from health providers.
- 2018-19 **Expert Consultation / Report / Deposition on the Interpretation of blood levels of a Cannabis metabolite in an accident with two fatalities**
Developed a means of estimating other cannabinoid concentration in a postmortem blood sample from a fatally injured person and determined whether cannabis contributed to the fatal accident.
- 2019 **Expert Consultation / Report / Deposition on the Occurrence of False Positive Serum Alcohol Measurements following the use of Lactated Ringer's Solution**
Lactated Ringer's solution is used for volume replacement following trauma. This use can lead to false positive alcohol determinations by many hospital labs and can be wrongfully interpreted as alcohol consumption.
- 2019 **Expert Consultation and Report regarding the Urinary Metabolites resulting from Use of Opiates**
The metabolic products of hydrocodone, used for pain management, may include hydromorphone, also prescribed for pain, and the occurrence of hydromorphone depends on genetic variation. The report provided context for the levels of hydromorphone observed in urine.

- 2018 Pro Bono Expert Report about Concentration of Phosphatidyl Ethanol (PEth) in the blood of an Emergency Room Physician**
PEth is a biomarker for chronic alcohol consumption. Report demonstrated that the measured concentration was likely due to hand sanitizer use consistent with recommended medical practice rather than alcohol consumption
- 2018 Expert Report regarding the Assessment of Intoxication from Methamphetamine, Cannabinoids and Benzodiazepines in a Fatal Motor Vehicle Accident**
The state toxicology laboratory provided only screening results, i.e. "positive" or "negative" and the report indicated whether these could be used to infer intoxication as described by the state
- 2018 Expert Consultation and Report regarding a Death Ascribed to Multiple Drug Intoxication**
Developed an opinion about the effect of multiple prescription drugs as a possible cause of death related to a Workman's Compensation Issue
- 2018 Expert Reports providing context for the Interpretation of Cannabis metabolites in urine resulting from Hemp Oil Use**
Hemp oil contains cannabidiol, a substance from cannabis without psychoactive effects and is sold over-the-counter throughout the US. Report provided context for employment decisions.
- 2018 Expert Report and Testimony on the Interpretation of THC blood levels and Cannabis Use as a Factor in a Non-fatal Motor Vehicle Accident**
Prepared a report that estimated time of cannabis use from blood sampled after the accident and whether the effects of THC could have been a contributing factor.
- 2018 Expert Consultation on the Exposure and Toxicity of Titanium Dioxide during Sunscreen Production**
Gave suggestions for laboratories to conduct testing and provided initial problem formulation.
- 2018 Expert Consultation/Deposition Alcohol Use as a Contributory Factor in an Accident**
Provided consultation and deposition to opposing counsel regarding the use of alcohol as a contributory factor to an injury crash in an all-terrain vehicle.
- 2018 Pro Bono Expert Consultation regarding the Detection of Amphetamines in Urine in a Military Firefighter**
Developed an opinion and attended military hearing regarding the likely false positive detection of amphetamines in urine due to cross-reactivity from non-amphetamine prescription medications.
- 2017-18 Expert Report and Testimony about alcohol as a factor in a motor vehicle death in a dram shop matter**
Provided report testimony in New Jersey regarding 2017 Expert Report about estimation of blood alcohol from postmortem measurements and the ability of servers to recognize impairment/intoxication.
- 2018 Pro Bono Expert Consultation regarding cocaine and metabolites in the hair of a bartender**
Provided a memorandum indicating that hair in cocaine is likely due to passive exposure, and, in the case of a bartender, the likely source was cocaine contamination of US banknotes.
- 2018 Expert Opinion on Cannabis Use for a Federal Sentencing Hearing**
Examined three urine screens spaced over two months for the defense to determine if cannabis had been used during this time.
- 2018 Pro Bono Expert Consultation regarding hair testing for drugs used in drug-facilitated sexual assault**
For an advocacy group for rape victims, developed a memorandum and list of suggested drugs for possible testing in victim's hair following incidents.
- 2018 Expert Consultation and Deposition about interpretation of postmortem drug levels in blood**
Provided verbal opinions to attorneys; gave deposition testimony to opposing counsel.
- 2017 Expert Opinions and Testimony on Phosphatidylethanol (PEth) in Blood**
Peth concentrations provide a measure of the amount of chronic alcohol consumption; provided an estimate of daily alcohol use corresponding to specific Peth concentrations. Gave testimony (examination and cross-examination) in Bartow County, GA family court to provide context to PEth blood levels as a marker of chronic alcohol consumption.

- 2017 Expert Consultation about Benzene as a Causal Factor in Leukemia due to Residence near a Former Gas Station**
Provided several discussions with counsel regarding the environmental evidence and collection of additional data.
- 2017 Expert Testimony about the effects and disposition of marijuana in a Workman's Comp case**
Underwent examination and cross-examination about the significance of measurements of THC and its metabolite THCCOOH as a causal factor in a traffic accident.
- 2017 Expert Testimony in a DUI case**
Provided testimony about the validity of a reading from the Alcometer V-XL.
- 2017 Expert Litigation Support about occupational exposure to solvents at a Cement Plant**
Developed model of exposure to solvent vapors occurring in a testing laboratory with multiple fume hoods to assess the effects of mixed solvent exposure on cognitive deficits in a worker.
- 2017 Expert Opinion on Drug Use by a Truck Driver**
Considered deposition and blood test results to determine if the use of Adderall was a contributing factor to an accident.
- 2017 Expert Opinion on Alcohol Blood Testing**
Read medical records and blood test for alcohol to determine if a blood test about 15 hours after an injury was useful in determining impairment at the time of the injury.
- 2017 Expert Report on THC Test Results in Blood and Urine and Cognitive/Psychomotor Effects**
Considered medical records and drug test results from an employee injured at work to conclude whether marijuana use may have contributed to the injury.
- 2016 Expert Consultation on Chemicals found in Floor Coverings and Possible Links to Multiple Chemical Sensitivity**
Examined material safety data sheets, deposition transcripts and the scientific literature to determine the whether a manufactured floor covering could account for effects in humans. Testimony expected in early 2017.
- 2016 Expert Consultation on the Effects of Prescribed Anti-Depressants, Opiates and Epilepsy Medications during Pregnancy**
Wrote an opinion about the effects of these various drugs during pregnancy, including possible effect on the infant after its birth.
- 2016 Expert Consultation on Effects of Anti-Depressant and Opiate Drugs in Humans**
Provided a written opinion regarding the combined effects of a selective serotonin reuptake inhibitor, a benzodiazepine and an opiate on an individual's mental state. Exposure to these drugs likely occurred from a poisoning attempt.
- 2016 Opinion on the Interpretation of Positive Urine Tests for Marijuana following Weight Loss**
Wrote an opinion regarding the increases observed in the levels of THC-COOH (metabolite of THC from marijuana) in urine that are due to release of THC from fat. The THC was likely used several weeks or months prior to testing.
- 2016 Consultation about the Association of Disinfection Byproducts in Drinking Water with Various Health Effects**
Conducted an investigation of the scientific literature regarding a claim that chlorine and trihalomethanes were associated with a range of diseases, including kidney disease and cancer.
- 2015-16 Expert Report on the Toxicity of Dioxin-like Chemicals**
Provided a report and deposition on differences in toxicity of the various dioxin-like chemicals.
- 2015 Consultation with a Water Utility regarding the Health Effects of Radium in Drinking Water**
Worked with a health physicist to develop a joint opinion about the health effects of radium and potential treatment technologies to enable the utility in an acquisition.

- 2015 Deposition to State and Federal Environmental Regulators and Private Sector Attorneys about the Effects of Selenium on Human Health**
Provided deposition regarding the toxicity of selenium discharged into streams near Appalachian coal mines.
- 2015 Expert Report on the Likelihood of Fungal Eye Infection after Contact with Fertilizer**
Investigated exposure of plaintiff to airborne fertilizer particles during spreading operations resulting in loss of an eye.
- 2015 Expert Opinion on the Toxicity and Health Effects of Synthetic Cannabinoids**
In January, provided a memorandum to the Fairfax County, VA Police Department detailing the health effects of synthetic cannabinoids used in the illegal drugs known as "spice" or "K-2."
- 2014-15 Development of Statistical Background Screening Methods for Use at a Potential Superfund Site**
In December, provided a comparison to background for concentrations of arsenic and polycyclic aromatic hydrocarbons at a site currently going through the Hazard Ranking System.
- 2008-14 Expert Consultation and Deposition on Regulatory Decisions at a Superfund Site**
Provided an expert report to attorneys about how the presence of dioxin-like chemicals and PCBs affected the regulatory activities/decisions at a Superfund site. In 2014, provided deposition in Wash. DC.
- 2014 Report on TSCA Compliance Status of Recent Data and Publications on the Health Effects of Chromium**
Prepared a report on the determinations of whether these data and publications could be considered "new" information. The purpose was to provide attorneys with risk information as indicated in the 1978 TSCA Section 8(e) Policy Statement on Substantial Risk Notifications to EPA.
- 2010 Rebuttal Report on Hexavalent Chromium**
Prepared a report rebutting a report submitted by the expert working for opposing counsel regarding the health and environmental effects of hexavalent chromium.
- 2008-10 Expert Testimony regarding the Effects of Inorganic Mercury**
Provided an expert report to attorneys in a child custody matter regarding the long term neurological and psychological effects of inorganic mercury. Provided expert testimony on this matter in family court in Fulton County, GA regarding the toxicity of inorganic mercury.
- 2009 Consultation and Statistical Modeling regarding the Dose-Response of Perfluorooctanoic Acid (PFOA) in Humans**
PFOA is used in the production of Teflon. Provided consultation about dose-response modeling as a sub-contractor to a consulting firm in Tallahassee, FL to be used in litigation support.
- 2009 Expert Consultation regarding USEPA's Arsenic Toxicity Value**
Provided a memorandum to attorneys and personnel from electric companies on the ramifications of EPA's proposed change in the oral cancer slope factor for Arsenic.
- 2008 Risk Communication and Expert Consultation regarding Aerosol Emissions**
Retained as an expert in toxicology by attorneys for Georgia Power to provide scientific consultation and risk communication regarding emissions of several inorganic chemicals from power plants.
- 2007 Pro Bono Evaluation of Exposure to para-dichlorobenzene (PDB)**
Provided an expert report on exposure and potential liver damage in an individual working in a botany laboratory in which PDB was used as an insect fumigant for plant specimens.
- 2006 Assessment of Possible Drug/Alcohol Impairment in for Workman's Compensation**
Examined quick urine drug screen results showing alcohol and marijuana use and developed an assessment of possible impairment.
- 2006 Expert Consultation on the Recent History of Arsenic Regulation by EPA**
Provided a memorandum detailing the history of arsenic regulation as a soil contaminant by EPA headquarters and by Region 4 EPA (Southeast) since 1988 to support the efforts of attorneys regarding a Superfund site.

- 2006 Consulting Expert regarding Indoor Dampness and Mold**
Served as a consulting expert regarding adverse effects of exposure to indoor dampness, associated mold and bacteria and the disinfectant chemicals used in the cleanup.
- 2003-4 Model of Chemical Release from a Railroad Tank Car**
Developed a mathematical model for the release and dispersion of a dense gas, ethyl acrylate, from a railroad tank car. The gas produced both sensory irritation and toxic effects. Dispersion modeling was performed for dense gas dispersion in complex terrain.
- 2003 Expert Testimony in EPA vs. Norman C. Mayes**
As an EPA toxicologist, provided testimony to Administrative Law Judge Barbara Gunning regarding the health effects of benzene and other fuel components and environmental sampling around underground storage tanks.
- 2002-4 Air and Exposure Modeling and PBPK Model Development of Creosote Exposure at a Wood Treatment Facility**
Developed a comprehensive database of chemicals in wood preservative made with coal tar creosote, a mathematical model of the air concentrations of these chemicals at a wood treatment facility, and a second model for human internal exposure to these chemicals that included ingestion, inhalation and dermal routes.
- 2001-2 Expert Testimony regarding Calibration of the Intoxilyzer 5000**
Developed testimony regarding the calibration procedures of the Intoxilyzer 5000, the "breathalyzer" used in Georgia for DUI testing. Charges in DUI cases were dropped prior to his testimony in the three cases in which Dr. Simon was involved.
- 2000 Chemical Release from a Railroad Tank Car**
Developed a model of release and transport of acrylamide from a railroad tank car for use in litigation.

TEACHING

- 2014 Instructor, Environmental Risk Assessment and Communication, EHSC 8110, University of Georgia**
Taught a graduate level course in the School of Public Health using his textbook, "Environmental Risk Assessment: A Toxicological Approach."
- 2008 Lecture on the Toxicology of PCBs**
Developed and presented a training segment as part of the Toxic Substance Control Act (TSCA) training for electric power company personnel at the Georgia Power Company.
- 2008 Introduction to Risk Assessment, a two-day class for the Ontario Ministry of Environment**
With another scientist, developed and taught a class on risk assessment for newly hired Ministry personnel.
- 2005 Probabilistic Risk Assessment and Statistics, a short course to Michigan Department of Environmental Quality**
With another scientist, presented a 1 ½ day class on probabilistic risk assessment and statistics as part of a workshop sponsored by the Society for Risk Analysis and Interstate Technology Regulatory Council.
- 2003 Graduate Course in Simulation Modeling, Georgia State University**
Taught a graduate level course in Simulation Modeling including statistics, probabilistic methods and time-dynamic differential equation models.
- 2003 Short Course to Ontario Ministry of Environment on Probabilistic Risk Assessment**
With another scientist, developed and taught a class on probabilistic risk assessment, including probabilistic approaches to dose-response to personnel at the Ontario Ministry of Environment in Toronto, Canada
- 2001-06 University of Georgia Graduate Course in Environmental Risk Assessment**
On three separate occasions, taught a graduate-level class on Environmental Risk Assessment lasting 15 weeks, 3 hours per week.

- 2001 Short Course to Texas Natural Resources Conservation Commission on Probability Distributions**
With another scientist, developed and taught a class on statistics and probability distributions to data to TNRCC personnel.
- 2000 Workshops on Probabilistic Risk Assessment**
Performed as an EPA toxicologist. In 1999 and 2000, worked with Dr. Steve Roberts of the University of Florida to organize two workshops on PRA sponsored by EPA, NIEHS and the University of Florida.
- 1999 Short Course to Texas Natural Resources Conservation Commission on Probabilistic Risk Assessment**
With another scientist, developed and taught a class on probabilistic risk assessment to TNRCC personnel.
- 1997 Short Course to Navy Environmental Health Center personnel on Probabilistic Risk Assessment**
With another scientist, developed and taught a class in probabilistic risk assessment Navy personnel in Norfolk, VA.

PRODUCT LIABILITY AND SAFETY EVALUATIONS

- 2013 Presentation to a French Government Agency on Product Safety**
Provided a report with estimates of both toxicity and exposure to rail workers on the use of a synthetic dielectric compound manufactured by a company in the UK. Met with French government personnel to discuss the report.
- 2012 Assessment of Risk from Metal Plating Flaking from an Auxiliary Faucet used with a Water Filter**
Developed risk estimates for water consumers from dissolved metals and metal flakes from the faucet. This assessment was used internationally and therefore incorporated World Health Organization methodology.

REGULATORY TOXICOLOGY

- 2019 Expert Panel on Quantitative Mode of Action Scoring for Carcinogenesis**
Participated with 15 other experts in a questionnaire and in-person two-day meeting to develop a methodology for determining measurable events predictive of cancer occurrence.
- 2019 Review of Teaching Materials for the Predictive Analytic Toolkit, a web-based platform for inferential statistics**
This toolkit provides a range of multivariate methods for use in predictive models. The work was sponsored by a chemical industry trade group and the materials included both videos and written materials.
- 2018 Comments to California's Office of Environmental Health Hazard Assessment (OEHHA) on Reference Exposure Levels for Toluene**
The comments were developed for submission by a chemical industry trade group and dealt specifically with the application of safety/uncertainty factors for human variability.
- 2018 Lead Author of a Document Developing Toxicity Reference Values for Inorganic Arsenic**
The report was developed for Health Canada, the Canadian equivalent of the US EPA. Data from many large epidemiologic studies were used for exposure-response modeling and development of TRVs such as reference doses and cancer slope factor. Custom software to perform the modeling was developed in the R software language.
- 2017 Report to Chemical Industry Trade Group on Perfluorinated Compounds**
These compounds have been used for stain resistance and waterproofing for many years. They are ubiquitous in the environment and human body burden. The report provides advice about which compounds bear the least risk to human health.
- 2016-17 Lead Author of a Toxicological Review of Inorganic Arsenic and Organic Arsenicals**
The review was developed for Health Canada, the Canadian equivalent of the US EPA and the purpose was to examine the feasibility of the integrating human, animal and in vitro laboratory data to provide an updated toxicity evaluation of arsenic.

- 2016 Publication titled "How Well Do HTS Carcinogen Characteristics Predict Carcinogenicity?"**
Provided statistical analysis, graphics and narrative development for this paper in collaboration with scientists from universities and industry trade groups.
- 2016 Analysis of Chemical Similarity for Abuse Liability of Candidate Drug Molecules**
Conducted a statistical analysis of chemical similarity between two candidate drugs and substances on the DEA Controlled Substance List to address the issue of potential abuse liability.
- 2015-16 Whitepaper on Causal Associations between Flame Retardant Exposure and Firefighters' Diseases**
Developed for the Flame Retardants Alliance.
- 2015 Adverse Outcome Summary Pathways for Chemicals with Uncertainty about the Mode of Action**
Adverse outcome pathways (AOPs) are being used by EPA and OECD to form a data wiki for eventual interpretation of high-throughput in vitro data. Developed separate summaries of AOPs for four chemicals carcinogenic in animals using the assumption of mutagenicity as mode of action and hyperplasia/cell proliferation as the mode of action.
- 2015 Revision of the Toxicity Factor for the Pesticide Toxaphene for use at the Hercules site in Brunswick, GA**
Developed a revised estimate of the toxicity criterion (Reference Dose) for the pesticide toxaphene for use in a new risk assessment for the Hercules site in Brunswick, Georgia.
- 2014-15 Report on Bayesian Statistical Methods used in the NRC (2014) Review of IRIS**
Developed a report examining 24 toxicity factors from EPA's Integrated Risk Information System database, the subject of a recent review by the National Research Council. The report compared EPA's methods with those recommended in the NRC report.
- 2014 Presentation on arsenic and chromium at EPA's Integrated Risk Information System (IRIS) Bimonthly Meeting**
In June, presented mode of action information for arsenic and hexavalent chromium at EPA's IRIS meeting. The purpose of these meetings is to seek input from stakeholders for development of IRIS risk assessments.
- 2013 Presentation on Quantitative Methods for Mode of Action Analysis to EPA's Bimonthly IRIS Meeting**
In December, presented slides and discussion to EPA and other stakeholders based on the paper written with ILSI/HESI titled "The Use of Mode of Action Information in Risk Assessment: Quantitative Key Events / Dose-Response Framework (Q-KEDRF) for Modeling the Dose-Response for Key Events."
- 2013-16 Development of Wiki files on the Adverse Outcome Pathway for the Organisation for Economic Cooperation and Development (OECD)**
Wrote and edited webpages for use in the new AOP Wiki sponsored by OECD, EPA and others. The purpose of the collection of AOPs and the Wiki is to contextualize in vitro data for use in risk assessment.
- 2013 Preparation of a Report Providing Derived LD50 Values for Metals in Fly Ash**
Doses of fly ash representing the LD50 for metals were developed for fly ash produced by an incinerator operated by a large county government in southern California.
- 2013 Development of Evidence Tables for EPA's Integrated Risk Information System (IRIS) Assessments**
Developed tabular format for presenting mode of action and toxicity information consistent with the National Academy of Sciences' Review of the Environmental Protection Agency's Draft IRIS Assessment of Formaldehyde. Presented the tables and accompanying rationale to EPA IRIS staff using hexavalent chromium as an example.
- 2013 Development and Presentation of Responses to Charge Questions for EPA's Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Scientific Advisory Panel**
Wrote responses on physico-chemical screening and the rainbow trout Expert System for estrogenic effects; presented the responses at the FIFRA/SAP meeting at EPA Headquarters.
- 2012 Review of EPA's Toxicological Review of Ammonia**
Reviewed the EPA draft document for ammonia to determine consistency with recommendations from the National Academy of Sciences. Presented results at EPA's IRIS listening session on Ammonia.

- 2012 Review of 2012 Texas Commission on Environmental Quality (TCEQ) "Guidelines to Develop Toxicity Factors"**
TCEQ develops its own toxicity criteria and does not depend on EPA's IRIS database. Prepared comments on the guidance for submission to TCEQ.
- 2012 Preparation of a White Paper and manuscript for publication on Validation of EPA's ToxCast™ Suite of High Throughput In Vitro Assays**
Wrote narrative paper and manuscript for a chemical industry trade group on issues with validation of these assays for chemical screening and prioritization.
- 2011 Development of Physiologically-based Pharmacokinetic Models for Dioxin, PCBs, DDT, Hexachlorobenzene and Organophosphate Pesticides for use as teaching tools at the Agency for Toxic Substances and Disease Registry (ATSDR)**
Developed PBPK models in Berkeley Madonna software for use as teaching aids for personnel at ATSDR.
- 2011 Review of EPA's Physiologically Based Pharmacokinetic Model for Acrylonitrile Used in the IRIS Risk Assessment**
Reviewed the MATLAB computer code and output for optimization of parameters used in this model.

TOXICOLOGY AND REGULATORY ANALYSIS OF DIOXIN-LIKE CHEMICALS INCLUDING POLYCHLORINATED BIPHENYLS

- 2012-15 Modeling of Dioxin-induced Gene Expression in Breast Cancer Cells**
Developed a model of gene expression using stochastic simulation methods that reproduced several phenomena such as non-monotonic dose response curves. ds
- 2012 Development of a Margin of Exposure for Enzyme Induction from Dioxin Exposure for Comparison with Recent EPA Toxicity Factors for a Weight-of-Analysis**
Using data from both humans and laboratory test species, determined the dose at which an increase in thyroid hormone metabolism could be expected and compared this dose with the current EPA reference dose based on thyroid effects in newborns.
- 2011 Inclusion of 2009 Reference Dose for 2,3,7,8-Tetrachlorodibenzodioxin (TCDD) in the ITER and TOXNET databases**
Presented conclusions from a 2009 publication to a peer review panel convened by Toxicology Excellence in Risk Assessment (TERA) for placement in the International Toxicity Estimates for Risk Assessment (ITER) database and linked to the TOXNET database at the National Library of Medicine.
- 2011 Developed a Revised Toxic Equivalence Factor (TEF) for 2,3,7,8-Tetrachlorodibenzofuran (TCDF)**
TCDF is a dioxin-like chemical that is metabolized and eliminated within hours in contrast to other dioxin-like chemicals that persist in the body for many years; developed an estimate of the TCDF TEF that incorporates this rapid metabolism for presentation at an International conference in Brussels, Belgium.
- 2011 Alliance for Risk Assessment Presentation on Dioxin using Science and Decisions Conceptual Models**
Presented results from the application of dose response methods described National Research Council's 2009 Report "Science and Decisions: Advancing Risk Assessment" to dioxin. The audience was an expert panel that included several of the authors of the NRC report.
- 2010 Report on Biota-Sediment Accumulation Factor (BSAF) for Aroclor 1260, a Commercial PCB Mixture**
Provided a review and commentary on the development of a BSAF for Aroclor 1260 (PCB mixture) and its general applicability to PCB contaminated sites.
- 2010 Rapporteur at a Workshop on Dose-Response Approaches for Nuclear Receptor-Mediated Modes of Action**
Led panel discussion and provided the presentation of the report for the panel examining the mode of action of the aryl hydrocarbon receptor that mediates gene expression from dioxin-like chemicals.
- 2010 Risk Assessment for Dioxin based on the Occurrence of Chloracne in Humans**
Developed a risk assessment for 2,3,7,8-tetrachlorodibenzo-p-dioxin based solely on data from humans and presented the work at the Dioxin 2010 meeting in San Antonio, TX.

- 2010 Analysis of Responses of Human and Rodent Liver Cells to Dioxin-Like Chemicals**
Conducted statistical analysis of genomic and proteomic data in response to three dioxin-like chemicals from human and rodent tissues *in vitro*.
- 2010 Cancer Slope Factors and Toxicity Equivalence Factors for Dioxin-Like Chemicals based on Internal Doses**
Developed a comparison of the toxicity of four dioxin-like chemicals based on tissue concentrations from National Toxicology Program bioassays using physiologically-based pharmacokinetic modeling and dose response models.
- 2009 Evaluation of Toxicity Equivalence Factors for Dioxin-like Chemicals based on external doses**
Developed a comparison of methods used to develop values for TEFs used in risk assessments of dioxin-like chemicals.
- 2009 EPA Federal Advisory Committee Act (FACA) Workshop on Dioxin**
Attended workshop on the risk assessment of 2,3,7,8-tetrachlorodibenzodioxin (TCDD); provided public commentary on EPA's proposed methods for revising the 2003 dioxin reassessment.
- 2008 Review of PCB Ecotoxicology Information in the Baseline Ecological Risk Assessment for the LCP Chemical Superfund Site, Brunswick, GA**
Reviewed the toxicity assessment for PCBs for the ecological risk assessment for this site to ensure consistency with the values and approach used in the human health risk assessment.
- 2007 Comparison between Blood Levels of Dioxin in residents of Midland, MI and those in rats associated with Adverse Effects**
Conducted a comparison between human blood levels of 2,3,7,8-TCDD and 2,3,4,7,8-PeCDF measured in humans in the University of Michigan Dioxin Exposure Study and estimated blood levels in rats from bioassays published by the National Toxicology Program in 2006.
- 2007 Development of a Risk Assessment Methodology Based on Changes in Gene Expression**
With very recent information on dioxin-related gene expression changes in the liver, developed a method for using these changes as a biomarker for the progression to type 2 diabetes.
- 2007 Whitepaper on the Non-cancer effects on humans of Dioxin-like Chemicals**
Collected scientific information related to potential and actual human health effects from published studies of the Yu-Cheng/Yusho poisoning, the Seveso exposure, the BASF plant exposure and the Viet Nam Ranchhands (Agent Orange handlers) and others to assess the likelihood of various health outcomes from dioxin exposure.
- 2007 Soil Cleanup Standards for Dioxin related to the Georgia Hazardous Substances Response Act for a secondary copper smelter**
Develop a dioxin cleanup level in soil for consideration by the Georgia EPD that included an epidemiological study of dioxin in the blood of workers at the smelter.
- 2005 Development of Surrogate Values for Reported Dioxin Concentrations Below the Analytical Detection Limit**
Performed as an EPA toxicologist; the use of contract-specified reporting limits as nondetect surrogates for dioxin analysis leads to large overestimates of soil concentrations; identified a more accurate nondetect surrogate value based on the actual chemical analysis.
- 2005 Reassessment for the Need for PCB Congener Analysis at the Anniston/Solutia PCB Site**
Performed as an EPA toxicologist; compared results from PCB cancer bioassays of their cancer potency.
- 2004-5 Geostatistical modeling of dioxin concentrations in soil at Superfund Sites in Florida**
Performed as an EPA toxicologist; these analyses demonstrated that cleanup at these sites had been successful and appropriate for the predicted land use; the analyses also showed that dioxin occurring off-site was unrelated to on-site contamination.

HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT AND RISK COMMUNICATION

- 2014 Development of a Probabilistic Risk Assessment for Nellis Dunes Recreation Area, Nevada**
Worked in conjunction with academic scientists at the University of Nevada, Montana State University and the University of South Carolina to use newly developed information of the geology of Nellis Dunes and site-specific toxicity bioassays of dust to complete a risk assessment for exposure to dust at this recreation area.
- 2012 Participation on a Risk Assessment Team developing methodology to assess a Superfund site consisting of a large area floodplain**
Evaluated risk assessment options and land use to support cleanup decisions at an impacted area comprising several square miles and many river miles.
- 2010 Screening Level Ecological Risk Assessment (SLERA) for a site in Flowery Branch in Hall County, Georgia**
At an industrial park near an interstate highway, the area of potential ecological concern consisted of a storm-water retention pond and a stream. Investigated the site and developed the SLERA document for submission to the Georgia Environmental Protection Division.
- 2009 Streamlined Human Health and Ecological Risk Assessments to support Removal Action at the Nabesna Mine Site in Nabesna, Alaska**
This site is located in the Wrangell-St. Elias National Park and was a functioning gold mine in the early 20th century with high concentrations of metals associated with mine tailings and acid mine drainage; developed both risk assessments to support a non-time-critical action at the site.
- 2009 Development of Georgia Risk Reduction Standards (RRS) for Drexel Chemical Company in Cordele, GA and another site in North Georgia**
Calculated Georgia RRS values for this site; negotiated in person and by teleconference with Georgia Environmental Protection Division personnel regarding the appropriate use of toxicity criteria.
- 2009 Risk Communication and Regulatory Review related to the TVA Coal Ash Spill in Kingston, TN**
Provided risk communication at public availability session for both the American Coal Ash Association and TVA; reviewed submissions to EPA developed by TVA.
- 2008 Quality Assurance for Fish Consumption Risk Assessment on the Passaic River**
Reviewed and provided comments on both the accuracy and conceptualization of the risk assessment.
- 2008 Development of Georgia Risk Reduction Standards for Trivalent and Hexavalent Chromium and several Volatile Organic Chemicals**
Calculated numerical standards under Georgia's Hazardous Site Response Rule 391-3-19 as a subcontractor in support of a property sale and transfer.
- 2008 Evaluation of Soil Concentrations of Arsenic with an Emphasis on Local Background at a Power Plant**
Developed a report for submission to the Georgia Environmental Protection Division regarding a release of waste material containing arsenic that occurred by storm water runoff; the report considered the geology and local background concentration and included a statistical analysis.
- 2008 Statistical Evaluation of Solvent Data in Groundwater and Critique of ATSDR Health Assessment of a Superfund Site**
Provided a report that included suggestions and comments on the ATSDR Report. Performed a statistical analysis to refine the conclusions reached and critiqued the methodology for the Health Assessment.
- 2008 Investigation into the Scientific Basis of Land Disposal Limit of 50 parts per million for PCBs**
Under the 1979 Toxic Substances and Control Act (TSCA), EPA has placed an upper limit of 50 ppm for land disposal of PCBs. Investigated the scientific basis of this value for application at a former chlor-alkali plant.
- 2008 Review of Cleanup Target Levels of Florida Department of Environmental Protection**
Provided a review of the Cleanup Target Levels used for regulation by Florida Department of Environmental Protection.

- 2007 Evaluation of Calculation Methods for the Georgia Risk Reduction Standards of the Georgia HSRA Program**
Examined RRS values for soil and groundwater developed for a site in north Georgia and provided an explanation of the rationale underlying discrepancies in the calculated values.
- 2007-9 Risk Assessment for the Exposure to Mercury and PCBs from contact with Marsh Sediment and Consumption of Fish and Game Birds at the LCP Chemical Superfund Site, Brunswick, GA.**
Conducted a risk evaluation for sediment exposure and, fish consumption with development of site-specific fish consumption estimates and a site-specific sediment exposure estimate for an updated Remedial Investigation Report for submission to the US Environmental Protection Agency.
- 2007 Pro Bono Evaluation of Georgia DNR Fish Advisories for PCBs and Mercury**
Evaluated current fish advisories near Brunswick, GA for Dr. Randy Manning, the Georgia state toxicologist.
- 2007 Georgia Risk Reduction Standards for PCBs, mercury and other chemicals in Soil and Groundwater at the LCP Chemical Superfund Site**
Prepared detailed calculations of soil and groundwater screening values based both on direct exposure and transfer of chemicals from soil to groundwater.
- 2006-10 Risk Assessment for the Residential Exposure Scenario for PCBs and mercury in Upland Soils at the LCP Chemical Superfund Site, Brunswick, GA.**
Conducted a risk evaluation for residential exposure. The original risk assessment for the LCP site did not include an estimate of risk to on-site residents or other human receptors with a small exposure unit (ca. 0.5 acres). This risk evaluation will be part of an updated remedial investigation to submit to USEPA.
- 2006-7 Risk Assessment for Consumption of Estuarine Fish containing Toxaphene Residues by Coastal Georgia Residents related the Hercules Chemical Superfund Site in Brunswick, GA**
Developed fish consumption estimates for coastal Georgia residents based on the previous surveys in the Brunswick area used along with published work on the toxicity of toxaphene to support a probabilistic risk assessment for fish consumption prepared for USEPA.
- 2006 Development of a Physiologically-based Pharmacokinetic Model for Copper in Migratory Birds for Ecological Risk Assessment of Mine-Associated Tailings Ponds**
High copper concentrations in water associated with acid mine drainage may be toxic to birds; developed of a PBPK model of copper absorption, distribution, metabolism and excretion (ADME) in juvenile ducks and adult geese; conducted a feasibility study of incorporating the physiological changes associated with migration into the model.
- 2006 Development of a Preliminary Risk Assessment for Selenium as part of a Proposal to Address Overall Effects of Selenium in a River System**
Developed human health and ecological risk estimates for selenium migrating from coal piles into a river. These estimates included consumption of fish and water by humans.
- 2006 Evaluation of Georgia DNR Fish Advisories near Brunswick, GA**
Conducted an evaluation of fish advisories for Toxaphene and PCBs published by the Georgia Department of Natural Resources.
- 2006 Development of a white paper presenting the history of Probabilistic Risk Assessment (PRA) at EPA**
Reviewed EPA guidance documents and scientific literature and produced a document that detailed this complete history of PRA at EPA and suggested likely uses of PRA in the future.
- 2005 Risk Communication regarding solvents in groundwater at Augusta, Georgia**
As an EPA toxicologist, provided information to citizens at a public meeting regarding the possible health effects of tetrachloroethylene and trichloroethylene in groundwater relating to a RCRA site.
- 2005 Review of Proposed Arsenic Toxicity Assessment to be placed on EPA's IRIS Database**
As an EPA toxicologist and consensus reviewer for EPA's IRIS database, reviewed and provided comment on proposed changes to the arsenic toxicity assessment.

- 2004-5 Risk Communication to Community Against Pollution (CAP), a citizens group in Anniston, AL**
As an EPA toxicologist, developed a relationship with CAP and presented information on the health effects of PCBs at several public and community meetings.
- 2004 Providence Park Ecological Risk Assessment**
Conducted a screening ecological risk assessment (SLERA) for a site in Fulton County, GA
- 2004 Risk Communication regarding Trichloroethylene**
As an EPA toxicologist, provided information to the Citizen's Advisory Group (CAG) at Anniston Army Depot and a group of concerned citizens about the health effects of trichloroethylene.
- 2003-5 Development of EPA's *Guidance on Surface Soil Cleanup at Hazardous Waste Sites: Implementing Cleanup Levels***
As an EPA toxicologist, developed a guidance document that presented methods for applying risk-based cleanup levels as area averages rather than not-to-exceed levels.
- 2003 Soil Cleanup Strategy for a Skeet Range at Naval Air Station Cecil Field in Jacksonville, FL.**
As an EPA toxicologist, used both geostatistics and exposure assessment to refine the size of the area needing remediation.
- 2000 Discussion of Florida's Secondary Drinking Water Standards based on Organoleptic Effects**
As an EPA toxicologist, investigated the biological basis of Florida's secondary drinking water criteria for aluminum, iron, manganese and silver for which secondary standards based on esthetics (smell and taste) were below health-based criteria.
- 2000 Memorandum presenting *Amended Guidance on Ecological Risk Assessment at Military Bases: Process Considerations, Timing of Activities, and Inclusion of Stakeholders***
As an EPA toxicologist, authored a memo that enabled ecological risk assessments at DOD facilities to be completed in a timely manner and ensures that risk assessment activities occur at times consistent with DOD funding schedules.
- 1996-9 Development of *Risk Assessment Guidance for Superfund, Part 3. Process for Conducting Probabilistic Risk Assessment***
As an EPA toxicologist, made significant contributions to this guidance, which received EPA's Science Achievement Award in 2001.
- 1995 Region 4 Bulletins: Regional Risk Assessment Guidance**
As an EPA toxicologist, authored Region 4 risk bulletins on Toxicity Assessment and on Development of Remedial Goal Options.

ADDITIONAL WORK IN TOXICOLOGY

- 2014-16 Development of an Adverse Outcome Pathway Document for a Mutagenic Mode of Action for Cancer**
Worked with individuals from both government and the private sector, collaborated on a manuscript detailing the mode of action / adverse outcome pathway for liver tumorigenesis in animals and humans by aflatoxin B1, a toxin produced by fungi and ubiquitous in grains and ground nuts.
- 2009-16 Ongoing Scientific Consultation on the Health Effects of Hexavalent Chromium**
Provides ongoing support for toxicological and risk assessment information for toxicological issues related to hexavalent chromium for a Fortune 100 company.
- 2010 Statistical Analysis of Reproductive Endpoints in Rats Exposed to Flame Retardant Chemical**
Performed statistical analysis of dichotomous data for reproductive endpoints to inform a European consortium about the most appropriate methods for data analysis.
- 2009 Responses to EPA Charge Questions for Review of the 2009 Toxicological Review of 1,4-Dioxane**
Wrote responses to EPA's "Charge to External Reviewers for the Toxicological Review of 1,4-Dioxane" related to uncertainty analysis, physiologically-based pharmacokinetic (PBPK) modeling and Benchmark Dose modeling.

- 2009 Physiologically-based Pharmacokinetic Models for Methylmercury, Arsenic, Cadmium and Bisphenol-A for use as teaching tools**
Translated existing models into the Berkeley Madonna computer software for use as teaching aids for personnel at the Agency for Toxic Substances and Disease Registry,
- 2008 Whitepaper on the Ethics of Environmental Regulation and Compounding Conservatism in Risk Assessment for the Ontario Ministry of the Environment**
Used historical sources, philosophical literature and modern scientific publications to provide an understanding of the extent to which environmental regulations and standards are based on the precautionary principle.
- 2008 Assessment of Conservatism of Soil and Groundwater Standards for the Ontario Ministry of the Environment**
Assessed the level of conservatism of proposed environmental media standards using statistical methods.
- 2007 Expert Panel Developing a Protocol for Toxicity Testing of a Legacy Pesticide Mixture**
Served on a panel to refine a protocol for toxicity testing of soil considering both individual pesticide isomers and mixtures.
- 2004 Consultation with EPA Region 4 Mercury Study Group**
As an EPA toxicologist, provided information to a group of Region 4 personnel to address a newspaper editorial regarding human health and mercury.

Peer Reviews and Peer Consultations

- 2019 Critical Reviews in Toxicology, Roger O. McClellan, Editor-in-Chief, "Toxicity of Mercury: Molecular Evidence"**
- 2019 Risk Analysis, Charles Haas, "Predicting the Probability That a Chemical Causes Steatosis Using Adverse Outcome Pathway Bayesian Networks (AOPBNs)"**
- 2019 Regulatory Toxicology and Pharmacology, Gio Bata Gori, Editor, "Derivation of Biomonitoring Equivalents (BE values) for Zinc"**
- 2019 Environment International, Lesa Aylward, Associate Editor, "Prediction of maternal and foetal exposures to perfluoroalkyl compounds in a Spanish birth cohort using toxicokinetic modelling"**
- 2018 Journal of Forensic, Legal and Investigative Sciences, Katherine Chelsea, "Drunk Drivers"**
- 2018 Environment International, Heather Stapleton, Associate Editor, "High concentrations of PCBs in breast milk among Czech women: interpretation of biomonitoring data using a Physiologically Based Pharmacokinetic Model"**
- 2018 Environment International, Lesa Aylward, Associate Editor, "Age-dependent Human Elimination of Dioxin-like Polychlorinated Biphenyls Derived from Cross-Sectional Biomonitoring Data in the General Population."**
- 2018 Current Pharmaceutical Biotechnology, Davide Prosperi, Editor, "A microplate-based platform with immobilized human glutathione transferase A1-1 for high-throughput inhibitor screening "**
- 2018 Agency for Toxic Substances and Disease Registry (CDC) "Comparative Analysis of Blood/Gas Partition Coefficients across Species."**
- 2018 Science of the Total Environment, Pavlos Kassomenos, Associate Editor, "Comparing Apples to Oranges: Interpreting Ozone Concentrations from Observational Studies in the Context of the United States Ozone Regulatory Standard"**
- 2018 Regulatory Toxicology and Pharmacology, Gio B. Gori, Editor, "Residual behaviors and risk assessment of prochloraz in bayberries and bayberry wine for Chinese population"**
- 2018 Environment International, Lesa Aylward, Associate Editor, "Age-Based and Time Trends of Chemical Exposure Biomarkers in the US Population 1999-2014"**
- 2018 EclinicalMedicine, Derek Anane, Senior Editor, "Remote alcohol monitoring to facilitate incentive-based treatment for alcohol use disorder: A randomized trial"**
- 2018 Regulatory Toxicology and Pharmacology, Gio B. Gori, Editor, "Biomonitoring Equivalents for Cyanide"**

- 2017** *Environment International*, Lesa Aylward, Editor, "An analysis of cumulative risks based on biomonitoring data for six phthalates using the Maximum Cumulative Ratio"
- 2017** *Toxicological Sciences*, William H. Farland, Assoc. Editor, "Identification of novel uncertainty factors for health hazard and risk assessment: Application to cleaning product Ingredients"
- 2097** *Environment International*, Lesa Aylward, Editor, "Excretion of Di-2-ethylhexyl Phthalate (DEHP) Metabolites in Urine is Related to Body Mass Index Because of Reverse Causality"
- 2017** *Risk Analysis*, L. Anthony Cox, Editor, "Cumulative Low-Dose Response Assessment: An Emergent Model For Carcinogens, Noncarcinogens, And Mixtures"
- 2017** *Regulatory Toxicology and Pharmacology*, Gio Bata Gori, Editor-in-Chief, "Guidelines for Performing Systematic Reviews in the Development of Toxicity Factors"
- 2017** *Risk Analysis*, Tony Cox, Editor-in-chief, "Cumulative Low-Dose Response Assessment: An Autocorrelated First-Order Model"
- 2017** *Chemical Research in Toxicology*, F. Peter Guengerich, Associate Editor, "Identification of potential aryl hydrocarbon receptor ligands by virtual screening of industrial chemicals"
- 2016** *Combinatorial Chemistry & High Throughput Screening*, Rathnam Chaguturu, Editor, "A Big Data Approach with Artificial Neural Network and Molecular Similarity for Chemical Data Mining and In-Silico Toxicity Prediction"
- 2016** *Science of the Total Environment*, Dr. Jay Gan, Editor, "Occurrence, Sources and Estimation of Air-Soil Exchange of Polychlorinated biphenyls in Indian cities"
- 2016** *Scientific Research and Essays*, Dr. N. J. Tonukari, Editor, "Bayesian Analysis to Detect Change-point in Two-Phase Laplace Model"
- 2016** *Environmental Science and Technology*, Dr. Beate Escher, Assoc. Editor, "Toxicogenomics of Developmental Toxicity of 6-OH-BDE47 in Chicken Embryo"
- 2016** *Environmental Health Perspectives*, Dr. Martin Van den Berg, Assoc. Editor, "Defining the neurotoxic potential of nondioxin-like polychlorinated biphenyls present in fish from US lakes using a ryanodine receptor-based equivalency scheme"
- 2016** *Science of the Total Environment*, Dr. Jay Gan, Editor, "Occurrence, Sources and Estimation of Air-Soil Exchange of Polychlorinated biphenyls in Indian cities"
- 2015** **Structured peer review of a comparison between the effects of tobacco smoke and nicotine vapor from modified risk tobacco products on the lungs of mice**
Answered a series of charge questions and also provided suggestion for future research.
- 2015** *IUMB Life*, Dr. Angelo Azzi, Editor, "Identification of differentially expressed three novel transcript variants of mouse Arnt gene."
- 2015** *Environmental Research*, Dr. Jose L. Domingo, Editor, "Antioxidant activity as a potential mechanism explaining the negative influence of lead and cadmium on working memory during aging."
- 2015** *Toxicological and Environmental Chemistry*, Dr. Sam Kacew, Editor, "Headspace and small chamber studies of airborne diacetyl release from selected food flavoring mixtures: Activity coefficients and air modeling Implications"
- 2015** *Environmental Research*, Dr. Jose L. Domingo, Editor, "Transcriptomic and visual gene-network analysis of silver nanoparticles potentially induced Alzheimer's disease progression in mouse brain neural cells"
- 2015** *Environmental Research*, Dr. Jose L. Domingo, Editor, "Identification of Free Phthalate Metabolites in Human Cerebrospinal Fluid."
- 2014** *Critical Reviews in Toxicology*, Dr. Roger O. McClellan, Editor, "Risk assessments for chronic exposure of children and prospective parents to ethylbenzene (CAS No. 100-41-4)"
- 2014** *Environmental Research*, Dr. Jose L. Domingo, Editor, "Impact of early-life bisphenol A exposure on precortical dopamine and serotonin systems in juvenile and adult male rats."

- 2014** *Environmental Research*, Dr. Jose L. Domingo, Editor, "Bisphenol A is associated with insulin resistance and modulates adipokines gene expression in obese children."
- 2014** *Human and Experimental Toxicology*, Dr. Kai Savolainen, Assoc. Editor, "Global Methaemoglobinaemia Research Output (1940–2013): A Bibliometric Analysis Based on Scopus Database."
- 2014** *Human and Experimental Toxicology*, Dr. A. Wallace Hayes, Assoc. Editor, "Pharmacokinetic Study of Omeprazole and its Metabolites in Males and Females, Females Exposed to Higher Levels of Omeprazole."
- 2013** *Consultation to a Water Utility Regarding the Quality of Water Provided to a Community* Provided initial consultation and coordinated a peer review of a risk assessment of the pesticide toxaphene occurring in trace amounts in the water.
- 2013** *Human and Ecological Risk Assessment*, Dr. Barry Johnson, Editor, "Assessment of Soil Screening Levels due to Accidental Ingestion of Chrysene and Benzo[k]fluoranthene at Iran's TOR Site."
- 2012** *Human and Experimental Toxicology*, Dr. A. Wallace Hayes, Editor, "Effect of nicotine pre-treatment on arsenic induced oxidative stress in Wistar rats."
- 2012** *Human and Experimental Toxicology*, Dr. A. Wallace Hayes, Editor, "Elemental impurities in Nigerian pediatric syrups: Mercury in violation of standard guidelines."
- 2011** *Journal of Toxicology and Environmental Health*, Dr. Sam Kacew, Editor, "Screening Level Risk Assessment for SAN Trimer Detected in Soil and Groundwater"
- 2011** *Human and Ecological Risk Assessment*, Dr. Barry Johnson, Ed. "Monte Carlo Simulation-based Health Risk Assessment of Heavy Metal Pollution - A Case Study in the Qixia Mining Area, China"
- 2011** *Risk Analysis*, Dr. Tony Cox, Editor, "A Gradient Markov Chain Monte Carlo Algorithm for Computing Multivariate Maximum Likelihood Estimates and Posterior Distributions: Mixture Dose Response Assessment"
- 2010** *Environmental Research*, Ellen Silbergeld, Ed. "Structural Neuroimaging Evaluation of Adults with Childhood Lead Exposure"
- 2010** *Human and Experimental Toxicology*, Prof. Kai Savolainen, Editor in Chief. "The World Library of Toxicology, Chemical Safety and Environmental Health (WLT)"
- 2010** *Journal of Exposure Science and Environmental Epidemiology*, Dr. Natalie Freeman, Assoc. Ed. "Comparison of a toxicokinetic and a questionnaire-based approach to assess methylmercury intake in exposed individuals"
- 2010** *Environmental Research*, Dr. Ellen Silbergeld, Ed. "Varying coefficient function models to explore interactions between maternal nutritional status and prenatal methylmercury toxicity in the Seychelles Child Development Nutrition Study"
- 2009** *Regulatory Toxicology and Pharmacology*, Gio Batta Gori, Ed. "Derived Reference Doses (RfDs) for the Environmental Degradates of the Herbicides Alachlor and Acetochlor: Results of an Independent Expert Panel Deliberation"
- 2009** *Environmental Research*, Ellen Silbergeld, Ed. "Environmental Policy and Children's Health in Mexico"
- 2009** *Toxicological Sciences*, Dr. John Lipscomb, Assoc. Editor, "Age-, Dose- and Time-Dependency of Plasma and Tissue Distribution of Deltamethrin in Immature Rats."
- 2009** *Chemosphere*, Heidelore Fiedler, Ed. "Quantitative structure-activity relationship (QSAR) studies for predicting activation of the ryanodine receptor type 1 channel complex (RyR1) by polychlorinated biphenyl (PCB) congeners"
- 2009** *Environmental Research*, Ellen Silbergeld, Ed. "Determination of bromadiolone residues in fox faeces by LC/ESI-MS in relationship with toxicological data and clinical signs after repeated exposure."
- 2008** *Chemosphere*, Heidelore Fiedler, Ed. "Tissue Distribution of Polychlorinated Biphenyls and Effects on Alaskan Northern Fur Seals Assessed with Five Congener Classification Schemes"

- 2008** *Chemosphere*, Heidelore Fiedler, Ed. "Levels of Polychlorinated Dibenzo-p-dioxins, Dibenzofurans, and Biphenyls in Southern Mississippi Catfish and Estimation of Potential Health Risks"
- 2007** *Critical Reviews in Toxicology*, Roger O. McClellan, Ed. "Risk Assessment of Toxaphene and its Breakdown Products: Time for a Change"
- 2006** *Environmental Forensics*, Ioana Petrisor, Ed. "Identifying Metals Contamination in Groundwater Using Geochemical Correlation Evaluation"
- 2002** *Environmental Science and Technology*, Mitchell J. Small, Ed. "Why and how should we assess occupational health impacts in integrated product policy?"
- 2001** Ohio Environmental Protection Agency, "Human Health Risk Assessment Concept Paper"
- 2000** Toxicology Excellence in Risk Assessment, "Lifetime Estimate of Skin Cancer Risk from use of Coal Tar Containing Shampoos"
- 1999** *Environmental Science and Technology*, Mitchell J. Small, Ed. "Chlordane Uptake and its Translocation in Food Crops"
- 1997** Agency for Toxic Substances and Disease Registry, "Public Health Interventions to Prevent or Mitigate Possible Adverse Health Effects Related to Methyl Parathion Pesticide Exposure"
- 1995** National Research Council, "Human Health Preliminary Risk Evaluation of the Jinkampo Incinerator Complex Activities in the Naval Air Facility, Atsugi, Japan"

Kenneth Dorsey Christian v. SEW-Eurodrive, Inc.
SCWCC No. 1614297

My expert opinions in the above-referenced matter, dated March 26, 2019 and June 22, 2019, are stated to a reasonable degree of scientific certainty.



Ted W. Simon, Ph.D., DABT

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VOCATIONAL CONSULTATION**Kenneth Christian**
[REDACTED] Circle
Easley, South Carolina
December 21, 2019**REFERRAL**

Mr. Ken Christian was referred for a vocational evaluation by his attorney Thomas Phillips. The purpose of the evaluation was to determine if Mr. Christian had suffered any loss in his ability to perform gainful work activity as a result of his work related injury. He was employed by Sew- Eurodrive Inc. as an Electronic Engineering Technician.

BACKGROUND INFORMATION

Ken Christian is a 68-year-old male who presently resides with his wife in Easley, South Carolina. He was born and raised in Martin Georgia and lived in the Hartwell Georgia area until he moved to South Carolina. He was a high school dropout but attended McDuffie High School at night so that he could graduate. He went on to Greenville Tech where he earned an AS in Civil Engineering and Industrial Electronics.

He appeared on time and was casually dressed. He was able to sit for the approximate 90 minutes of this evaluation without discomfort. He does have a valid driver's license and drove himself to this appointment. He does not use alcohol, tobacco or any illegal drugs.

He stands 5'9" tall and weighs 147 pounds which he describes as less than his usual 160 pounds. He participated fully in this evaluation and answered all questions directly. He was explained the scope and purpose of this examination and acknowledged understanding.

MEDICAL TREATMENT

Mr. Christian was under the care of his personal care physician, Dr. Kemmerlin. His office notes indicate that Mr. Christian did have a history of an MI and was being treated for CAD. He was also been followed by Dr. Siachos at Upstate Cardiology.

Kenneth Christian
Page 2

Mr. Christian had been complaining of a dry cough and ongoing sinus condition. He was referred for a CT scan by Dr. Kimberlin. The CT scan was abnormal and revealed that he had chronic bilateral interstitial lung changes. Dr. Kimberlin thought that this was possibly early interstitial pneumonitis. He had the CT scan repeated and also placed Mr. Christian on prednisone in August of 2015.

He was referred to the GHS pulmonary lung center for evaluation. His symptoms included shortness of breath and dry cough. He was evaluated by Dr. Edward Knight. Mr. Christian described a dry cough which had lasted approximately two years and was mostly non-productive and gradually increasing shortness of breath. He was placed on prednisone with some improvement but his symptoms returned after the prednisone treatment. His dyspnea has gradually worsened.

Dr. Knight reviewed a CT scan which was not consistent with IPF but more consistent with SIEP for hypersensitivity pneumonitis. X-rays were taken in the office of Dr. Knight which he reviewed and opined that they revealed bilateral lower lobe changes which appeared to be fibrotic in nature. He again reviewed the CT scans and felt that these were positive for the ground glass changes that are mostly peripheral in pattern along with reticular changes.

Dr. Knight recommended a thoracic biopsy which would help diagnose the interstitial lung disease. Mr. Christian's case was then taken over by Dr. Justin Greg. He met with Mr. Christian prior to the surgery to perform a preoperative evaluation. Dr. Greg found him to be stable and functioning well with his ILD. He was given supplemental O2 to be used as needed.

The biopsy was completed by Dr. William Bolton and the surgery went well. The results of the biopsy were examined by Dr. William Bolton. His final diagnosis was advanced interstitial fibrotic process with UIP pattern features of patchy and temporally variable fibrosis with areas of honeycombing. There was also minute, poorly formed granulomas which is highly suggestive of chronic hyper sensitivity pneumonitis which in advanced stages may have a UIP pattern. He felt that this could possibly be due to solder fume exposure.

The biopsy of the lung was sent to Memorial Sloan Kettering for additional evaluation. Dr. William Travis indicates in a letter that he agrees with the opinion that Mr. Christian has chronic hyper sensitivity pneumonitis. Dr. Travis feels that the resections of the lung demonstrate a fibrosing and cellular interstitial pneumonia with patchy organizing pneumonia granulomas and focal usual interstitial pneumonitis pattern.

Kenneth Christian
Page 3

Following the surgery, he was placed on a long term treatment of Prednisone and placed in a Pulmonary Rehabilitation Program. He did show signs of improvement but continues under the care of Dr. Cochran. At the end of 2016, he was advised not to continue working around the solder fumes. He retired from Sew-Eurodrive Corporation.

He has been placed on Oxygen, Breo Inhaler and Musenex. He uses the oxygen 24/7 but does not sleep with it. He continues to have bouts of shortness of breath and weakness. He continues to see Dr. Cochran on a regular basis.

Dr. Cochran has opined that Mr. Christian has been diagnosed with interstitial lung disease and that is causally related to his history of working around smoldering fumes at Sew Eurodrive. He also opines that Mr. Christian has reached maximum medical improvement and that he has sustained a 75% impairment rating.

ACTIVITIES OF DAILY LIVING

Mr. Christian describes a rather sedentary lifestyle in which he still has difficulty going up and down steps, showering, or walking more than about 100 feet. These situations tend to cause shortness of breath.

He gets up each day around 830 or 9 o'clock and has coffee he then usually watches 2 to 3 hours of television and gets cleaned up. He helps his wife to perform cleaning chores around the house such as washing dishes or vacuuming for short periods of time. He is unable to dust or perform any chores which require bending over. In the afternoon he again watches television for several hours or plays games on his tablet.

He describes his sleep as not very good as he has to get up two to three times nightly to get water or to go to the bathroom. He indicates that putting on his clothes or taking them off causes him to be short of breath. Tying his shoes is most difficult as this also cuts off his breath.

He does try to go to the gym several times per week for light workouts. He occasionally will go to the grocery store for his wife.

WORK HISTORY

Mr. Ken a Christian was employed by SEW Eurodrive for approximately 33 years. He began work for them in September 1984. For approximately nine years he worked in the maintenance department as electronics tech working on CNC equipment. This job required lifting of up to 75 pounds as well as a crawling underneath the machinery.

Kenneth Christian

Page 4

He then transferred to the electronic engineering lab where he was responsible for troubleshooting and repairing electronic devices. The work came in from all over and he worked on such things as computer drives, controllers, robotics and high-speed equipment. He describes being exposed to soldering fumes during this time.

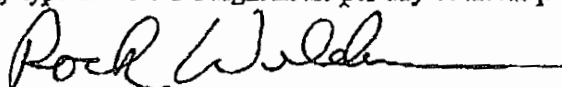
Prior to his work at SEW Eurodrive he was employed by National Water Lift in Beaufort, South Carolina. He worked for approximately nine months as an electronic technician maintaining repairs on electronics and hydraulic machinery.

He also has worked for Tel America communications where his job was to install long distance telephone service for local customers. He also has worked for short periods wiring and maintaining textile machinery.

SUMMARY AND RECOMMENDATIONS

Mr. Kenneth Christian is a 68-year-old male who has been diagnosed with chronic interstitial pneumonia. He continues under the treatment of Dr. Cochran who recommended that he retire from SEW Eurodrive. He uses oxygen on a regular basis and is maintained on several inhalers. He continues to have difficulty walking for long distances or performing activities which require a lot of physical abilities such as showering or putting on his clothes. Bending over especially gives him difficulty as it makes it hard to breathe. He also notes a loss of memory and states that he suffers from anxiety and depression.

It is recommended that he continue under the regular treatment of Dr. Cochran and follow the treatment protocol as indicated. With the diagnosis and limitations as outlined by his physicians, it is my vocational opinion that he should be considered permanently and totally vocationally disabled. I do not believe that he is capable of any type of work for eight hours per day 40 hours per week.



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June 28, 2019

Mr. Benjamin M. Renfrow
872 S. Pleasantburg Dr.
Greenville, SC 29607

Re: Kenneth Christian vs. SEW Eurodrive, Inc.
WCC File No.: 1614297 DOI: 8/25/2016
Carrier: Great American Alliance Insurance Company – Claim No.: 564-661257
WJC&B File No.: 0285.00350

Dear Mr. Renfrow,

Per your request I have reviewed all available medical records for Mr. Kenneth Christian.

That included records

- from St. Francis Hospital, Dec 18, 2015-through Dec 30-2015
- Cardiothoracic Surgery, dated July 6, 2016 through September 21, 2016
- GSH Pathology examination of surgical lung biopsy dated 8-30-2016
- Lung Center at Patewood, dated June 28, 2016 through January 30, 2019

I have also conducted an extensive literature review (see enclosures)

It is my understanding, from the information that you have provided, that Mr. Christian claims lung damage **related to soldering and other unspecified chemicals**, as a result of work at SEW Eurodrive, INC. He has also worked in a shipyard for the Navy, prior. There is also a history of respiratory congestion, cough, sinusitis, requiring surgery in 2000.

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On 8-18-2016, Mr. Christian was evaluated by Pulmonologist, Dr. Justin Wayne Gregg of Pulmonary and Lung Center in Greenville, South Carolina.

Dr. Gregg noted:

ILD (interstitial lung disease) suspected CEP (Chronic eosinophilic pneumonia), based off CT findings, peripheral eosinophilia 9%, and BAL (Bronchoalveolar lavage) of 26% eosinophils on 12/20/2015. He has also noted that patient also had extremely good response to steroids. He has noted that lung biopsy is normally is not needed for the diagnosis of Chronic Eosinophilic Pneumonia, however patient wanted to know his diagnosis definitively, and therefore per his request VATS biopsy was scheduled. Dr. Gregg has advised patient of the risks of surgical biopsies in ILD, and he has noted studies that show of ILD flares after surgical biopsy.

-on 8-26-2019, lung biopsy by means of VATS was performed by Dr. William Bolton at GHS with several wedge biopsies done and send to pathology

On 8-30-2016, Dr. Jackson H Carter has issued a pathology report, in addition specimen was send to Dr. William Travis, Memorial Sloan Kettering –I do not have this report

C. Irregular moderately to markedly advanced interstitial fibrosis with UIP pattern and minute granulomata. Favor Chronic Hypersensitivity Pneumonitis, see comment

Dr. McCarter has opined in his comment

“The multiple wedge biopsy samples show an advanced interstitial fibrotic process, with UIP pattern features of patchy spatially and temporarily variable fibrosis, with areas of honeycombing. The association with minute, poorly formed granulomata is highly suggestive of chronic hypersensitivity pneumonitis, which in advanced stages may have a UIP pattern. Clinical correlation, particularly history of possible exposure to inhaled antigens, is recommended”

Dr. McCarter who is a pathologist-has opined more

“The patient is an electronics technician who has had frequent exposure to solder fume, which has been reported as a rare cause of hypersensitivity pneumonitis.

However, from the medical records provided to me, I was unable to find any information to the frequency of exposure and level of exposure. Therefore, I am not certain where this information can be obtained and how Dr. McCarter arrived to that assessment.

Inside pathology report, more information is contained to assist in clinical diagnosis, specifically

C. This is lung parenchyma also showing irregular, patchy areas of marked interstitial fibrosis with intervening uninvolved alveoli...There are prominent associated areas of bronchoalveolar hyperplasia with mucus lakes within air spaces with a honeycomb pattern. There are small to moderate numbers of plasma cells and lymphocytes **with small numbers of intermingled eosinophils focally**. Only a few small scattered poorly formed granulomata are seen within interstitial fibrosis”

Assessment

The term granulomatous lung disease does not refer to a specific disease entity, such as chronic hypersensitivity pneumonitis, let alone an extremely rarely reported association with soldering. Granulomatous inflammation is a relatively non-specific histopathological finding. As granuloma alone is nonspecific histopathological finding, the multidisciplinary approach is important for a confident diagnosis. Occasional granulomata has also been observed in Usual Interstitial pneumonia (UIP) and when UIP was associated with other disorders, such as sarcoidosis.

Radiographically, in rare cases of suspected soldering induced lung disease HRCT thorax showed centri lobular nodular lesions and interstitial thickening with relative sparing of lower zones and with pleural thickening. Multiple enlarged mediastinal lymph nodes were also noted. HRCT scan in this case not only does not show any of the findings that would be consistent with soldering but revealed changes consistent with UIP, honeycombing and involvement of lower lung zones.

Moreover soldering would not be expected to be associated with eosinophilic lung disease, and as a rule eosinophils are completely absent on lung biopsies. However in this case it was clearly demonstrated - very high BAL eosinophilia as well as blood eosinophilia as well as presence of eosinophils in all pathological specimens. Therefore on clinical, BAL findings, soldering would be an improbable cause of this man's condition, even if one to accept a diagnosis of chronic hypersensitivity pneumonitis, as a cause of this patient's advanced pulmonary fibrosis. Characterization of other histological features coupled with an understanding of the clinical context are key to diagnosis.

The differential diagnosis of Mr. Christian eosinophilic lung disease in association with Usual Interstitial Pneumonia will include

1. **Idiopathic UIP-the presence of eosinophils has been recognized in BAL studies for many years, and presence of occasional minute granulomas does not exclude this diagnosis, and indeed pathological findings, clinical progressive deterioration course in association with exacerbation after lung biopsy is pointing to this diagnosis, with**

presence of granulomas has been described in this condition and may not be atypical in UIP

2. Sarcoidosis

Peripheral eosinophilia is commonly described in sarcoidosis but not in any chemically induced chronic hypersensitivity pneumonitis and would not be expected finding in soldering lung disease.

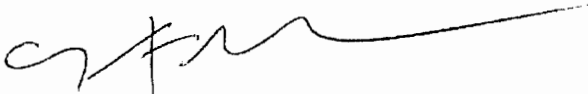
-There are several case reports of sarcoidosis with increased BAL eosinophils. Moreover Renston, et al reported that 41% of patients with sarcoidosis showed an increase of peripheral blood eosinophilia percentage more than 4% (it was 9% in this case) Moreover in late stages of sarcoidosis, clinical-pathological finding can be similar to other causes of UIP and pulmonary fibrosis

Also, several patients underwent lung transplantation for sarcoidosis had either overlapping features of sarcoidosis and UIP or UIP alone.

- 3. Chronic hypersensitivity pneumonitis secondary to chemicals -is not a known cause of eosinophilic lung disease, however organic material, on rare occasions in immunologically mediated organic material, but not any chemicals, such as soldering**
- 4. Combined UIP with Chronic Eosinophilic Pneumonia has also been described in the literature**

Conclusion

After reviewing patient's extensive medical records, several CT scans of the chest obtained over the years, laboratory data including BAL data, pathology reports, to a reasonable degree of medical certainty, I find no evidence of chemical such as soldering induced lung disease. There is plenty of evidence for usual interstitial pneumonia with rapidly progressive course and with differential diagnosis as listed above, with soldering lung disease being an improbable diagnosis.



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September 13, 2019

Mr. Benjamin M. Renfrow
872 S. Pleasantburg Dr.
Greenville, SC 29607

Re: Kenneth Christian vs. SEW Eurodrive, Inc. 564-661257
Letter dated 6/19/19 from James Pearle, M.D.

Dear Mr. Renfrow,

At your request, I have reviewed the note written by Dr. James Pearle dated June 16, 2019. It is no longer appropriate for clinicians to make a diagnosis of interstitial lung disease on the basis of lung biopsy and currently that requires multidisciplinary Clinical-Radiological-Pathological approach.

However, soldering lung disease, such as chronic fibrotic hypersensitivity pneumonitis is a clinical not a pathological diagnosis. The pathologist simply has no tools to make a clinical diagnosis and it appears had no access to the clinical information which is not even mentioned.

Moreover, due to the presence of blood eosinophilia, as well as significant eosinophilia on bronchoalveolar lavage, this diagnosis is clinically improbable.

UIP (usual interstitial pneumonia) is not a disease or clinical diagnosis, but an end result of several clinical conditions that look the same in the fibrotic stage and require clinical differentiation.

As I have outlined previously in my report, the differential diagnosis includes IPF (idiopathic pulmonary fibrosis – which is most likely), organically induced CHP and sarcoidosis with or without chronic eosinophilic pneumonia.

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There is simply no clinical evidence for soldering-related CHP and it is excluded on clinical grounds such as the results of the CT chest, the presence of blood eosinophilia, BAL eosinophilia and the presence of eosinophils in all lung biopsies.

With regard to the sub-acute hypersensitivity pneumonitis, it is not even mentioned by the pathologist and such an entity is neither present nor germane for response or discussion.

In conclusion, soldering induced chronic fibrotic hypersensitivity pneumonitis is excluded in this case on clinical and radiological grounds.

This opinion is given to a reasonable degree of medical certainty.

A handwritten signature in black ink, appearing to read 'Gregory Feldman', with a long horizontal flourish extending to the right.

Gregory Feldman, MD

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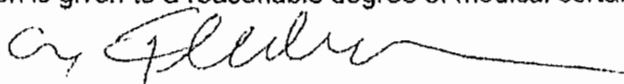
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Gregory Feldman, MD

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2004-Present

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04/06-Present

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LANGUAGES

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**MEMBERSHIPS IN
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American Thoracic Society
European Respiratory Society

**SYMPOSIUM
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Challenges in Lung Cancer and Thoracic Neoplasm's
March 26-28, 1999.

Program Chairman
Carolina Thoracic Society
Greenville, South Carolina
1999

**PUBLICATIONS/
PRESENTATIONS**

Feldman GJ, Parker HW
**Visceral Larva Migrans Associated with the
Hypereosinophilic Syndrome and the Onset of Severe
Asthma.** Ann Intern Med, May 15, 1992.
116(10) p838-40

**Usual and Unusual Applications of Laser and
Tracheobronchial Stents.** IV International Meeting
Respiratory Endoscopy; Barcelona, Spain 1995

**Urgent Intraluminal Nd: Yag Laser ad Brachytherapy
For Tracheobronchial Lung Cancer.** IV International
Meeting Respiratory Endoscopy; Barcelona, Spain
1995

**Interventional Endoscopy. Distinguished Lecturer
Carolina SGNA, 1996. Seven Consecutive Cases of
Ednobronchial Management of Airway Obstruction.**
Invited Speaker
42nd Tri-State Consecutive Case Conference on Lung
Disease. Ponte-Vedra Beach, Florida. September 1997.

**Insertion of High Cervical Esophageal Wallstents
Requiring Tracheal Stent Placement.** *Journal of
Bronchology.* 5: 213-215; 1998

**Stent Selection in Bronchoesophagology; Beyond the
Surface,** 10th World Meeting of Bronchology, Budapest,
Hungary, 1998.

Laryngotracheal Sarcoidosis and Airway Obstruction.
Journal of Bronchology. 6: 104-105; 1999

Cancer and Airway Obstruction. First Upstate Carolina Thoracic Society Symposium. Greenville, SC 1999.

A. Anzueto, G. Ferguson, G. Feldman, A. Seibert, K. Chinsky, A. Emmett, F. Crater, K. Knobli, D. O'Dell, C. Kalberg, UTHSCSA, San Antonio TX; Pulm. Res. Inst., Michigan, Livonia, MI; SC Pharm. Res., Spartanburg, SC, Pulm. Assoc. of Mobile, Mobile, AL, Chest Dis. of NWP, Erie, PA, GSK, RTP, NC; **A Randomized, Double-Blind Trial Comparing the Effect of Fluticasone/Salmeterol 250/50 with Salmeterol on COPD Exacerbations**; 2007 COPD Journal, Volume 6 (5)

E. Rand Sutherland, Shari Brazinsky, Gregory Feldman, Joe McGinty, LaTanya Tomlinson and Kimberly Denis-Mize; **Bronchodilator maintenance treatment improves pulmonary function and health related quality of life in COPD patients.** Current medical research and opinion 2009;25(3):653-61.

G. Feldman, T. Siler, N Prasad, S Piggott, R Owen, M Higgins, and B Kramer. Poster Presentation. ERS, Vienna **Efficacy and safety of indacaterol 150µg once-daily in COPD: A 12-week study**; Poster Presentation. ERS, Vienna 2009

Antonio Anzueto, Gary T. Ferguson, Greg Feldman, Kenneth Chinsky, Allan Seibert, Amanda Emmett, Katharine Knobil, Dianne O'Dell, Christopher Kalberg and Glenn Carter. **Effect of Fluticasone Propionate/Salmeterol (250/50) on COPD Exacerbations and Impact on Patient Outcomes**; COPD 2009 6(5):320-9

Gregory Feldman¹, Thomas Siler², Niyati Prasad³, Damon Jack³, Simon Piggott³, Roger Owen³, Mark Higgins³, Benjamin Kramer^{4*} and the INLIGHT 1† study group **Efficacy and safety of indacaterol 150 µg once-daily in COPD: a double-blind, randomised, 12-week study** *BMC Pulmonary Medicine* 2010, 10:11

Nicola A. Hanania MD, FCCP; Gregory Feldman, MD; Wolfgang Zachgo, MD; Jae-Jong Shim, MD, PhD; Courtney Crim, MD, FCCP; Lisa Sanford, MSc; Sally Lettis, PhD, Frank Barnhart, DVM; Brett Haumann, MD

The Efficacy and Safety of the Novel Long-Acting β_2 Agonist Vilanterol in Patients with COPD. Poster Presentation, ATS, San Francisco, Ca , May 2011

M Decramer, F. Maltais, G. Feldman, J. Brooks, S. Harris, G. Crater. **Dose-related efficacy of GSK573719, a new long-acting muscarinic receptor antagonist (LAMA) offering sustained 24-hour bronchodilation in COPD;** Poster Presentation. 2011, ERS Amsterdam

Eric Bateman, Gregory Feldman, Sally Kilbride, Jean Brooks, Rashmi Mehta, Stephanie Harris, Claire Maden, Glenn Crater **Efficacy and safety of the long-acting muscarinic antagonist GSK233705 delivered once daily in patients with COPD.** Clin Resp Research J 2012 6(4) :248-257

Feldman, G; Walker, R; Brooks, J; Mehta, R; and Crater, G. **Safety and tolerability of the GSK573719/vilanterol combination in patients with COPD;** Chest 2012;142(1):119-127

Gregory Feldman, Robert Walker, Jean Brooks, Rashmi Mehta, Glenn Crater: **28-day safety and tolerability of umeclidinium in combination with vilanterol in COPD: A randomized placebo-controlled trial**

Review manuscript Improving the quality of life in patients with chronic obstructive pulmonary disease: focus on indacaterol: International Journal of COPD 2013;8 89–96
Feldman, G J

Fluticasone furoate/vilanterol (100/25;200/25 μ g) improves lung function in COPD: A randomized trial: Fernando J. Martinezk, Joseph Boscia, Gregory Feldman, Catherine Scott-Wilson, Sally Kilbride, Leonardo Fabbri, Courtney Crim, Peter M. A. Caverley

AS03-adjuvanted versus non-adjuvanted inactivated trivalent influenza vaccine against seasonal influenza in elderly people: a phase 3 randomised trial; Prof Janet E McElhaney MD a, Prof Jiri Beran MD b *, Jeanne-Marie Devaster MD c *, Meral Esen MD d *, Prof Odile Launay MD e f g h *, Prof Geert Leroux-Roels MD i *, Guillermo M Ruiz-Palacios MD j *, Gerrit A van Essen MD k *, Adrian Caplanusi MD l †, Carine Claeys MD l †, Christelle

Durand MSc c †, Prof Xavier Duval MD m n †, Mohamed El Idrissi MSc l †, Prof Ann R Falsey MD o †, Gregory Feldman MD p †, Prof Sharon E Frey MD q †, Florence Galtier MD r s †, Prof Shinn-Jang Hwang MD t u †, Bruce L Innis MD v †, Martina Kovac MD c †, Peter Kremsner MD d †, Prof Shelly McNeil MD w †, Andrzej Nowakowski PhD x y †, Prof Jan Hendrik Richardus PhD z †, Andrew Trofa MD v †, Dr Lidia Oostvogels MD

Brochodilation of umeclidinium, a new long acting muscarinic antagonist, in COPD patients; Decramer M, Maltais F, Feldman, G, Harris S, Mehta R, Crater G.

INFLUENZA SYMPTOMS AND IMPACT ON QUALITY OF LIFE IN ELDERLY ADULTS: EFFECT OF AS03-ADJUVANTED OR NON-ADJUVANTED INACTIVATED TRIVALENT SEASONAL INFLUENZA VACCINES; G A van Essen¹, J Beran², J-M Devaster³, C Durand³, X Duval⁴, M Esen⁵, A Falsey⁶, G Feldman⁷, P Gervais⁸, B L Innis⁹, M Kovac³, O Launay¹⁰, G Leroux-Roels¹¹, J E McElhaney¹², S McNeil¹³, M Oujaa³, J H Richardus¹⁴, G Ruiz-Palacios¹⁵, R H Osborne^{16,17} and L Oostvogels³

The combination of umeclidinium bromide and vilanterol in the management of chronic obstructive pulmonary disease: current evidence and future prospects. Ther Adv Respir Dis., September 3, 2013; Gregory J. Feldman and Anton Edin

A role of indacaterol in chronic obstructive pulmonary disease management: a turning point or crossroads? Gregory J. Feldman, Anton Edin; J Thorac Dis. 2013 August; 5(4): 378–380.

Lung function efficacy of olodaterol QD delivered via Respimat® in COPD patients: Results from two 48-week studies
Oral Presentation by Gregory J. Feldman, MD
G. Ferguson, G. Feldman, P. Hofbauer, A. Hamilton, L. Allen, L. Korducki, P. Sachs (Livonia, Spartanburg, Ridgefield, Stamford, United States Of America; Weinheim, Germany; Burlington, Canada)
European Respiratory Congress, Barcelona 2013.

Scientific Program 2nd International Summit on Toxicology; Pharmaceutical Toxicology, Regulatory Toxicology and Analytical Toxicology.
Session Chair: Gregory Feldman, MD
Oct. 2013

Reactive airway dysfunction syndrome after inhalation of the acrylonitrile: Prespective of the pulmonologist.
Gregory Feldman, MD
Oct. 2013

The combination of umeclidinium bromide and vilanterol in the management of chronic obstructive pulmonary disease: current evidence and future prospects: Feldman GJ et al.

"Chronic Obstructive Pulmonary Disease Research vs Clinical Practice: Turning Point or Crossroads?" IDDST 2013, Haikou, China

"Genetic and antigenic typing of seasonal influenza breakthrough cases from a 2008-2009 vaccine efficacy trial" by Serge Durviaux, John Treanor, Jiri Beran, Xavier Duval, Meral Esen, Gregory Feldman, Sharon Frey, Odile Launay, Geert Leroux-Roels, Janet McElhaney, Andrzej Nowakowski, Guillermo Ruiz-Palacios, Gerrit van Essen, Lidia Oostvogels, Jeanne-Marie Devaster, and Karl Walravens (CVI00544-13R1),

"Lung function efficacy of olodaterol once daily delivered via Respimat® in COPD patients: results from two 48-weeks studies"; Gary T. Ferguson, Gregory J. Feldman, Peter Hofbauer, Alan Hamilton, Lisa Allen, Lawrence Korducki, Paul Sachs (TSANZ-2014)

"The 24-h FEV1 Time Profile of Olodaterol Once Daily via Respimat® and Formoterol Twice Daily via Aerolizer® in Patients with GOLD 2-4 COPD: Results from tow 6-week crossover studies; Feldman, Gregory; Bernstei, Jonathan; Hamilton, Alan; Nivens, Michael; Korducki, Lawrence; LaForce, Craig; (CHEST-13-2839)

Efficacy and safety of olodaterol once daily delivered via Respimat(®) in patients with GOLD 2-4 COPD: results from two replicate 48-week studies.

Ferguson GT¹, Feldman GJ², Hofbauer P³, Hamilton A⁴, Allen L⁵, Korducki L⁵, Sachs P⁶. *Int J Chron Obstruct Pulmon Dis.* 2014 Jun 16;9:629-45.

The 24-h FEV₁ time profile of olodaterol once daily via Respimat® and formoterol twice daily via Aerolizer® in patients with GOLD 2–4 COPD: results from two 6-week crossover studies. Gregory J Feldman^{1*}, Jonathan A Bernstein², Alan Hamilton³, Michael C Nivens⁴, Lawrence Korducki⁵ and Craig LaForce⁶

Gregory J. Feldman, MD Letter to the Editor
Self TH, Patterson SJ, Headley AS, et.al. **Action plans to reduce hospitalizations for chronic obstructive pulmonary disease exacerbations: focus on oral corticosteroids.** *Curr Med Res Opin* 2014;30(12):2607-15
Current Medical Research & Opinion Vol. 30, No. 12, 2014, 2617-2618

24-hour lung function profile of novel co-suspension technology glycopyrrolate/formoterol metered dose inhaler versus placebo and Spiriva® Respimat®, in patients with moderate-to-very-severe chronic obstructive pulmonary disease Colin Reisner¹, Gregory Gottschlich², Faisal Fakhri³, Andras Koser⁴, James Krainson⁵, Luis Delacruz⁶, Samir Arora⁷, Gregory Feldman⁸, Krishna Pudi⁹, Shahid Siddiqui¹, ChaOrevillo¹, Andrea Maes¹

Efficacy and Safety of Twice-Daily Glycopyrrolate in Patients with Stable, Symptomatic COPD with Moderate-to-Severe Airflow Limitation: The GEM1 Study; Craig LaForce, MD¹; Gregory Feldman, MD²; Selwyn Spangenthal, MD³; Joerg H. Eckert, PhD⁴; Michelle Henley, MSc⁵; Francesco Patalano, MD⁴; Peter D'Andrea, MD⁵

A randomized, blinded study to evaluate the efficacy and safety of umeclidinium 62.5 µg compared with tiotropium 18 µg in patients with COPD.

Feldman G, et al. *Int J Chron Obstruct Pulmon Dis.* 2016

Efficacy and safety of twice-daily glycopyrrolate in patients with stable, symptomatic COPD with moderate-to-severe airflow limitation: the GEM1 study
 LaForce C, Feldman G, Spangenthal S, Eckert JH, Henley M, Patalano F, D'Andrea P; International Journal of COPD 2016;11 1-11

A randomized, blinded study to evaluate the efficacy and safety of umeclidinium 62.5 µg compared with tiotropium 18 µg in patients with COPD
 Gregory Feldman, François Maltais, Sanjeev Khindri³, Mitra Vahdati-Bolouri³, Alison Church⁴, William AFahy³, Roopa Trivedi^{4,5}; International Journal of COPD 2016;11 719-730

24-hour lung function profile of novel Co-Suspension™ Delivery Technology glycopyrronium/formoterol metered dose inhaler versus placebo and tiotropium

(Spiriva® Respimat®), in patients with moderate-to-very severe chronic obstructive pulmonary disease
 Colin Reisner,¹ Gregory Gottschlich,² Faisal Fakih,³ Andras Koser,⁴ James Krainson,⁵ Luis Delacruz,⁶ Samir Arora,⁷ Gregory J. Feldman,⁸ Krishna Pudi,⁹ Shahid Siddiqui,¹⁰ Chad Orevillo,¹ Andrea Maes¹
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Immunogenicity of AS03-adjuvanted and non-adjuvanted trivalent inactivated influenza vaccines in elderly adults: A Phase 3, randomized trial and *post-hoc* correlate of protection analysis

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Efficacy and Safety of Glycopyrrolate/Formoterol MDI Formulated using Co-Suspension™ Delivery Technology in Patients with COPD Fernando J. Martinez, MD, MS, FCCP, Klaus F. Rabe, MD, PhD, Gary T. Ferguson, MD, FCCP, Leonardo M. Fabbri, MD, FCCP, FERS, Stephen Rennard, MD, FCCP, Gregory J. Feldman, MD, Sanjay Sethi, MD, Selwyn Spangenthal, MD, Gregory M. Gottschlich, MD, MS, Roberto Rodriguez-Roisin, MD, PhD, FCCP, FRCP, FERS, Samir Arora, MD, Thomas M. Siler, MD, FCCP, Shahid Siddiqui, MD, MHSA, Patrick Darken, PhD, Tracy Fischer, Pharm.D, Andrea Maes, PhD, Michael Golden, MS, Chad Orevillo, MPH, Colin Reisner, MD, FCCP, FAAAAI

BENEFICIAL EFFECT OF GFF MDI, A LAMA/LABA FDC DELIVERED BY MDI USING NOVEL COSUSPENSION DELIVERY TECHNOLOGY, ON INSPIRATORY CAPACITY IN PATIENTS WITH COPD Colin Reisner,¹ Gregory Gottschlich,² Faisal A. Fakhri,³ Andras Koser,⁴ Luis DeLaCruz,⁵ Samir Arora,⁶ Gregory J. Feldman,⁷ Krishna K. Pudi,⁸ Shahid Siddiqui,¹ Chad Orevillo,¹ Andrea Maes¹

Correct and ease of use for a dry powder inhaler in asthma/chronic obstructive pulmonary disease Feldman G1, Imber V2, Galkin D3, Patel P2, Collison K3, Sharma R4

Beneficial effect of GFF MDI, a LAMA/LABA FDC delivered by MDI using novel Co-Suspension™ Delivery Technology, on inspiratory capacity in patients with COPD Colin Reisner¹, Gregory Gottschlich², Faisal A. Fakhri³, Andras Koser⁴, Luis DeLaCruz⁵, Samir Arora⁶, Gregory J.

Feldman⁷, Krishna K. Pudi⁸, Shahid Siddiqui⁹, Chad Orevillo¹, Andrea Maes¹

Efficacy and safety of twice-daily glycopyrrolate in patients with stable, symptomatic COPD with moderate-to-severe airflow limitation: the GEM1 study
Craig LaForce,¹ Gregory Feldman,² Selwyn Spangenthal,³ Joerg H Eckert,⁴ Michelle Henley,⁵ Francesco Patalano,⁴ Peter D'Andrea⁵

A randomized, blinded study to evaluate the efficacy and safety of umeclidinium 62.5 µg compared with tiotropium 18 µg in patients with COPD
Gregory Feldman,¹ François Maltais,² Sanjeev Khindri,³ Mitra Vahdati-Bolouri,³ Alison Church,⁴ William A Fahy,³ Roopa Trivedi^{4,5}

Safety and Tolerability of Revefenacin, a Novel Once-daily Nebulized Long-acting Muscarinic Antagonist: Results of Two 12 week, Randomized, Double-blind, Placebo-controlled, Parallel-group Phase 3 Trials in Participants with moderate to Very Severe Chronic Obstructive Pulmonary Disease; Gregory Feldman, 1 Chris N. Barnes, 2 Edmund J. Moran, 2 Brett Haumann, 3 Srikanth Pendyala, 2 Glenn Crater 2; 1 S. Carolina Pharmaceutical Research, Spartanburg, SC, US; 2Theravance Biopharma US, Inc., South San Francisco, CA, US; 3Theravance Biopharma UK Limited, London, UK

**RESEARCH
EXPERIENCE:**

Sub-Investigator
RW Johnson Pharmaceutical Research.
Multicenter Non-Comparative Study to Evaluate the Safety and Efficacy of Levo-Floxacin in the Treatment of Community Acquired Pneumonia in Adults. (Phase 3)
Protocol M92-075. 1993-1994
Expected Enrollment: 20
Actual Enrollment: 68

Sub-Investigator
RW Johnson Pharmaceutical Research.
A Multicenter, Open-Label Study to Evaluate The Safety and Efficacy of Levofloxacin In the Treatment of Bacterial Infections.
Protocol LOFBIV-MULT-001. 1994-1995
Expected Enrollment: 20
Actual Enrollment: 46

Sub-Investigator
Parke Davis. Double-Blind, Prospective, Randomized, Multicenter, Comparative Study of Clinafloxacin-Based Regimen in the Treatment of Community Acquired Pneumonia.
Protocol 960-033. 1995-1998
Expected Enrollment: 20
Actual Enrollment: 70

Sub- Investigator
RW Johnson Pharmaceutical Research. A Noncomparative, **Multicenter** Study to Evaluate the Safety and Efficacy of Levofloxacin 500mg QD in the treatment of Community Acquired Pneumonia in Adults.
Protocol LOFBIV-PCAP-001. 1996-1998

Expected Enrollment: 20
Actual Enrollment: 156

Sub-Investigator

Parke Davis. Open-Label, Randomized, Comparative, Multicenter Study of Clina-Floxacin vs. Cefazidime based Regimen in the treatment of Nosocomial Pneumonia.

Protocol 960-012. 1995-1998

Expected Enrollment: 10-20
Actual Enrollment: 44

Sub-Investigator

RW Johnson Pharmaceutical Research.

Multicenter, Active Controlled, Randomized Study to Evaluate the Safety and Efficacy of Oral Levofloxacin vs. Cefaclor in the Treatment of Acute Bacterial Exacerbation of Chronic Bronchitis in Adults.

Protocol K90-070. 1993-1994

Expected Enrollment: 10
Actual Enrollment: 6

Sub-Investigator

Bristol Myers Squibb. Double-Blind, Multicenter, Comparative Study of Cefprozil 250 mg bid vs. Cefuroxime Axetil 250 mg, bid in the Treatment of Bronchitis.

Protocol A1414-153. 1995

Expected Enrollment: 20
Actual Enrollment: 25

Sub-Investigator

Parke Davis. A Double-Blind, Randomized, Comparative, Multicenter Study of a 5 day Regimen of Cefdinir vs. a 10 day Regimen of Cefprozil in the Treatment AECB in Adult Patients.

Protocol 983-060. 1996

Expected Enrollment: 20
Actual Enrollment: 32

Sub-Investigator

Bristol-Myers Squibb. An Open Label, Multicenter, Non-Comparative study of Oral Gatifloxacin in the Treatment of AECB. Protocol A1420-004. 1997.

Expected Enrollment: 20
Actual Enrollment: 20

Sub-Investigator

Dey labs. A 12-week, Randomized, Double-blind, Positive Control, Crossover Study of Albuterol, Ipratropium, and the combination, As an Inhalation Solution in Patients with COPD Protocol DL-024.1996.

Expected Enrollment: 18

Actual Enrollment: 77

Sub-Investigator

Bristol-Myers Squibb. Randomized, Double-Blind, Multi-center, Phase II Comparison of Gatifloxacin to ClarithroMycin in the Treatment of Patients with Acute Maxillary Sinusitis. Protocol AI420-008. 1997-1998.

Expected Enrollment: 15

Actual Enrollment: 27

Sub-Investigator

Bristol-Myers Squibb. Open Label, Multi-center, Non-Comparative Study of Gatifloxacin in Acute Bacterial Infections; Treatment to include patients with Acute Exacerbation of Chronic Bronchitis, Acute Sinusitis, Community Acquired Pneumonia. Protocol AI420-008. 2000-2001.

Expected Enrollment: 6

Actual Enrollment: 12

Principal Investigator

Aventis Pharmaceuticals. Randomized, Double-Blind, Parallel-Group, Multicenter Study to Compare Clinical Health Outcomes of Telithromycin versus Azithromycin in Outpatients with Community-Acquired Lower Respiratory Tract Infections. Protocol HMR3647A/4019. 2004-2006.

Expected Enrollment: 20

Actual Enrollment: 54

Principal Investigator

GlaxoSmithKline

A Randomized, 24-week, Double-Blind, Placebo-group Study to Evaluate the Efficacy Safety and Tolerability of Ariflo (15mg BID) in Patients with Chronic Obstructive Pulmonary Disease (COPD)

Protocol CIL103657. 2004-2006.

Expected Enrollment: 6

Actual Enrollment: 50

Principal Investigator
GlaxoSmithKline
A Randomized, Double-Blind, Parallel Group, 52-Week Study to
Compare the Effect of the Fluticasone Propionate/Salmeterol
DISKUS™ Combination Product 250/50 mcg BID with
Salmeterol DISKUS 50 mcg BID on the Annual Rate of
Moderate/Severe Exacerbation in Subjects with Chronic
Obstructive Pulmonary Disease (COPD). 2005-2007.
Expected Enrollment: 8
Actual Enrollment: 37

Principal Investigator
Merck
A Multicenter, Randomized, Double-Blind Study Comparing the
Clinical Effects of Intravenous Montelukast With Placebo in
Patients With Acute Asthma. 2005-2007.
Expected Enrollment: 4
Actual Enrollment: 21

Principal Investigator
AstraZeneca
A 12-month double-blind, double-dummy, randomized, multi-
center study of ICS in combination with LABA compared to
LABA and placebo in patients with COPD
(12 Hour Visits). 2005-2007.
Expected Enrollment: 6
Actual Enrollment: 71

Principal Investigator
AstraZeneca
A 6-month double-blind, randomized, multi-center study of ICS
compared to LABA, ICS, and placebo in COPD patients (12 Hour
Visits with PK's). 2005-2007.
Expected Enrollment: 6
Actual Enrollment: 54

Principal Investigator
MGI Pharma
A Phase 3, Randomized, Double-Blind, Dose-Controlled Study to
Assess the efficacy and Safety of Aquavan® (Fospropofol
disodium) injection for minimal-to-moderate sedation in patients
undergoing flexible bronchoscopy.
Protocol No.: 3000-0524
July 2006-April 2007
Expected Enrollment: 10
Actual Enrollment: 33

Principal Investigator
Oscient Pharmaceuticals
A Phase IV, Stratified, Randomized, Prospective, Unblinded,
Active-Control Trial of Factive® Versus Biaxin XL® for the
Treatment of Community Acquired Pneumonia and Versus
Amoxicillin/clavulanate for the Treatment of Acute Bacterial
Exacerbation of Chronic Bronchitis Protocol No.: OS-001
February 2005-January 2007
Expected Enrollment: 50
Actual Enrollment: 103

Principal Investigator
GlaxoSmithKline
Evaluation of Novel Endpoints in Subjects with Chronic
Obstructive Pulmonary Disease (COPD) in a Randomized,
Double-Blind, Placebo-Controlled Study of Treatment with
Fluticasone Propionate/Salmeterol 500/50mcg combination (FSC
500/50) and its individual components Fluticasone/Propionate
500mcg (FP500) and Salmeterol 50mcg (SAL50) Protocol No.:
SC0104925
June 2006-February 2007
Expected Enrollment: 6
Actual Enrollment: 16

Principal Investigator:
Epix Pharmaceuticals
A Randomized, Double-Blind, Placebo-Controlled study to
Evaluate the short-term efficacy and safety of PRX-08066 in
patients with pulmonary hypertension and obstructive Pulmonary
disease Protocol No.: PRX-CP-017
October 2006-June 2007
Expected Enrollment: 6
Actual Enrollment: 37

Principal Investigator
Boehringer Ingelheim
A Randomized, double-blind, double-dummy, placebo-controlled,
3 X 4 factorial design trial to evaluate telmisartan 20 and 80mg
tablets in combination with rampril 1.25, 10 and 20mg capsules
after 8 weeks of treatment in patients with Stage I or II
Hypertension with and APBM sub-study Protocol No.: 1236.1
November 2005-July 2007
Expected Enrollment: 3
Actual Enrollment: 19

Principal Investigator
UnitedBioSource Corp.
Prospective Study to Evaluate the Reliability and Validity of
EXACT Protocol No.: A2-4333
February 2007-September 2007
Expected Enrollment: 6
Actual Enrollment: 24

Principal Investigator
Astra Zeneca
A two-week, randomised, double-blind study assessing the Onset
of Effect Questionnaire (OEQ) administered daily versus weekly in
adult subjects (≥ 18 years of age) with mild to moderate asthma,
receiving SYMBICORT® pMDI 80/4.5 μ g x 2 actuations twice
daily or budesonide HFA pMDI 80 μ g x 2 actuations twice daily
Protocol No.: D5896C00023
January 2007-November 2007
Expected Enrollment: 10
Actual Enrollment: 8

Principal Investigator
Dey LP
A Randomized , Open-Label, Two-Way Crossover Trial of
Formoterol Fumarate Inhalation Solution (20mcg) and Combivent
Inhalation Aerosol (Ipratropium Bromide 18 mcg/Albuterol Sulfate
103mcg) in the Treatment of Patients with Chronic Obstructive
Pulmonary Disease
Protocol No.: 201-081
April 2007-September 2007
Expected Enrollment: 7
Actual Enrollment: 15

Principal Investigator
Astra Zeneca LP
Cognitive Debriefing Interview Assessment of Breathlessness
Among Patients with Chronic Obstructive Pulmonary Disease
Protocol No.: A2-6047
September 2007-November 2007
Expected Enrollment: 6
Actual Enrollment: 6

Principal Investigator
GlaxoSmithKline
A Comparison of Fluticasone Furoate Nasal Spray versus Oral
Fexofenadine in the Treatment of Seasonal Allergic Rhinitis
Protocol No.: FFU109047

June 2007- November 2007

Expected Enrollment: 15

Actual Enrollment: 17

Sub-investigator

GlaxoSmithKline

Incidence of airway obstruction consistent with chronic obstructive pulmonary disease (COPD) in subjects with a history of cigarette smoking and symptoms of chronic bronchitis in a primary care setting

Protocol No.: ADC109043

February 2007-October 2007

Expected Enrollment: 25

Actual Enrollment 20

Principal Investigator

Altana Pharma

BY 217/M2-124-“Effect of Roflumilast on Exacerbation Rate in Patients with Chronic Obstructive Pulmonary Disease-52 Weeks, Double,-blind Study with 500 mcg Roflumilast Once Daily versus Placebo”

Protocol No.: BY217/M2-124

February 2006-February 2008

Expected Enrollment: 6

Actual Enrollment: 11

Principal Investigator

Novartis Pharmaceuticals

A Randomized, double-blind, placebo-controlled, parallel group, multi-center, study to assess the safety and tolerability of 28 days treatment with NVA237 (100 or 200 µg once a day) in patients with moderate to severe Chronic Obstructive Pulmonary Disease (COPD)

Protocol No. CNVA237A2206

April 2007-March 2008

Expected Enrollment: 13

Actual Enrollment: 22

Principal Investigator

Boehringer Ingelheim

A study to assess the responsiveness of the Cough and Sputum Assessment Questionnaire (CASA-Q) in outpatients recovering from mild/moderate exacerbations of COPD and/or chronic bronchitis

Protocol No.: 1219.7

March 2008-May 2008

Expected Enrollment: 12
Actual Enrollment: 20

Principal Investigator

Replydine Inc.

A Prospective, Randomized, Double-Blind, Placebo-Controlled Trial to Evaluate the Efficacy and Safety of Faropenem Medoxomil 600mg PO, BID FOR 5 Days Versus Placebo Versus Telithromycin In the Treatment of Acute Exacerbation of Chronic Bronchitis

Protocol No.: REP-FAR-005

November 2005-August 2008

Expected Enrollment: 6

Actual Enrollment: 7

Principal Investigator

GlaxoSmithKline

A Randomized, Double-Blind, Double-Dummy, Parallel-Group, Factorial Design Trial to Assess the Efficacy and Safety of up to Six-Weeks Treatment with 20mg, 40mg, or 80mg QD Doses of Carvedilol Controlled Release Formulation (COREG CR) or 10mg 20mg, or 40mg QD Doses of Lisinopril (Zestril) or a Combination of One of the Doses of Each Medication

Protocol No.: CFD105453

Expected Enrollment: 8

Actual Enrollment: 24

Sub-Investigator

Novartis Pharmaceuticals (Formerly Chiron Inc.)

A Phase 3, Multicenter, Randomized, Placebo-Controlled, Double-blind, Three-Arm Study to Evaluate the Safety and Efficacy of Tifacogin (Recombinant Tissue Factor Pathway Inhibitor) Administration in Subjects with Severe Community-Acquired Pneumonia”.

Protocol No.: TFP561A2308 (formerly TFP008) SRMC

December 2005-August 2008

Expected Enrollment: 10

Actual Enrollment: 28

Principal Investigator

Novartis Pharmaceutical (Formerly Chiron Inc.)

A Phase 3, Multicenter, Randomized, Placebo-Controlled, Double-blind, Three-Arm Study to Evaluate the Safety and Efficacy of **Tifacogin (Recombinant Tissue Factor Pathway Inhibitor)** Administration in Subjects with Severe Community-Acquired Pneumonia”.

Protocol No.: TFP561A2308 (formerly TFP008) MBMH
February 2006-August 2008
Expected Enrollment: 10
Actual Enrollment: 8

Principal Investigator
Boehringer Ingelheim
A 24-week (+ 24 extension), randomized, placebo-controlled (only 1st 12-week period), double-blind, parallel-group, efficacy and safety comparison, of Tiotropium/Salmeterol (7.5µg/25µg) Inhalation Powder in the morning (PE capsule via tiotropium/salmeterol HandiHaler®), Tiotropium (18µg) Inhalation Powder in the morning (gelatine capsule via Spiriva® HandiHaler®), Salmeterol Inhalation (25µg) Posder in the morning and evening (PE capsule via tiotropium/salmeterol HandiHaler®) and Tiotropium.Salmeterol (7.5µg/25µg)n Inhalation Powder in the morning (PE capsule via tiotropium.salmeterol HandiHaler®) plus Salmeterol (25µg) Inhalation Powder in the evening (PE capsule via tiotropium/salmeterol HandiHaler®) in patients with COPD

Protocol No.: 1184.14
February 2008-December 2008 (Sponsor closed study)
Expected Enrollment: 6
Actual Enrollment: 15

Principal Investigator
GlaxoSmithKline
A Dose Finding Study of GW642444 versus Placebo in Patients with COPD
Protocol No.: BC2111045
February 2008-November 2008
Expected Enrollment: 10
Actual Enrollment: 45

Principal Investigator
Novartis Pharmaceuticals
A 12-week treatment, multi-center, randomizes, double-blind, placebo-controlled, parallel –group study to assess the efficacy and safety indacaterol (150µg o.d.) in patients with chronic obstructive pulmonary disease.
Protocol No.: CQAB146B2346
January 2008-October 2008
Expected Enrollment: 10
Actual Enrollment: 16

Principal Investigator
Boehringer Ingelheim
BIPI Protocol 1160.26: Randomized Evaluation of Long term
anticoagulant therapy (RE-LY) comparing the efficacy and safety
of two blinded doses of dabigtran etexilate with open label warfin
for the prevention of stroke and systemic embolism in patients with
n on-valvular atrial fibrillation: prospective, multi-centre, parallel-
group, non-inferiority trial (RE-LY STUDY)
Protocol: 1160.26
March 2006-September 2009
Open enrollment
Actual Enrollment: 9

Principal Investigator
Genetech Inc.
A phase IIIb multicenter, randomized, double-blind, placebo-
controlled study of Xolair® in subjects with moderate to severe
persistent asthma who are inadequately controlled with Advair
500/50 BID
Protocol No.: Q3662g
Expected Enrollment: 15
Actual Enrollment: 21

Principal Investigator
United BioSource Corp
Cognitive Debriefing Protocol for COPD Assessment Tool (CAT)
Protocol No.: A2-7304-CD
Expected Enrollment: 5
Actual Enrollment: 20

Principal Investigator
AstraZeneca
A 52-week, randomised, double-blind, parallel-group, multi-centre,
Phase IIIB study comparing the long term safety of
SYMBICORT® pMDI 160/4.5 µg x 2 actuations twice daily to
budesonide HFA pMDI 160 µg x 2 actuations twice daily in adult
and adolescent (≥ 12 years) African American subjects with
asthma
Protocol No.: D5896C00022
Open Enrollment:
Actual Enrollment: 9

Principal Investigator
AstraZenca
A Phase IIIB, 12-Month, Double-blind, Double-dummy,
Randomized, Parallel-group, Multicentre Exacerbation Study of

SYMBICORT® pMDI 160/4.5µg x 2 Actuations Twice-daily and
80/4.5µg x 2 Actuations Twice-daily Compared to Formoterol
TBH 4.5µg x 2 Inhalations Twice-daily in COPD Subjects
Protocol No.: D589CC00003
Expected Enrollment: 10
Actual Enrollment: 23

Principal Investigator
GlaxoSmithKline
Dose ranging study for GSK233705B delivered once daily in
subjects with COPD (AC2110664)
Protocol No.: AC2110664
Expected Enrollment: 20
Actual Enrollment: 12

Principal Investigator
Dey Labs
A Randomized, Multiple-Dose, Double-Blind, Crossover Trial to
Assess the Systemic Exposure of Fluticasone Propionate
(FP)/Formoterol Fumarate (FF) Fixed-Dose Combination
Compared to FP and FF Monocomponents, and a 7-Day Open-
Label Extension in subjects with Chronic Obstructive Pulmonary
Disease (COPD).
Protocol No.: 191-087
Expected Enrollment: 6
Actual Enrollment: 12

Principal Investigator
GlaxoSmithKline
A Multicenter, Randomized, Double-Blind, Placebo-Controlled,
Parallel Group, 4 –week Study to Evaluate the Safety, Tolerability,
Pharmacodynamics and Pharmacokinetics of Repeat Inhaled Doses
of the Combination for GSK233705 and GW642444 Administered
Once-Daily in Subjects with COPD
Protocol No.: DB1111581
Expected Enrollment: 10
Actual Enrollment: 13

Principal Investigator
Boehringer Ingelheim
A randomized, double-blind, placebo-controlled two-year trial to
examine the changes in Exercise Endurance and COPD Patients
Treated with Tiotropium (Spiriva® HandiHaler®) 18µg once daily
(EXACTT trial)
Protocol No.: 205.368
Open Enrollment

Actual Enrollment: 7

Principal Investigator

GlaxoSmithKline

A Randomized, Double-Blind, Double-Dummy, Parallel Group
12-Week Comparison of the Efficacy and Safety of Fluticasone
Propionate/Salmeterol Hydrofluoroalkane 134a Metered-Dose-
Inhaler 230/42 mcg twice-daily with Fluticasone
Propionate/Salmeterol DISKUS 250/50 mcg twice-daily in
Subjects with COPD

Protocol No.: ADC111117

Expected Enrollment: 20

Actual Enrollment: 22

Principal Investigator

Boehringer Ingelheim

A Randomised, Double-Blind, Parallel-Group Study to Assess the
Efficacy and Safety of 4 Weeks of Once Daily Treatment of 3
Doses of orally Inhaled Bi 1744 CL, each in fixed dose
Combination with 5µg Tiotropium Bromide (Delivered by the
Respimat® Inhaler) Compared with 5 µg Tiotropium Bromide
Monoprodukt (Delivered by the Respimat® Inhaler) in Patients
with COPD

Protocol No.: 1237.4

Expected Enrollment: 12

Actual Enrollment: 16

Principal Investigator

GlaxoSmithKline

A 52-week, Randomized, Double-Blind, Parallel-Group Study of
Fluticasone Propionate/Salmeterol DISKUS Combination Product
(FSC) 250/50 mcg BID and Fluticasone Propionate (FP) DISKUS
250 mcg BID in Treatment of Subjects with Asthma

Protocol No.: ADA109055

Expected Enrollment: 6

Actual Enrollment: 7

Principal Investigator

GlaxoSmithKline

An Evaluation of Lung Function and Symptoms in Patients with
Chronic Obstructive Pulmonary Disease (COPD) on Long-Acting
Bronchodilator Monotherapy

Protocol No.: ADC111891

Expected Enrollment: 25

Actual Enrollment: 26

Principal Investigator
United BioSource Corp
Prospective Study to Evaluate the Reliability and Validity of the
Shortness of Breath with Daily Activities Questionnaire
Protocol No.: A2-4398-003
Expected Enrollment: 12
Actual Enrollment: 28

Principal Investigator
Boehringer Ingelheim
ATROVENT® HFA open-label Actuation Indicator evaluation
and handling study in adults with chronic obstructive pulmonary
disease (COPD)
Protocol No.: 244.2507
Expected Enrollment: 20
Actual Enrollment: 20

Principal Investigator
Pfizer Inc.
Gastrointestinal (GI) Randomized event and safety open-label
NSAID study (GI reasons): A randomized, open-label, blinded-
endpoint, parallel-group trial of GI safety of celecoxib compared
with non-selective nonsteroidal anti-inflammatory drugs (NSAIDs)
in osteoarthritis patients
Protocol No.: A3191331
Expected Enrollment: 5
Actual Enrollment: 3

Principal Investigator
GlaxoSmithKline
A Randomized, Double-Blind, Parallel-Group, 24-Week Study to
Evaluate the Efficacy and Safety of ADVAIR DISKUS
(Fluticasone Propionate/Salmeterol Combination Product
250/50mcg Inhalation Powder) BID Plus Spiriva HandiHaler
(Tiotropium Bromide Inhalation Powder 18mcg) QD Versus
Spiriva QD Puls Placebo DISKUS BID in Subjects with Chronic
Obstructive Pulmonary Disease (COPD)
Protocol No.: ADC111114
Expected Enrollment: 20
Actual Enrollment: 24

Principal Investigator
Novartis Pharmaceuticals
**12 week treatment, multi-center, randomized, parallel group,
double blind, double dummy study to assess the superiority of
indacaterol (150µg o.d) via a SDDPI in patients with moderate to**

severe COP, using salmeterol (50µg b.i.d.) as an active comparator delivered via a DISKUS inhaler

Protocol: CQAB146B 2349

Expected Enrollment: 5

Actual Enrollment: 20

Sub-Investigator

Cephaolon, Inc.

A Randomized, Double-Blind, Active Controlled Crossover Study to Evaluate the Efficacy and Safety of Fentanyl Buccal Tablets Compared With Immediate Release Oxycodone for the Management of Breakthrough Pain in Opioid Tolerant Patients with Chronic Pain, Followed by a 12 Week Open Label Extension to Evaluate the Impact of Fentanyl Buccal Tablets on Patients Outcomes.

Protocol: C25608/3056/BP/MN

Expected Enrollment: 10

Actual Enrollment: 1

Principal Investigator

Mpex Pharmaceuticals

A Phase 2, Multi-Center, Randomized, Double-Blind, Placebo-Controlled Study to Evaluate the Safety, Tolerability and Efficacy of MP-376 Inhalation Administered for 5 days every 28 days to prevent acute exacerbations in high risk COPD patients.

Protocol: MPEX 302

Expected Enrollment: Open

Actual Enrollment: 34

Principal Investigator

Forest Research Institute

Efficacy and safety of aclidinium bromide at three dose levels (200 µg twice daily, 400µg twice daily, 200 µg once daily) vs. placebo when administered to patients with moderate to severe chronic obstructive pulmonary disease (COPD)

Protocol: LAS-MD-33

Expected Enrollment: 8

Actual Enrollment: 13

Principal Investigator

GlaxoSmithKline

A Randomized, Double-Blind, Placebo-Controlled, 3-Way Cross-Over Study to Evaluate the Safety, Efficacy, and Pharmacokinetics of GSK573719 administered once- and twice-daily in Subjects with COPD

Protocol: GSK-AC4113073

Expected Enrollment: 30
Actual Enrollment: 36

Principal Investigator
GlaxoSmithKline
A Randomized, Double-Blind, Parallel-Group, 16-Week Study to Evaluate the Effect of Fluticasone Propionate/Salmeterol DISKUS 250/50 mcg BID and Placebo on Arterial Stiffness in Subjects with Chronic Obstructive Pulmonary Disease (COPD)
Protocol: GSK-ADC112355
Expected Enrollment: 20
Actual Enrollment: 20

Principal Investigator
GlaxoSmithKline
A randomized, double-blind, parallel-group, placebo-controlled study to evaluate the efficacy and safety of GSK573719 delivered once-daily over 28 days in subjects with COPD.
Protocol: AC4113589
Expected Enrollment: 30
Actual Enrollment: 36

Principal Investigator
GlaxoSmithKline
Validation of a New Shortness of Breath with Daily Activities Questionnaire in patients with Chronic Obstructive Pulmonary Disease
Protocol: ASQ112989
Expected Enrollment: 40
Actual Enrollment: 20

Principal Investigator
Boehringer Ingelheim
Randomised, double-blind, double-dummy, placebo-controlled, 4-way cross-over study to determine the 24-hour FEV1-time profiles of orally inhaled BI 1744 CL (5µg [2 actuations of 2.5µg] and 10µg [2 actuations of 5µg]) administered once daily with the Respimat® Inhaler, and orally inhale Foradil® (12µg), administered twice daily with the Aerolizer® Inhaler, after 6 weeks of treatment in patients with Chronic Obstructive Pulmonary Disease (COPD)
Protocol:1222.24
Expected Enrollment: Open
Actual Enrollment: 25

Principal Investigator
Schering Plough
A Randomized Placebo-Controlled Efficacy and Safety Study of 1 -
Year Treatment Duration With High-and Medium Dose Inhaled
Mometasone Furoate/Formoterol Combination Formulation
Compared With Formoterol and High-Dose Inhaled Mometasone
Furoate Monotherapy in Subjects With Moderate to Severe COPD
Protocol: P04229
Expected Enrollment: 5
Actual Enrollment: 11

Principal Investigator
GlaxoSmithKline
A three-way incomplete block crossover study to investigate the
24-hour pulmonary function of three dosage strengths of
Fluticasone Furoate/GW642444 inhalation powder vs. placebo in
subjects with COPD
Protocol: HZC110946
Expected Enrollment: 12
Actual Enrollment: 12

Principal Investigator
AstraZeneca
A 12-week randomised, double-blind, placebo-controlled, parallel
group, multinational, phase IIb dose range finding study to
evaluate the efficacy and safety of AZD9668 administered orally at
3 dose levels to patients with Chronic Obstructive Pulmonary
Disease (COPD) on treatment with tiotropium
Protocol: D0520C00012
Expected Enrollment: 5
Actual Enrollment: 5

Principal Investigator
Novartis Pharmaceutical
A randomized, double-blind, double-dummy, placebo-controlled,
parallel-group study to assess the efficacy and safety of different
doses of indacaterol in patients with moderate to severe chronic
obstructive pulmonary disease using salmeterol as an active control
Protocol: CQAB149B2356
Expected Enrollment: 10
Actual Enrollment: 16

Principal Investigator
Novartis Pharmaceutical
A 12—week treatment, multi-center, randomized, double-blind,
placebo-controlled, parallel-group study to assess the efficacy and

safety of once daily indacaterol in patients with chronic obstructive pulmonary disease.

Protocol: CQAB149B2355

Expected Enrollment: 6

Actual Enrollment: 9

Principal Investigator

Forest Research Institute

Efficacy and Safety Study of Two Fixed-Dose Combinations of Acclidinium Bromide With Formoterol Fumarate Compared With Acclidinium Bromide, Formoterol Fumarate, and Placebo All Administered Twice Daily to Patients With Stable, Moderate to Severe Chronic Obstructive Pulmonary Disease (COPD)

Protocol: LAC-MD-27

Expected Enrollment: 6

Actual Enrollment: 11

Principal Investigator

GlaxoSmithKline

A 24-Week Study to Evaluate the Efficacy and Safety of Fluticasone Furoate (FF)/GW642444 Inhalation Powder and the Individual Components Delivered Once Daily (AM) Via a Novel Dry Powder Inhaler Compared with Placebo in Subjects with Chronic Obstructive Pulmonary Disease (COPD)

Protocol: HZC112206

Expected Enrollment: 38

Actual Enrollment: 25

Principal Investigator

Forest Research Institute

A Long-term, Randomized, Double-Blind, Extension Study of the Safety, Tolerability and Efficacy of Acclidinium Bromide at Two Dose Levels When Administered to Patients with Moderate to Severe Chronic Obstructive Pulmonary Disease

Protocol: LAS-MD-36

Expected Enrollment: Roll over from LAS-MD-33

Actual Enrollment: 7

Principal Investigator

GlaxoSmithKline

A 24-week Study to Evaluate the Efficacy and Safety of Fluticasone Furoate (FF) GW642444 Inhalation Powder and the Individual Components Delivered Once Daily (AM) Via a Novel **Dry Powder Inhaler Compared with Placebo** in subjects with **Chronic Obstructive Pulmonary Disease (COPD)**

Protocol No.: HZC112207

Jun. 2010-Feb. 2011

Expected Enrollment: 25

Actual Enrollment: 30

Principal Investigator

Dey Labs

A 12-week, Randomized, Multiple-Dose, Double-Blind, Placebo-Controlled, Parallel-Group Trial to Assess the Pharmacodynamic Response of Fluticasone Propionate in Fixed Dose-Combination with Formoterol Fumarate in Subjects with COPD

Protocol No.: 191-090

Aug. 2010-Mar. 2011

Expected Enrollment: 14

Actual Enrollment: 37

Principal Investigator

GlaxoSmithKline

An eight-week, multicentre, double-blind, randomized, parallel group study of fluticasone propionate/salmeterol DISKUS combination product (FSC) 250/50 mcg twice daily plus tiotropium 18 mcg daily versus placebo DISKUS twice daily plus tiotropium 18 mcg daily on exercise time and physiological parameters in subjects with Chronic Obstructive Pulmonary Disease (COPD)

Protocol No.: ADC113877

Dec. 2010-May 2011

Expected Enrollment: 25

Actual Enrollment: 26

Principal Investigator

GlaxoSmithKline

A randomized, observer-blind, active-controlled phase III study to demonstrate the superior efficacy of GSK Biologicals' adjuvanted influenza candidate vaccine [GSK2186877A], administered intramuscularly in elderly aged 65 years or above, as compared to Fluarix™.

Protocol 106372 (FLU NG-006 PRI)

Oct 2008-Apr. 2011

Expected Enrollment: 100

Actual Enrollment: 171

Principal Investigator

GlaxoSmithKline

A 52-week efficacy and safety study to compare the effect of three dosage strengths of Fluticasone Furoate/GW642444 Inhalation Powder with GW642444 on the Annual Rate of Exacerbations in Subjects with Chronic Obstructive Pulmonary Disease (COPD)

Protocol No.: HZC102871
Sept 2009-Apr. 2011
Expected Enrollment: 30
Actual Enrollment: 18

Principal Investigator
Bristol Myers Squibb
A Phase 3, Active (Warfin) Controlled, Randomized, Double-Blind, Parallel, Arm Study to Evaluate Efficacy and Safety of Apixban in Preventing Stroke and Systemic Embolism in Subjects with Nonvalvular Atrial Fibrillation
Protocol No.: CV 185030
Aug. 2007- Jun. 2011
Expected Enrollment: 19
Actual Enrollment: 5

Principal Investigator
Boehringer Ingelheim
A randomized, double-blind, placebo and active controlled, parallel group study to evaluate the safety and efficacy of 6-week treatment with oral doses of 50mg bid, 200 mg bid, and 400 mg bid BI 671800 ED in steroid naïve patients with persistent asthma
Protocol No.: 1268.17
Jan. 2011-Aug. 2011
Expected Enrollment: 5
Actual Enrollment: 23

Principal Investigator
GlaxoSmithKline
A 12-Week Study to Evaluate the 24-Hour Pulmonary Function Profile of fluticasone Furoate/Vilanterol (FF/V1) Inhalation Powder 100/25mcg Once Daily Compared with Fluticasone Propionate/Salmeterol Inhalation Powder 250/50mcg Twice Daily in Subjects with Chronic Obstructive Pulmonary Disease (COPD)
Protocol No.: HZC112352
Mar. 2011-Sept. 2011
Expected Enrollment: 32
Actual Enrollment: 38

Principal Investigator
GlaxoSmithKline
A Randomised, Double-Blind, Double-Dummy, Parallel-Group, Multicentre Study to assess efficacy and safety of Fluticasone Furoate (FF)/GW642444 Inhalation Powder and Fluticasone Propionate (FP)/Salmeterol Inhalation Powder in the Treatment of Persistent Asthma in Adults and Adolescents

Protocol No.: HZA113091

Aug. 2010-Aug. 2011

Expected Enrollment: 18

Actual Enrollment: 13

Principal Investigator

GlaxoSmithKline

A long-term, randomized, double-blind, parallel group study of Fluticasone Furoate/GW642444 inhalation powder once-daily and Fluticasone Furoate inhalation powder once-daily in subjects with asthma

Protocol No.: HZA106837

Mar. 2010-Sept. 2011

Expected Enrollment: 20

Actual Enrollment: 12

Principal Investigator

GlaxoSmithKline

A 52-week efficacy and safety study to compare the effect of three dosage strengths of Fluticasone Furoate/GW642444 Inhalation Powder with GW642444 on the Annual Rate of Exacerbations in Subjects with Chronic Obstructive Pulmonary Disease (COPD)

Protocol No.: HZC102970:

May 2010-Oct. 2011

Expected Enrollment: 16

Actual Enrollment: 24

Principal Investigator

Boehringer Ingelheim

RELY-ABLE long term multi-center extension of dabigatran treatment in patients with atrial fibrillation who completed the RELY trial and a cluster randomised trial to assess the effect of a knowledge translation intervention on patient outcomes

Protocol No.: Protocol 1160.71

Dec. 2008-Nov. 2011

Expected Enrollment: Open

Actual Enrollment: 3

Principal Investigator

Boehringer Ingelheim

Phase II, randomized, double-blind, cross-over study to compare the 24-hour FEV-1-time profile of orally inhaled olodaterol, delivered with the Respimat ® inhaler, after 3 weeks of olodaterol once daily 5 µg [2 actuations of 2.5 µg], twice daily 2.5 µg [2 actuations of 1.25 µg] and placebo or after 3 weeks of once daily 10 µg [2 actuations of 5 µg], twice daily 5 µg [2 actuations of 2.5

µg] and placebo administration in patients with moderate to severe persistent Asthma

Protocol No.: Protocol 1222.29

Mar. 2011-Feb. 2013

Expected Enrollment: Open

Actual Enrollment: 10

Principal Investigator

GlaxoSmithKline

A Randomised, Double-Blind, Placebo-Controlled, Parallel-Group, Multi-centre, Dose Ranging Study to Evaluate the Efficacy and Safety of Losmapimod (GW856553) Tablets Administered Twice Daily compared with Placebo for 24 Weeks in Adult Subjects with Chronic Obstructive Pulmonary Disease (COPD)

Protocol No.: MKI113006:

Nov.2010-Jan. 2012

Expected Enrollment: 20

Actual Enrollment: 20

Principal Investigator

GlaxoSmithKline

A 24-Week, Randomized, Double-Blind, Placebo-Controlled Study to Evaluate the Efficacy and Safety of GSK573719/GW642444 Inhalation Powder and the Individual components Delivered Once-Daily Via a Novel Dry Powder Inhaler in Subjects with Chronic Obstructive Pulmonary Disease.

Protocol No.: DB2113373

Mar. 2011- Jan. 2012

Expected Enrollment: 35

Actual Enrollment: 45

Principal Investigator

GlaxoSmithKline

A randomized, double blind, placebo controlled, incomplete block, crossover, dose ranging study to evaluate the dose response of GSK573719 administered once or twice daily over 7 days in patients with COPD

Protocol No.: AC4115321

Jul. 2011-Dec. 2011

Expected Enrollment: 30

Actual Enrollment: 32

Principal Investigator
GlaxoSmithKline
A multicenter trial comparing the efficacy and safety of
GSK573719/GW642444 with GSK573719 and with tiotropium
over 24 weeks in subjects with COPD
Protocol No.: DB2113374
Mar. 2011-Jan. 2012
Expected Enrollment: 25
Actual Enrollment: 24

Principal Investigator
INC Research
A Phase 2, Randomized, Double-Blind, Placebo-Controlled
Multicenter Study Evaluating the Efficacy and Safety of Two
Doses of Favipiravir in Older Adult Patients with Uncomplicated
Influenza
Protocol No.: T705Aus204
Jan. 2011-Dec. 2011
Expected Enrollment: Open
Actual Enrollment: 4

Principal Investigator
GlaxoSmithKline
A 12-Week, Randomized, Double-Blind, Placebo-Controlled,
Parallel-Group Study to Evaluate the Efficacy and Safety of
GSK573719 Delivered Once-Daily via a Novel Dry Powder
Inhaler in Subjects with Chronic Obstructive Pulmonary Disease.
Protocol No.: AC4115408
Jul. 2011-Jan. 2012
Expected Enrollment: 30
Actual Enrollment: 12

Principal Investigator
GlaxoSmithKline
A Randomized, Double-Blind, Parallel Group, Multicenter Study
250/50mcg BID (ADVAIR DISKUS™) in Comparison to
Salmeterol 50mcg BID (SEREVENT DISKUS™) on the Rate of
Exacerbations of Chronic Obstructive Pulmonary Disease (COPD)
Following Hospitalization
Protocol No.: ADC113784
Aug. 2010-Mar. 2012
Expected Enrollment: 40
Actual Enrollment: 41

Principal Investigator

AstraZeneca

A double-blind, placebo-controlled, randomised, parallel-group, phase-II, multi-centre study to assess the efficacy, safety and tolerability of 4 twice daily doses and 2 once daily doses of AZD1981 given as tablets during 12 weeks in asthmatic patients treated with inhaled corticosteroids and long-acting- β 2-agonists

Protocol No.: D9830C00008

Feb. 2011-Mar. 2012

Expected Enrollment: Open

Actual Enrollment: 6

Principal Investigator

Cephalon, Inc.

A 12 Week, Randomized, Double-Blind, Placebo-Controlled Study to Evaluate the Efficacy and Safety of Hydrocodone Bitartrate Extended-Release Tablets (CEP-33237) at 15 to 90 mg Every 12 Hours for Relief of Moderate to Severe Pain in Patients With Osteoarthritis or Low Back Pain Who Require Opioid Treatment for an Extended Period of Time

Protocol C33237/3079

Nov. 2010-May 2011

Expected Enrollment: 15

Actual Enrollment: 4

Principal Investigator

Sepracor Inc.

A Large Simple Safety Study of Arformoterol Tartrate Inhalation Solution in Subjects with Chronic Obstructive Pulmonary Disease

Protocol No.: 091-080

May 2010-May 2012

Expected Enrollment: Open

Actual Enrollment: 36

Principal Investigator

Boehringer Ingelheim

Twice-daily oral direct thrombin inhibitor dabigatran etexilate in the long-term prevention of recurrent symptomatic venous thromboembolism in patients with symptomatic deep-vein thrombosis or pulmonary embolism. RE-SONATE

Protocol 1160.63:

Apr. 2008-Apr. 2012

Expected Enrollment: Open

Actual Enrollment: 1

Principal Investigator
GlaxoSmithKline
An exercise endurance study to evaluate the effects of treatment of
COPD patients with a dual bronchodilator:
GSK573719/GW642444
Protocol No.: DB2114417
Apr. 2011-Jun. 2012
Expected Enrollment: 40
Actual Enrollment: 51

Principal Investigator
GlaxoSmithKline
A 52-Week, Multicenter, Randomized, Double-Blind, Parallel
Group, Placebo-Controlled Study to Evaluate the Safety and
Tolerability of GSK573719 125mcg once-daily alone and in
combination with GW642444 25mng once-daily via novel Dry
Powder Inhaler (nDPI) in Subjects with Chronic Obstructive
Disease (COPD)
Protocol No.: DB2113359
Feb. 2011-Jul. 2012
Expected Enrollment: 35
Actual Enrollment: 42

Principal Investigator
GlaxoSmithKline
A randomised, double-blind, placebo-controlled (with rescue
medication), multi-centre study to evaluate the efficacy and safety
of inhaled fluticasone furoate in the treatment of persistent asthma
in adults and adolescents not currently receiving inhaled
corticosteroids
Protocol No.: FFA115283
Mar. 2012-Aug. 2012
Expected Enrollment: 22
Actual Enrollment: 11

Principal Investigator
GlaxoSmithKline
A 4-Week Randomized Cross-Over Study to Evaluate Daily Lung
Function Following the Administration of Albuterol/Salbutamol
and Ipratropium in Subjects with Chronic Obstructive Pulmonary
Disease
Protocol No.: DB2114956:
Aug. 2012-Oct. 2012
Expected Enrollment: 40
Actual Enrollment: 31

Principal Investigator

GlaxoSmithKline

A multi-national, randomized, double-blind, placebo-controlled, 3-period crossover study with GSK 573719 as monotherapy in adult subjects with asthma

Protocol No.: ALA116402

Jun. 2012-Oct. 2012

Expected Enrollment: 15

Actual Enrollment: 18

Principal Investigator

Forest Research

A Phase III, Randomized, Double-Blind, Placebo-Controlled Evaluating the Efficacy, Safety, and Tolerability of Two Fixed Dose Combinations of Acclidinium Bromide/Formoterol Fumarate Compared With Acclidinium Bromide, Formoterol Fumarate and Placebo for 24-Weeks Treatment in Patients With Moderate to Severe, Stable Chronic Obstructive Pulmonary Disease (COPD)

Protocol No.: LAC-MD-31

Expected Enrollment: 7

Actual Enrollment: 30

Principal Investigator

GlaxoSmithKline

A 12-Week Study to Evaluate the 24-Hour Pulmonary Function Profile of Fluticasone Furoate /Vilanterol (FF/VI) Inhalation Powder 100/25mcg Once-Daily via a Novel Dry Powder Inhaler Compared with Tiotropium Bromide Inhalation Powder 18mcg Delivered Once-Daily via the HandiHaler® in Subjects with Chronic Obstructive Pulmonary Disease (COPD) Who Have or Are at Risk for Co-morbid Cardiovascular Disease

Protocol No.: HZC115805

Apr. 2012-Oct. 2012

Expected Enrollment: 35

Actual Enrollment: 33

Sub-Investigator

Cephalon Inc.

A 12-Month, Open-Label Study to Evaluate the Long-Term Safety of Hydrocodone Bitartrate Extended-Release Tablets (CEP-33237) at 15 to 90 mg Every 12 Hours in Patients Who Require Opioid Treatment for an Extended Period of Time

Protocol No.: C33237/3080

Expected Enrollment: 15

Actual Enrollment: 2

Sub-Investigator

Cephalon Inc.

A Randomized, Double-Blind, Placebo-Controlled, Ascending-Dose Study to Evaluate the Safety and Efficacy of CEP-37247 Administered at Single Doses of 0.5, 1, 3, 6, or 12 mg by the Transforaminal Epidural Route for the Treatment of Patients With Lumbosacral Radicular Pain Associated With Disk Herniation
Protocol No.: C37247/1083:

Nov. 2010-Dec. 2013

Expected Enrollment: 15

Actual Enrollment: 21

Principal Investigator

Boehringer Ingelheim

A 12-week, randomised, placebo-controlled, double-blind, parallel group, multi-center trial to assess the efficacy and safety of tiotropium bromide (18 µg) delivered via the HandiHaler® in patients with newly diagnosed and/or maintenance treatment naïve Chronic Obstructive Pulmonary Disease (COPD) experiencing an acute respiratory infection (TICARI 1: Tiotropium In COPD patients with an Acute Respiratory Infection 1)

Protocol No.: 205.479:

Expected Enrollment: Open

Actual Enrollment: 27

Principal Investigator

Pharmaxis Ltd

A Phase III Multicenter, Randomized, Parallel Group, Controlled, Double Blind Study to Investigate the Safety and Efficacy of Inhaled Mannitol over 12 Months in the Treatment of Bronchiectasis.

Protocol No.: DPM-B-305

Sept. 2010-Jun. 2013

Expected Enrollment: 5

Actual Enrollment: 5

Principal Investigator

GlaxoSmithKline

A 12-Week Study to Evaluate the 24-Hour Pulmonary Function Profile of Fluticasone Furoate /Vilanterol (FF/VI) Inhalation Powder 100/25mcg Once Daily Compared with Fluticasone Propionate/Salmeterol Inhalation Powder 250/50mcg Twice Daily in Subjects with Chronic Obstructive Pulmonary Disease (COPD)
Protocol No.: RLV116974

Oct. 2012-Apr. 2013

Expected Enrollment: 40

Actual Enrollment: 44

Principal Investigator
Sunovion Pharmaceuticals
A Randomized, Double-Blind, Double-Dummy, Placebo-
Controlled, Multi-Center, Parallel Arm, 4-Week Dosing, Phase 2b
Study to Determine the Optimal Dose, Optimal Dosing Regimen,
and Safety of Nebulized EP-101 in Subjects with Moderate to
Severe COPD
Protocol No.: EP-101-04
Nov. 2012-Jun. 2013
Expected Enrollment: 15
Actual Enrollment: 23

Principal Investigator
GlaxoSmithKline
A Preference Study Of Device Attributes Between Two Placebo
Dry Powder inhalers; ELLIPTA and DISKUS, in Adult Subjects
with Chronic Obstructive Pulmonary Disease
Protocol No.: RLV116669
May 2013-Jul. 2013
Expected Enrollment: 20
Actual Enrollment: 24

Principal Investigator
Forest Research
A Phase III, Long-Term, Randomized, Double-Blind, Extension
Study of the Efficacy, Safety and Tolerability of Two Fixed Dose
Combinations of Acclidinium Bromide/Formoterol Fumarate,
Acclidinium Bromide, Formoterol Fumarate and Placebo for 28-
Weeks Treatment in Patients with Moderate to Severe, Stable
Chronic Obstructive Pulmonary Disease (COPD)
Protocol No.: LAC-MD-36
Sept. 2009-Jul 2013
Expected Enrollment: 7
Actual Enrollment: 6

Principal Investigator
GlaxoSmithKline
A multicenter, randomized, double-blind, parallel group study to
evaluate the efficacy and safety of the addition of umeclidinium
bromide Inhalation Powder (62.5mcg) once-daily to fluticasone
propionate/salmeterol (250/50mcg) twice-daily, umeclidinium
bromide Inhalation Powder (125mcg) once-daily to fluticasone
propionate/salmeterol (250/50mcg) twice-daily versus placebo to
fluticasone propionate/salmeterol (250/50mcg) twice -daily over
12 weeks in subjects with COPD
Protocol No.: AC4116136:

Jan. 2013-Jul 2013
Expected Enrollment: 25
Actual Enrollment: 37

Principal Investigator
Boehringer Ingelheim
A randomised, active-controlled, double-blind, double-dummy, parallel group design, multi-center trial to compare the efficacy and safety of 2.5 µg and 5 µg Tiotropium Inhalation Solution delivered by the Respimat® Inhaler with Tiotropium inhalation capsules 18 µg delivered by the HandiHaler®.
Protocol No.: Protocol 205.452
Jul. 2010-Sept. 2013
Expected Enrollment: Open
Actual Enrollment: 20

Principal Investigator
Teva Branded Pharmaceuticals
A 12-Week Dose ranging Study to Evaluate the Efficacy and Safety of Fp Spiromax® (Fluticasone Propionate Inhalation Powder) Administered Twice Daily compared with Placebo in Adolescent and Adult Subjects with Persistent Asthma Uncontrolled on Non-steroidal Therapy
Protocol No. : FpS-AS-201
Nov. 2012-Sept. 2013
Expected Enrollment: Open
Actual Enrollment: 17

Principal Investigator
Boehringer Ingelheim
Randomised, double-blind, placebo-controlled, 6 treatment, 4 period, incomplete cross-over trial to characterise the 24-hour lung function profiles of tiotropium + olodaterol fixed dose combination (2.5/5 µg, 5/5 µg), tiotropium (2.5 µg, 5 µg) and olodaterol (5 µg) (oral inhalation, delivered by the Respimat® Inhaler) after 6 weeks once daily treatment in patients with Chronic Obstructive Pulmonary Disease (COPD) [VIVACITO™]
Protocol No.: 1237.20
May 2012-Oct. 2013
Expected Enrollment: 8
Actual Enrollment: 12

Sub-Investigator

Cephalon Inc.

A 16- Week, Randomized, Double-Blind, Placebo-Controlled Study to Evaluate the Efficacy and Safety of Reslizumab (3.0 mg/kg) Treatment in Patients With Moderate to Severe Asthma
Protocol No.: C38072/3084

Mar. 201-Oct. 2013

Expected Enrollment: 10

Actual Enrollment: 7

Principal Investigator

GlaxoSmithKline

A randomized, multi-center, double-blind, double-dummy, parallel group study to evaluate the efficacy and safety of umeclidinium/vilanterol compared with fluticasone propionate/salmeterol over 12 weeks in subjects with COPD

Protocol No.: DB2114930

Apr. 2013-Oct. 2013

Expected Enrollment: 25

Actual Enrollment: 37

Principal Investigator

GlaxoSmithKline

A Clinical Outcomes Study of Darapladib versus Placebo in Subjects with Chronic Coronary Heart Disease to Compare the Incidence of Major Adverse Cardiovascular Events (MACE)

Protocol No.: LPL100601

Mar. 2009-Oct. 2013

Expected Enrollment: 7

Actual Enrollment: 7

Principal Investigator

Teva Branded Pharmaceuticals

A 12-Week Dose-ranging Study to Evaluate the Efficacy and Safety of Fp Spiromax® (Fluticasone Propionate Inhalation Powder) Administered Twice Daily compared with Placebo in Adolescent and Adult Subjects with Severe Persistent Asthma Uncontrolled on High-dose Inhaled Corticosteroid Therapy

Protocol No.: FpS-AS-202

Apr. 2013-Dec. 2013

Expected Enrollment: Open

Actual Enrollment: 6

Principal Investigator
Boehringer Ingelheim

A randomised, double blind, parallel group study to assess the efficacy and safety of 12 weeks of once daily, orally inhaled, co-administration of olodaterol 5 µg (delivered by the Respimat® Inhaler) and tiotropium 18 µg (delivered by the HandiHaler®) compared to once daily, orally inhaled, co-administration of placebo (delivered by the Respimat® Inhaler) and tiotropium 18 µg (delivered by the HandiHaler®) in patients with Chronic Obstructive Pulmonary Disease (COPD) (ANHELTO™1)

Protocol No.: 1222.51

Oct. 2012-Dec.2013

Expected Enrollment: Open

Actual Enrollment: 21

Principal Investigator
Boehringer Ingelheim

A randomised, double blind, parallel group study to assess the efficacy and safety of 12 weeks of once daily, orally inhaled, co-administration of olodaterol 5 µg (delivered by the Respimat® Inhaler) and tiotropium 18 µg (delivered by the HandiHaler®) compared to once daily, orally inhaled, co-administration of placebo (delivered by the Respimat® Inhaler) and tiotropium 18 µg (delivered by the HandiHaler®) in patients with Chronic Obstructive Pulmonary Disease (COPD) (ANHELTO™2)

Protocol No.: 1222.52

Feb. 2013-Dec. 2013

Expected Enrollment: Open

Actual Enrollment: 28

Principal Investigator
Dey Labs

Phase II - A 12-week Randomized, Multiple-Dose, Double-Blind, Placebo-Controlled, Parallel-Group Study to Replicate Efficacy of Nebulized Fluticasone Propionate (FP) in Adult Subjects with Partly Controlled and Uncontrolled Asthma

Protocol 191-092

Feb. 2013- Feb. 2014

Expected Enrollment: 10

Actual Enrollment: 30

Principal Investigator
Boehringer Ingelheim

A randomised, double-blind, parallel group to assess the efficacy and safety of 52 weeks of once daily treatment of orally inhaled tiotropium + olodaterol fixed dose combination (2.5µg/5µg;

5µg/5µg) (delivered by the Respimat® Inhaler) compared with the individual components (2.5µg and 5µg tiotropium 5µg olodaterol) (delivered by the Respimat® Inhaler) in patients with Chronic Obstructive Pulmonary Disease (COPD) [TOnado™2]
Protocol: 1237.6
Aug. 2011-Feb. 2014
Expected Enrollment: 28
Actual Enrollment: 28

Principal Investigator
Novartis Pharmaceuticals
A multi-center, randomized, double-blind, 52-week study to assess the safety of QVA149 compared to QAB149 in patients with Chronic Obstructive Pulmonary Disease (COPD) who have moderate to severe airflow limitation
Protocol: CQVA149A2340
Apr. 2013-Nov. 2013
Expected Enrollment: 8
Actual Enrollment: 5

Principal Investigator
Novartis Pharmaceuticals
A 12-week multi-center, randomized, double-blind, placebo controlled study to assess the efficacy and safety of NVA237 in stable COPD patients
Protocol: CNVA237A-2317
Sept. 2012-Feb. 2014
Expected Enrollment: 8
Actual Enrollment: 23

Principal Investigator
Boehringer Ingelheim
A randomised, double-blind, 5 treatment arms, 4-period, incomplete cross-over study to determine the effect of 6 weeks treatment of orally inhaled tiotropium + olodaterol fixed dose combination (FDC) (2.5 / 5 µg; and 5 / 5 µg) (delivered by the Respimat® Inhaler) compared with tiotropium (5 µg), olodaterol (5 µg) and placebo (delivered by the Respimat® Inhaler) on lung hyperinflation and exercise endurance time during constant work rate cycle ergometry in patients with Chronic Obstructive Pulmonary Disease (COPD) [MORACTO™ 1]
Protocol: 1237.13
Jan. 2012-Feb. 2014
Expected Enrollment: 7
Actual Enrollment: 7

Principal Investigator

GlaxoSmithKline

A study to compare the addition of umeclidinium bromide (UMEC) to fluticasone furoate (FF)/vilanterol (VI), with placebo plus FF/VI in subjects with Chronic Obstructive Pulmonary Disease (COPD) -Study

Protocol: 200110

Sept. 2013-Feb. 2014

Expected Enrollment: 25

Actual Enrollment: 30

Principal Investigator

Novartis Pharmaceuticals

A 12-week treatment, multi-center, randomized, doubleblind, parallel-group, placebo and active controlled study to assess the efficacy, safety, and tolerability of QVA149 (indacaterol maleate/glycopyrronium bromide) in COPD patients with moderate to severe airflow limitation

Protocol: QVA149A2336

Aug. 2013-Apr. 2014

Expected Enrollment: 8

Actual Enrollment: 4

Principal Investigator

Novartis Pharmaceuticals

A 12-week treatment, multi-center, randomized, doubleblind, parallel-group, placebo and active controlled study to assess the efficacy, safety, and tolerability of QVA149 (indacaterol maleate / glycopyrronium bromide) in COPD patients with moderate to severe airflow limitation

Protocol: CQVA149A2337

Nov. 2012-Jun. 2014

Expected Enrollment: 16

Actual Enrollment: 33

Principal Investigator

GlaxoSmithKline

A 24-week study to evaluate the effect of fluticasone furoate/ vilanterol 100/25 mcg Inhalation Powder delivered once-daily via a Novel Dry Powder Inhaler on arterial stiffness compared with placebo and vilanterol in subjects with Chronic Obstructive Pulmonary Disease (COPD)

Protocol: HZC113108

Feb. 2011-Jun. 2014

Expected Enrollment: Open

Actual Enrollment: 89

Principal Investigator
Sunovion Pharmaceuticals
A DOSE-RANGE FINDING STUDY OF SUN-101 IN
SUBJECTS WITH MODERATE TO SEVERE COPD: GOLDEN
6 (GLYCOPYRROLATE FOR OBSTRUCTIVE LUNG
DISEASE VIA ELECTRONIC NEBULIZER)
Protocol: SUN101-201
Jan. 2014-Jun. 2014
Expected Enrollment: Open
Actual Enrollment: 28

Principal Investigators
GlaxoSmithKline
A Preference Study of Inhaler Attributes Between Two Inhalers;
ELLIPTA and MDI, in Adult Subjects with Asthma
Protocol: 201344
May 2014-Jul. 2014
Expected Enrollment: 20
Actual Enrollment: 20

Principal Investigators
Theravance
A Phase IIB, 28-Day, Randomized, Double-Blind Placebo-
Controlled Parallel Group Study of Nebulized TD-4208 in Subjects
with Chronic Obstructive Pulmonary Disease
Protocol: TD-4208-0117
Apr. 2014-Sep. 2014
Expected Enrollment: Open
Actual Enrollment: 29

Principal Investigator
Boehringer Ingelheim
A randomized, placebo-controlled, double-blind, parallel group, multi-
center study to assess the safety and efficacy of tiotropium bromide
(18µg) delivered via the HandiHaler® in Chronic Obstructive Pulmonary
Disease (COPD) subjects recovering from hospitalization for an acute
exacerbation (Hospital Discharge Study1) (Phase IV)
Protocol 205.477
Jul. 2012-Aug. 2014
Expected Enrollment: Open
Actual Enrollment: 16

Principal Investigator
Ardea Bioscience
A Phase 3 Randomized, Double-Blind, Multicenter, Placebo-
Controlled, Combination Study to Evaluate the Efficacy and Safety
of Lesinurad and Allopurinol Compared to Allopurinol Alone in
Subjects with Gout who have had an Inadequate Hypouricemic
Response to Standard of Care Allopurinol
Protocol: RDEA594-301
Mar. 2012-Oct. 2014
Expected Enrollment: 5
Actual Enrollment: 10

Principal Investigator
Takeda Global Research
A Multicenter, Randomized, Double-Blind, Active-Controlled,
Phase 3 Study to Evaluate the Efficacy and Safety of TAK-875 25
mg and 50 mg Compared to Glimepiride When Used in
Combination with Metformin in Subjects with Type 2 Diabetes
Protocol TAK-875-304
Feb. 2012-Sept. 2014
Expected Enrollment: Open
Actual Enrollment: 2

Principal Investigator
Pearl Therapeutics
An Open Label, Multi-Center, Dose Indicator Study of
Glycopyrronium and Formoterol Fumarate (GFF) Metered Dose
Inhaler (MDI) in Adult Subjects With Moderate to Very Severe
Chronic Obstructive Pulmonary Disease (COPD)
Protocol: PT003016
Nov. 2014-Apr. 2015
Expected Enrollment: 13
Actual Enrollment: 24

Principal Investigator
GlaxoSmithKline
A 12-Week Study to Evaluate the Efficacy and Safety of
Fluticasone Furoate/Vilanterol Inhalation Powder (FF/VI) 100/25
mcg Once Daily Compared with Vilanterol Inhalation Powder (VI)
25 mcg Once Daily in Subjects with Chronic Obstructive
Pulmonary Disease (COPD)
Protocol: 200820
Mar. 2014-Apr. 2015
Expected Enrollment: 15
Actual Enrollment: 17

Principal Investigator
Pearl Therapeutics
A Randomized, Double-Blind, (Test Products and Placebo),
Chronic Dosing (24 Weeks), Placebo-Controlled, Parallel Group,
Multi-Center Study to Assess the Efficacy and Safety of PT003,
PT005, and PT001 in Subjects With Moderate to Very Severe
COPD, Compared With Placebo and Spiriva® Handihaler®
(Tiotropium Bromide 18 µg, Open-Label) as an Active Control
PT003006
May 2013-Apr. 2015
Expected Enrollment: 15
Actual Enrollment: 42

Principal Investigator
Boehringer Ingelheim
Multi-center open-label expanded access program of oral
nintedanib 150 mg twice daily in patients with idiopathic
pulmonary fibrosis.
Protocol 1199.177
Nov. 2014-Mar. 2015
Expected Enrollment: Open
Actual Enrollment: 3

Principal Investigator
Boehringer Ingelheim
A randomised, double-blind, placebo- and active-controlled
parallel group study to assess the efficacy of 12 weeks of once
daily treatment of two doses of orally inhaled tiotropium +
olodaterol fixed dose combination (delivered by the Respimat®
inhaler) in patients with moderate to severe Chronic Obstructive
Pulmonary Disease (COPD) [OTEMTO™1]
Protocol: 1237.25
Jan. 2014-Feb. 2015
Expected Enrollment: 20
Actual Enrollment: 23

Principal Investigator
Pearl Therapeutics
A Randomized, Double Blind, Chronic Dosing (28 Days), Four
Period, Five Treatment, Incomplete Block, Multi Center,
Crossover Study to Assess the Efficacy and Safety of PT009,
PT008, and PT005 in Subjects With Moderate to Severe COPD
PT009001
Aug. 2014-Apr. 2015
Expected Enrollment: 11
Actual Enrollment: 15

Principal Investigator
GlaxoSmithKline
A Clinical Study to Evaluate Four Doses of Umeclidinium
Bromide in Combination with Fluticasone Furoate in COPD
Subjects with an Asthmatic Component
Protocol: 200699:
Aug. 2014-Apr. 2015
Expected Enrollment: 15
Actual Enrollment: 17

Principal Investigator
GlaxoSmithKline
The Utility of a Clinical Questionnaire to Identify Subjects with Features
of Both Asthma and COPD.
Protocol: 201703
Dec. 2014-Apr. 2015
Expected Enrollment: Open
Actual Enrollment: 64

Principal Investigator
Pearl Therapeutics
A Randomized, Double-Blind (Test Products and Placebo), Chronic
Dosing (24 Weeks), Placebo-Controlled, Parallel Group, Multi Center
Study to Assess the Efficacy and Safety of PT003, PT005, and PT001 in
Subjects with Moderate to Very Severe COPD, Compared with Placebo
Protocol: PT003007
Aug. 2013-Apr. 2015
Expected Enrollment: 10
Actual Enrollment: 35

Principal Investigator
Pearl Therapeutics
A 28-Week, Multi-Center, Randomized, Double-Blind, Parallel-Group,
Active- Controlled Safety Extension Study to Evaluate the Safety and
Efficacy of PT003, PT001, and PT005 in Subjects With Moderate to
Very Severe COPD, With Spiriva® Handihaler® as an Active Control
Protocol: PT003008
Dec. 2014-Apr. 2015
Expected Enrollment: 10
Actual Enrollment: 10

Principal Investigator
Actelion Pharmaceuticals
Effects of combination of bosentan and sildenafil versus sildenafil
**monotherapy on morbidity and mortality in symptomatic patients
with pulmonary arterial hypertension-A multicenter, double-blind,**

randomized, placebo-controlled, parallel group, prospective, event driven Phase IV study

Protocol: AC-052-414 COMPASS 2

Feb. 2013-Apr. 2015

Expected Enrollment: 10

Actual Enrollment: 10

Principal Investigator

GlaxoSmithKline

A Randomized, Blinded, Double-dummy, Parallel-group Study to Evaluate the Efficacy and Safety of Umeclidinium (UMEC) 62.5 mcg compared with Tiotropium 18 mcg in Subjects with Chronic Obstructive Pulmonary Disease (COPD)

Protocol: 201316:

Aug. 2014-May. 2015

Expected Enrollment: 20

Actual Enrollment: 43

Principal Investigator

Boehringer Ingelheim

A Phase III, multicentre, international, randomised, parallel group, double blind cardiovascular safety study of BI 10773 (10 mg and 25 mg administered orally once daily) compared to usual care in type 2 diabetes mellitus patients with increased cardiovascular risk.

Protocol: 1245.25

May 2011-July 2015

Expected Enrollment: 8

Actual Enrollment: 15

Principal Investigator

Aquinoix Pharmaceutical

THE FLAGSHIP STUDY: A 12-WEEK PHASE II STUDY TO EVALUATE THE EFFICACY AND SAFETY OF AQX-1125 FOLLOWING EXACERBATIONS IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) BY TARGETING THE SHIP1 PATHWAY

Protocol Number: AQX-1125-202

July 2014- July 2015

Expected Enrollment: 5

Actual Enrollment: 2

Principal Investigator

GlaxoSmithKline

A Randomized, Double-Dummy, Parallel Group, Multicenter Trial Comparing the Efficacy and Safety of UMEC/VI (a Fixed Combination of Umeclidinium and Vilanterol) With

Tiotropium In Subjects with COPD Who Continue To Have
Symptoms on Tiotropium
Protocol: DB2116960
Jan. 2015-Sept. 2015
Expected Enrollment: 10
Actual Enrollment: 12

Principal Investigator
Boehringer Ingelheim
Multi-center open-label expanded access program of oral nintedanib 150
mg twice daily in patients with idiopathic pulmonary fibrosis.
Protocol: 1199.177
Sept. 2014- Jun. 2015
Expected Enrollment: 2
Actual Enrollment: 3

Principal Investigator
Mylan Global
A RANDOMIZED, DOUBLE-BLIND, DOUBLE DUMMY,
PARALLEL GROUP STUDY TO DETERMINE THE LOCAL
EQUIVALENCE OF MULTIPLE DOSES OF MGR001 TO
ADVAIR® DISKUS® ADMINISTERED VIA ORAL INHALATION
IN ADULT ASTHMA PATIENTS
Protocol: MGR001-3001
Feb. 2014- Aug. 2015
Expected Enrollment: Open
Actual Enrollment: 20

Principal Investigator
GlaxoSmithKline
“A Clinical Outcomes Study to compare the effect of Fluticasone
Furoate/Vilanterol Inhalation Powder 100/25mcg with placebo on
Survival in Subjects with moderate Chronic Obstructive
Pulmonary Disease (COPD) and a history of or at increased risk
for cardiovascular disease”
Protocol: HZC113782
Jan. 2011-Sept. 2015
Expected Enrollment: Open
Actual Enrollment: 16

Principal Investigator
AstraZeneca
A Multicenter, Randomized, Double-blind, Parallel Group,
Placebo-controlled, Phase 3 Study to Evaluate the Efficacy and
Safety of Benralizumab in Adult Patients with Mild to Moderate
Persistent Asthma
Protocol: D3250C00032
Dec. 2014-Nov. 2015
Expected Enrollment: 2

Actual Enrollment: 5

Principal Investigator

Pearl Therapeutics

A Randomized, Phase IIb, Three-period, Three-treatment, Double-blind, Multi-center, Crossover Study to Evaluate the 24 hour Lung Function Profile in Subjects with Moderate to Very Severe COPD after 4 Weeks of Treatment with PT003, Open Label Spiriva® Respimat® (Tiotropium Bromide) as an Active Control, and Placebo MDI

Jan. 2015-Nov. 2015

Protocol: PT003011

Expected Enrollment: 8

Actual Enrollment: 15

Principal Investigator

Pearl Therapeutics

A Randomized, Phase IIb, Two-period, Two treatment Double-blind, Multi-center, Crossover Study to Evaluate the 24 hour Lung Function Profile in Subjects with Moderate to Very Severe COPD after 4 Weeks of Treatment with PT003 and Placebo MDI

Protocol: PT003012

Jan. 2015-Nov. 2015

Expected Enrollment: 8

Actual Enrollment: 10

Principal Investigator

Pearl Therapeutics

A Randomized, Double-Blind, Chronic Dosing (4 weeks), Four-Period, Five-treatment, Incomplete Block, Cross-Over, Multi-Center Study to Assess the efficacy and Safety of Four Doses of Budesonide Inhalation Aerosol (BD MDI, T008) Relative to Placebo MDI in Adult Subjects With Mild to Moderate persistent Asthma

Protocol PT008001

Mar. 2014-Nov. 2015

Expected Enrollment: 10

Actual Enrollment: 15

Principal Investigator

GlaxoSmithKline

Adequacy of existing COPD Patient Reported Outcome Instruments for use in Patients with Asthma COPD Overlap Syndrome

Protocol No.: GSK7074A

Apr. 2015-Dec. 2015

Expected Enrollment: Open
Actual Enrollment: 9

Principal Investigator
Roxanne Laboratories
A Randomized, Parallel-Group, Placebo-Controlled, Clinical
Endpoint Bioequivalence Study of Generic Fluticasone Propionate
100 µg and Salmeterol Xinafoate 50 µg Inhalation Powder
Compared with Advair Diskus® 100/50 in Subjects with Asthma
Protocol: FLSA-P100/50-PVCL
May 2015-Jan. 2016
Expected Enrollment: 12
Actual Enrollment: 13

Gordon Early, MD, MPH
Occupational Medicine and Medical Toxicology Consultant
1241 Boiling Springs Rd
Spartanburg, SC 29301
864-591-0992

Case Review On Ken Christian vs. SEW Eurodrive Inc.

Case 564-661257

Outside medical records reviewed:

Medical Records from:

GHS Pulmonary, GHS CT Surgery, GHS Imaging Dept., GHS inpatient notes

SFMC Pulmonary, SFMC Imaging, SFH Inpatient notes

Allergy Partners of the Upstate

Drs. Kendall and Kemmerlin PA.

Piedmont Imaging

Solder roll orders from SEW Eurodrive from 2000 to 2019

MSDS on: Soder-Wick Rosin Desoldering Braid

Rosin Flux remover pen

Mg 4900 lead free solder

Kester flux Pen 186

Flux Off

Electrosolve Contact Cleaner

Dykem remover and prep

Wacker Silicon Paste

44 Lead (Pb) Alloy Solder Wire

NC Solder Wire

Exposure History

Mr. Christian worked at SEW Eurodrive in the repair lab from approximately 2000-2016. In this job he took electrical equipment that was not functioning and repaired it. He frequently repaired the circuitry of the equipment and occasionally did soldering in this process. The repair process is outlined in more detail in other documents. Other reports are submitted as to the volume of repairs. It is reported that 3-4 units were repaired per day per worker. Not all units required soldering in their repair.

The electronic equipment that was being repaired frequently needed to be cleaned off. The cleaning process could be done in a number of different manners. It was very dirty. One of these things could have been done. Rarely was it taken to the wash booth-this was a booth where solvents were sprayed onto the board. This occurred once every few months when the equipment was very dirty. Occasionally product was taken to the parts washer and dipped into a solvent tank. This happened every week or so. Occasionally it was taken outside of the lab to the air hose and blown off with the air hose. This happened every 2-3 days. On a daily basis equipment was cleaned off with two spray can agents located inside the lab. These agent were Flux Off, a hexane solvent based cleaner. After this was used Electrosolve cleaner was used to dry the product. This product contained an iso propyl alcohol based cleaner that dried the board.

No respiratory protection was used in the cleaning process or in the soldering process.

I had the opportunity to visit the repair lab where Mr. Christian worked. It is about 25 feet by 25 feet. The ceiling is 8 feet tall. There are four workstations in the repair room. The room has three workstations with working negative pressure suction fans and one station lacked a fan. Newer suction fans were installed in 2006-7. There was no overhead fan, only local negative pressure fans.

The main soldering device used was a soldering iron. When soldering, a flux core solder wire was used. The same brand of flux core was used from 2006 to present. It was reported that in the last 5 or 10 years the lab had been using the pen type of solder to supplement the flux core. In reviewing the 4 MSDS provided on the solder used, the flux core Lead free solder is > 65% tin, 3-5% rosin, and smaller amounts of silver copper, antimony and bismuth. The 4900 lead free solder is composed of tin and silver. The 44 Lead alloy solder wire is composed of lead and tin with rosin at 1-3%. The No clean solder wire is composed of tin 94%, silver 3%, rosin 2.2% and copper 0.5%.

When soldering was required in the repair job, removal of old solder from the circuit board was sometimes required. When this was necessary, the removal process was done with a heated iron to melt the old solder. Sometimes a copper wire was used to locally heat the old solder to facilitate its removal. There was a coating on the copper wire. The MSDS for Rosin Flux remover lists isopropyl alcohol 60-80%, isopropyl alcohol 3-10%, 1-methoxy-2-propanol 1-5%. Solder Wick Remover is another product used for this purpose and it contained 90-98% copper with no other constituents listed.

Clinical History

Mr. Christian was in good respiratory health until 2013 or 2014. He then developed respiratory symptoms such as cough, shortness of breath, and impaired exercise tolerance. He was evaluated initially by the onsite nurse practitioner at SEW Eurodrive. I do not have her notes. He ultimately was referred to St Francis (SF) Pulmonary for an evaluation. Bronchoscopy on 12-30-15 revealed no clear cause for the cough. Hypersensitivity pneumonitis was entertained as a possibility in the differential diagnosis.

In the summer of 2016 he consulted Greenville Hospital System (GHS) Pulmonary. There was concern about hypersensitivity pneumonitis (HP). He was referred for open lung biopsy. The open lung biopsy revealed changes consistent with HP. He has been treated for HP. His clinical condition has deteriorated and his dyspnea has progressed. He last worked in summer, 2016.

A number of tests have been done that I would like to comment upon. GHS Pulmonary refer to a "Hypersensitivity pneumonitis panel" lab test that came back within normal limits. This most likely checked for some of the more common causes of HP by checking for antibodies to these common causes.

Allergy Partners of the Upstate did an aspergillus test in their office on 10-11-16. It appears that this was a pinprick test. It came back positive.

Drs. Kendall and Kemmerlin (Primary care physicians) list hobbies in an 8-25-15 note and they document "woodworking". This is not mentioned by other providers.

Drs. Kendall and Kemmerlin (Primary care physicians) list a family history of Mr. Christian's brother having died of "occupational lung disease" in a 9-19-14 office note. This is not mentioned by other providers.

Discussion

Multiple physicians support a diagnosis of HP. The lung biopsy was interpreted as consistent with HP. The working diagnosis for Mr. Christian's respiratory illness is HP.

HP is a disorder characterized by inflammation of the alveoli within the lung caused by hypersensitivity to inhaled organic dusts. The gradual onset of symptoms over months and years suggests that Mr. Christian has chronic HP.

Fishman's Pulmonary Disease textbook lists the most common causes of HP in the table below:

Type	Specific antigen	Exposure
Bird fancier's lung Also called bird breeder's lung, pigeon breeder's lung, and poultry worker's lung	Avian proteins	Feathers and bird droppings
<u>Bagassosis</u>	<u>Thermophilic actinomycetes</u>	Moldy bagasse (pressed sugarcane)
<i>Cephalosporium</i> HP	<u>Cephalosporium</u>	Contaminated basements (from sewage)
Cheese-washer's lung	<u>Penicillium casei</u> or <u>P. roqueforti</u>	Cheese casings
Chemical worker's lung – Isocyanate HP	<u>Toluene diisocyanate (TDI)</u> , <u>Hexamethylene diisocyanate (HDI)</u> , or <u>Methylene bisphenyl isocyanate (MDI)</u>	Paints, resins, and polyurethane foams
Chemical worker's lung^[3] – Trimellitic anhydride (TMA) HP	<u>Trimellitic anhydride</u>	Plastics, resins, and paints
Coffee worker's lung	Coffee bean protein	Coffee bean dust
Compost lung	<u>Aspergillus</u>	<u>Compost</u>

Detergent worker's disease	<u>Bacillus subtilis</u> enzymes	Detergent
Familial HP Also called Domestic HP	<u>Bacillus subtilis</u> , puffball spores	Contaminated walls
The molds		
• <u>Aspergillus</u> species		
The bacteria		
Farmer's lung	• Thermophilic actinomycetes^[13] • <u>Thermoactinomyces vulgaris</u> • <u>Saccharopolyspora rectivirgula</u> • <u>Absidia corymbifera</u> • <u>Eurotium amstelodami</u>	Moldy hay
Hot tub lung	<u>Mycobacterium avium</u> complex	Mist from <u>hot tubs</u>
The bacteria		
• <u>Thermoactinomyces candidus</u> • <u>Bacillus subtilis</u> • <u>Bacillus cereus</u>, and <u>Klebsiella oxytoca</u>; • Thermophilic actinomycetes^[13]		
Humidifier lung	The fungi	Mist generated by a machine from standing water
• <u>Aureobasidium pullulans</u>;		
The amoebae		
• <u>Naegleria gruberi</u>, • <u>Acanthamoeba polyhaga</u>, and • <u>Acanthamoeba castellanii</u>.		
Japanese summer house HP Also called Japanese summer-type HP	<u>Trichosporon cutaneum</u>	Damp wood and <u>mats</u>
Laboratory worker's lung	Male <u>rat</u> urine protein	Laboratory rats
<u>Lycoperdonosis</u>	<u>Puffball</u> spores	Spore dust from mature puffballs

Malt worker's lung	<u>Aspergillus clavatus</u>	Moldy <u>barley</u>
Maple bark disease	<u>Cryptostroma corticale</u>	Moldy <u>maple</u> bark
Metalworking fluids HP	<u>Nontuberculous mycobacteria</u>	Mist from metalworking fluids
Miller's lung	<u>Sitophilus granarius</u> (wheat weevil)	Dust-contaminated grain
Mollusc shell HP	Aquatic animal proteins	Mollusc shell dust
Mushroom worker's lung	Thermophilic actinomycetes	Mushroom compost
Peat moss worker's lung	Caused by <u>Monocillium sp.</u> and <u>Penicillium citreonigrum</u>	Peat moss
Pituitary snuff taker's lung	<u>Pituitary snuff</u>	Medication (<u>Diabetes insipidus</u>)
Potato peeler's lung	<u>Potatococcus</u> , <u>Potato skin (bacterium)</u> spp	Potato dipped in immune globulins
Sauna worker's lung	<u>Aureobasidium</u> , <u>Graphium</u> spp	Contaminated sauna water
Sequoiosis	<u>Aureobasidium</u> , <u>Graphium</u> spp	Redwood bark, sawdust
Streptomyces HP	<u>Streptomyces albus</u>	Contaminated fertilizer
<u>Suberosis</u>	<u>Penicillium glabrum</u> (formerly known as <u>Penicillium frequentans</u>)	Moldy cork dust
Tap water HP	Unknown	Contaminated tap water
Thatched roof disease	<u>Saccharomonospora viridis</u>	Dried grass
Tobacco worker's lung	<u>Aspergillus</u> spp	Moldy tobacco
Trombone Player's lung (Brass Player's Lung)	<u>Mycobacterium chelonae</u>	Various Mycobacteria inside instruments
Well-emptier's lung	<u>Wellerococcus</u> spp	Contaminated well

		water
Wine-grower's lung	<u>Botrytis cinerea</u> mold	Moldy grapes
Woodworker's lung	<u>Alternaria</u> , <u>Penicillium</u> spp	Wood pulp, dust

The list does not include the types of exposures that Mr. Christian would have in an electrical equipment repair lab. The products Mr. Christian was exposed to in soldering were primarily inorganic products. The soldering flux was inorganic. The soldering pen was inorganic. Additionally, Mr. Christian was repairing 3-4 units/day for 220 work days/year. Of these 660-880 units/year, it was estimated about half required soldering. Even if he never used his ventilation suction fan, the amount of solder fume exposure would have been rather minimal in my opinion.

I did find one case report of HP in a soldering worker. Hameed et al. report on a 42 year old worker who did an average of 6 hours a day of soldering without any protective equipment. He worked at his job for one year and developed HP symptoms presenting with shortness of breath and hypoxia. This amount of soldering is very different from what Mr. Christian experienced.

There are multiple other potential causes for Mr. Christian's HP. Allergy Partners of the Upstate was concerned enough about fungal exposure to do an Aspergillus pinprick test. This test came back positive. Aspergillus is a well-known trigger for fungal HP. It is thought to be related to HP in compost exposed workers, hay exposed workers, moldy barley exposed workers, and moldy tobacco exposed workers. This fungus is one of the most commonly known substances mediating HP. In the over 1000 pages of medical records that I reviewed, no one documents the moisture conditions in Mr. Christian's home. I am very interested in Mr. Christian's home and the possibility of water damage and/or mold contamination. Hurricane Joaquin caused historic flooding in South Carolina in 2015 and the possibility exists that Mr. Christian's home or secondary residence may have been flooded or had moisture damage.

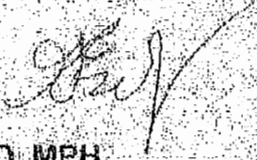
Mr. Christian is reported to have been a woodworker. Alternaria and Penicillium fungi have been known to cause HP in woodworkers via wood pulp dust. Redwood sawdust has been known to cause HP. Cedar, oak, mahogany, pine, and spruce wood dust have also been reported to cause HP. More information is needed about Mr. Christian's woodworking in the 2012-15 time period.

The lack of improvement in Mr. Christian's respiratory condition after removal from work argues against a work related causative factor for his HP. One of the characteristics of HP is that it typically gets better when removed from the trigger. If the trigger had been his work related exposures (solder, cleaning materials, and solder removal products) then he should have improved in late 2016 after removal from work. He worsened in late 2016.

Conclusion

Mr. Christian has had hypersensitivity pneumonitis that has worsened since its diagnosis in summer, 2016. It has not responded to removal from his workplace. The listed exposures in his electrical repair workshop are atypical for HP triggers and most are not documented in the medical literature. The amount of soldering done at his work was not impressive in my opinion.

The medical opinions that I reviewed who opined that he had a work related HP did not discuss his home exposures, his woodworking or his positive Aspergillus pinprick test. I think that it is more likely than not Mr. Christian's work-related exposures did not aggravate or contribute to his HP.



Gordon Early, MD, MPH

Board Eligible in Medical Toxicology and Occupational/Environmental Medicine

Past President of Carolinas Occupational Medicine

Fellow in the American College of Occupational Medicine

MPH in Epidemiology

Bibliography

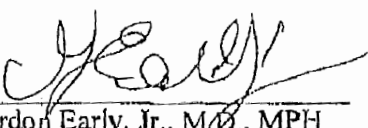
1. Enelow, RI (2008). *Fishman's Pulmonary Diseases and Disorders* (4th ed.). McGraw-Hill. pp. 1161–72
2. Dr. Raiza Hameed, Dr. Rajesh V., Dr. Melcy Cleetus, Dr. Jolsana Augustine and Dr. Divya R. .Soldering Fume Expsoure as a cause of Acute Hypersensitivity Pneumonitis. *European J of Pharmaceutical and Med Research*. 2019, 6 (4), 363-365.
3. Hypersensitivity Pneumonitis. National Institute of Health.
<https://www.nhlbi.nih.gov/health-topics/hypersensitivity-pneumonitis>
4. Gian Galeazzo Riario Sforza and Androula Marinou. Hypersensitivity pneumonitis: a complex lung disease. *Clin Mol Allergy*. 2017; 15: 6.
5. Hypersensitivity Pneumonitis. Medscape. July 24, 2018.
6. Young Jae Kim, M.D. Eu Dong Hwang, Ah Young Leem, Beo Deul Kang, Soo Yun Chang, Ho Keun Kim, In Kyu Park, Song Yee Kim, Eun Young Kim, Ji Ye Jung, Young Ae Kang, Moo Suk Park, Young Sam Kim, Se Kyu Kim, Joon Chang, Kyung Soo Chung. A Case of Occupational Hypersensitivity Pneumonitis Associated with Trichloroethylene. *Tuberc Respir Dis* . 2014 Feb; 76(2): 75–79.
7. Yves Lacasse and Yvon Cormier. Hypersensitivity pneumonitis, *Orphanet J Rare Dis*. 2006; 1: 25.

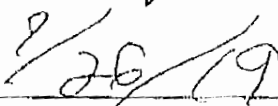
Re: Kenneth D. Christian
[REDACTED]

Is the opinion given in your report of July 26, 2019, regarding the above referenced claimant and his alleged work injury of August 25, 2016, given to a reasonable degree of medical certainty?

Yes ☒

No ☐


I. Gordon Early, Jr., M.D., MPH


Date

CURRICULUM VITAE

Gordon Early, MD, MPH, FACOEM
1241 Boiling Springs Rd
Spartanburg, SC 29303
864-591-0992
www.upstateoccmed.com

Professional Experience

Upstate Occ Med 11-98 to present

Clinical and consultative Occupational Medicine focusing on work attribution issues, toxicology consultations and Independent Medical Exams. Services have been rendered to a number of local and regional companies. Started an Occ Med clinic in 1999 and built it up to one of the major Occ Med clinics in the area. I have performed over 4000 disability related exams for the state, insurance companies and Workers' Compensation carriers since 1998.

Spartanburg Regional Healthcare System 9-96 -11-98

Helped to start a major regional Occ Med clinic for the second largest hospital system in the Upstate. Served as the senior physician in a department with 8 employees. Presented to BMW upper management in response to a RFP for a contract Occupational Health Clinic. Started the BMW Occ Med clinic serving 2000 employees and 500 contractors. Assisted BMW in achieving the second lowest OSHA 200 recordability and Workers' Comp rates in the USA among the nine major automobile manufacturers

Duke Occupational and Environmental Med Fellowship 7-94 – 6-96

Functioned as Chief Fellow and coordinator of educational activities for fellows and attendings from 6-95- 1-96. Worked with multiple projects in the NC and SC area dealing with: ergonomic program development, Indoor Air Quality, work attribution of cumulative trauma disorders, work attribution of respiratory illness after toxin exposure and ADA accommodation issues. Received scholarships for leadership in the AMA, and for research with NIOSH.

PROFESSIONAL SOCIETY MEMBERSHIPS

SC Medical Society (SCMS), ACOEM, Carolinas Occupational Medicine Association (COMA)-President (2003-4), member of SCMS (98-2003) and NCMS (1994-96) committees on Workers' Compensation Commission relations, NCMS committee on Environmental Medicine (94-96), and delegate to ACOEM National Congress (98-99)

CERTIFICATIONS AND LICENSURE

Medical Licensure

South Carolina; 18944; 9/96; active
North Carolina; 32936; 7-88; active

Board Certified/Eligible	Occ. & Env. Medicine. Preventive Med, Medical Toxicology
Specialty Society Designation	Fellow, ACOEM
President: Carolinas Occ Med Astrn, 03-4	
MRO certified (MROCC)	October, 1995
FLEX	6/87

EDUCATION AND TRAINING

Fellowship: Occupational & Environmental Med Duke Medical Center
Durham, NC. 7/94 - 6/96
Chief Fellow: July-Dec, 95.
Recipient of the 1996 **Glaxo-Wellcome**
AMA leadership award.

Public Health: University of North Carolina Chapel Hill, NC. 1994-96	MPH in Epidemiology
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Residency: Family Practice Denver, Colorado. 7/90 - 1/92 Co-Chief Resident: July-Dec, 91	Uni. of Colorado
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Internship: Charlotte Memorial Hospital Charlotte, NC. 1987-88	Internal Medicine
--	-------------------

Medical School: Chapel Hill, NC. 1983-87 Honors --third year of medical school	University of North Carolina, M.D.
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Undergraduate: Atlanta, Georgia. 1977-81	Emory University, B.S. in Biology
---	-----------------------------------

PERSONAL DOB: September 10, 1959
Hometown: Winston-Salem, NC
Marital Status: married

CLINICAL INTERESTS AND SPECIAL SKILLS

Toxicology, attribution assessments of occupational respiratory disease and occupational malignancies. Independent Medical Exams concerning work fitness issues.

Additional Consulting Experience

- US Department of Energy/Labor. 1-03 to present
Serve as one of the physician panel reviewers for the 30,000+ cases of potential toxin mediated disease among DOE employees and contractors. Was among the first physicians nominated to the program and South Carolina's only representative for the first eight months.
- American Arts and Crafts Materials Inc. 94-96
Toxicology telephone call taken for toxin related issues for all of their domestic products.
- Sara Lee (North Carolina, South Carolina, Tennessee-1996). Executive physical exam program.

- US Army through NIOSH Health Hazard Evaluation (Frederick, MD-1995). Cumulative trauma outbreak investigation.
- Takeda Inc (Cheraw, SC-1994). Ergonomic program development.

REFERENCES AND PUBLICATIONS

Available upon request.

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gearly@usa.net

AREAS OF CLINICAL EXPERTISE

- ☐ Adverse health effects from occupational and environmental exposure to toxic agents.
- ☐ Occupational asthma: attribution assessment, and apportionment
- ☐ Attribution assessment of chronic pulmonary and neurological illnesses
- ☐ Adverse health effects of compromised indoor air quality
- ☐ Heavy metal toxicity
- ☐ Chlorinated solvent toxicity
- ☐ Chemical dermatitis: attribution assessment and apportionment

Dr Early sees patients from throughout the region to evaluate and treat toxin mediated illnesses. He was South Carolina's first Board Eligible Medical Toxicologist.

Dr Early was nominated to the physician review panel for the US Department of Energy and Department of Labor's review of cases of potential toxin related illness in 1-03. He was one of the first 30 physicians nationally to be nominated. This panel deals with reviewing and certifying cases of former nuclear weapons plant employees with toxin related disease.

PRACTICE HISTORY

Medical Director (11/98-).
Special focus on medicolegal issues
in OEM, toxicology, and assessment
of work capability.

Upstate Occ Med
1241 Boiling Springs Rd
Spartanburg, SC 29303

Spartanburg Regional (9/96- 11-98).
Clinic physician and senior, contract
physician to BMW Manufacturing Inc.
Responsibilities included: clinical care at
the onsite facility and clinic policy develop-
ment,

Regional Occupational Health
8311 Abernathy Highway
Spartanburg, SC 29301

Occupational and Environmental
Medicine Fellowship (7/94-7/96).

Duke Medical Center
PO Box 2914
Durham, NC 27710

Family Practice (1/92-6/94).

Primary Care Clinic
Fitzsimmons Army Hosp, Bld 409
Aurora, CO 80045-5001

Family Practice Residency (6/90 - 1/92). Dept. of Family Med.-Uni. Of Colorado
1180 Clermont
Denver, CO 80220

General Practice (9/88-6/90). Manny Pickett, MD
8013 W. Alameda, Suite 270
Lakewood, CO 80226

Emergency Room Experience (1988-01). total of >4000 hours experience
Intermittently worked ER shifts.

CERTIFICATIONS AND LICENSURE

Medical Licensure South Carolina; 18944; 9-96; active
North Carolina; 32936; 7-88; active
Colorado; 29024; 8/88-6/17; inactive

Board Eligible Occ. & Env. Medicine, 98
Preventive Medicine, 00
Medical Toxicology, 06

Faculty Appointment Adjunct Clinical Professor USC School of
Pharmacy, 2001-2006
Via Osteopathic College, 2011-16

Specialty Society Designation Fellow in ACOEM, 1998
President: Carolinas Occ Med Astn, 03-4

MRO certified (MROCC) October, 1995

FLEX 6/87

DEA BE 1446081. Active since 1988.

EDUCATION AND TRAINING

Fellowship: Occupational & Environmental Med.
Duke Medical Center
Durham, NC. 7/94 - 6/96
Chief Fellow: July-Dec, 95.
Recipient of the 1996 **Glaxo-Wellcome**
AMA leadership award.

Public Health: MPH in Epidemiology
University of North Carolina
Chapel Hill, NC. 1994-96

Residency: Family Practice-Uni. of Colorado
Denver, Colorado. 7/90 - 1/92

Co-Chief Resident: July-Dec, 91

Internship:

Internal Medicine
Charlotte Memorial Hospital
Charlotte, NC. 1987-88

Medical School:

University of North Carolina, M.D.
Chapel Hill, NC. 1983-87
Honors--third year of medical school

Undergraduate:

Emory University, B.S. in Biology
Atlanta, Georgia. 1977-81

PERSONAL

DOB: September 10, 1959
Hometown: Winston-Salem, NC
Marital Status: married

PROFESSIONAL SOCIETY MEMBERSHIPS

SC Medical Society (SCMS).

American College of Occupational and Environmental Medicine, ACOEM. Fellow

Carolinas Occupational Medicine Association (COMA)-Past President in 2003-4.

member on SCMS (98-2002) and NCMS (94-96) committees on the Workers'

Compensation Commission

Past member on NCMS committee on Environmental Medicine

past representative to ACOEM National Congress

PUBLICATIONS

1) Issued by the Agency for Toxic Substances and Disease Registry (ATSDR): Early, IG, Greenberg, GN, et al. Medical Management Guideline: Ethylene Glycol. Final report. Dpt of Health and Human Services, ATSDR (US). Division of Toxicology, Atlanta, GA. 1997.

2) Issued by the Agency for Toxic Substances and Disease Registry (ATSDR): Early, IG, Greenberg, GN, et al. Medical Management Guideline: Sulphur Dioxide. Final report. Dpt of Health and Human Services, ATSDR (US). Division of Toxicology, Atlanta, GA. 1997.

3) Greenberg, GN, Early, IG. Letter to the Editor. Archives of Environmental Health. May-June, 1996.

4) Early, G. Fungal sensitivity in the South Carolina Governor's Mansion: a descriptive study.

J S C Med Assoc. 2006 Jun;102(5):122.

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American Board of Forensic Medicine

Board Certified in Forensic Trauma

September 12, 2019

Steve Anthony
Claim Director / Strategic Comp
A Division of Great American Insurance Group
P.O. Box 5789
Cincinnati, OH 45201

Claimant: Kenneth Christian
Date of Loss: CT 1983 through 09/23/2016
Risk: Sew-Eurodrive Inc.
Claim#: SCWCC1614297

Dear Mr. Anthony:

I have examined the file material you have sent concerning Mr. Kenneth Christian pertaining to his CT (*Continuous Trauma/exposure*) claim from what appeared to be 1983 through 2016. During this time, Mr. Christian worked for Sew-Eurodrive Inc. as a engineering technician.

Background:

Part of the activities of Mr. Christian's job description were soldering a metal which contained colophony/rosin and hydrogenated rosin. Mr. Christian believes that exposure to this solder produced his current condition which will be discussed in the body of this report as hypersensitivity interstitial pneumonitis.

Kenneth Christian

The medical records found in the file date back to 05/26/2001 when Mr. Christian was a 50-year-old male, who suffered an episode of chest pain two weeks prior which resolved spontaneously. While Mr. Christian was outdoors cutting his grass the morning of 05/26/2001 he again developed chest pain.

Mr. Christian was seen at Greenville Hospital by Dr. Head. Dr. Head documented in a report authored on that date that an EKG demonstrated an anterior wall myocardial infarction (*heart attack*). Mr. Christian was admitted and treated for an acute MI.

On 10/14/2010, Mr. Christian was seen by Dr. Siachos. Dr. Siachos documented that Mr. Christian was *"working hard, doing landscaping without any limitations."* Dr. Siachos authored another report on 11/05/2013 documenting a follow-up visit. Under the review of systems section/respiratory, there was no cough, hemoptysis, or wheezing. Thus as late as 2013, Mr. Christian did not suffer symptoms consistent with a pulmonary condition.

However, on 08/25/2015 a chest x-ray was performed due to a history of chronic cough. Said x-ray demonstrated hyperinflation suggestive of COPD. Diffuse fibrosis was also noted. This chest x-ray led to the performance of a CT scan of Mr. Christian's chest on 09/09/2015.

On 10/30/2015, Dr. Payne documented that Mr. Christian suffered a cough for years, however, said cough had worsened prior to his annual physical in the summer of 2015. Further, it was documented that Mr. Christian was diagnosed as suffering *"early interstitial pneumonitis."* The occupational exposure was thought to be metal fumes from soldering and several other chemicals. Based on the CT scan of 9/9/15, chronic bilateral interstitial lung changes were noted as well as a ground-glass appearance within the lungs. This raised question of alveolitis or pneumonitis and brought into consideration hypersensitivity interstitial pneumonitis.

On 11/06/2015, a pulmonary function study was performed. The study demonstrated a normal spirometry. However, the lung volume demonstrated a restrictive defect. Diffusion capacity was also decreased.

On 12/30/2015, a bronchoscopy was performed demonstrating a high eosinophil count in the aspirate. An Aspergillus skin test was positive, however, antibodies were negative.

Dr. Gregg authored report on 08/23/2016 documenting that Mr. Christian also demonstrated a positive skin test to mold. However, other workup noted that there was a negative ANA and hypersensitivity panel. A surgical lung biopsy was performed on 08/26/2016. Dr. McCarter indicated that the biopsy was *"highly suggestive"* of chronic hypersensitivity pneumonitis and that solder fumes were a *"possible cause."*

Dr. Greg authored report on 11/01/2016 and opined that Mr. Christian suffered pneumonitis from soldering fumes. It should be stated this was hypothesis. Mr. Christian was advised to avoid the fumes created by soldering. It was further documented that Mr. Christian was never a smoker.

Kenneth Christian

A CT scan performed on 10/13/2016 was compared to a CT scan performed on 09/09/2015 demonstrating no change in the ground-glass appearance of Mr. Christian's lungs. On 11/11/2016, another spirometry was performed with essentially the same findings as were prior noted.

There are no further records found in the file to determine Mr. Christian's current state of being.

Diagnosis:

Hypersensitivity interstitial pneumonitis unrelated to work exposure.

Summary/Conclusions:

Mr. Kenneth Christian in his CT claim believes that as he was exposed to soldering fumes throughout his work history, he (Mr. Christian) developed what was diagnosed by the treating physicians as hypersensitivity interstitial pneumonitis. When one reviews the records concerning this individual, it is noted that Mr. Christian began work at Sew-Eurodrive in 1983. While in 2001 Mr. Christian developed his first symptoms of shortness of breath, a pulmonary symptom, it should be noted that Mr. Christian's shortness of breath was secondary to an MI which Mr. Christian developed while mowing his lawn.

It was not until 2015, another 14 years later, that objective testing demonstrated a pulmonary problem which was later diagnosed as hypersensitivity interstitial pneumonitis. Thus, this individual had been exposed to the alleged antigen (soldering fumes) for approximately 30 years prior to developing objective evidence of hypersensitivity interstitial pneumonitis.

While a prolonged latency period is consistent with this disease state, 30 years is outside of the normal latency period. Further, this individual, once diagnosed by the objective studies of CT scan, bronchoscopy, and surgical biopsy, continued to be exposed to the alleged antigen (soldering fumes) and his condition on these studies did not change over time.

The bronchoscopy demonstrated eosinophils present in the fluid. Eosinophilic reaction is consistent with hypersensitivity or allergic response to an antigen. However, the only positive antigen found was Aspergillus without antibodies. This antigen/antibody profile implies that Mr. Christian had been prior exposed to Aspergillus but no longer was mounting a reaction via antibody response. This is also consistent with hypersensitivity interstitial pneumonitis secondary to Aspergillus. Mr. Christian has demonstrated a positive skin test to mold. IgG antibodies which are elevated in hypersensitivity reactions and can help to determine the cause or the antigen involved have not been performed.

Kenneth Christian

However, Mr. Christian, while he suffers hypersensitivity interstitial pneumonitis which can be secondary to many antigens has not demonstrated an antigenic reaction to the soldering mold and thus, has never demonstrated any evidence which would relate his condition to the soldering mold.

The "assumption" that this individual's condition is related to soldering is theoretical at best. Further, Mr. Christian's exposure to the theoretic antigenic cause of his condition has continued; however, failed to demonstrate any objective worsening.

Thus, in order to causally relate Mr. Christian's condition to soldering fume exposure, one must do so with most evidence to the contrary. In summary, this individual was exposed to the theoretic causal antigen for 30 years prior to developing objective findings consistent with his condition and has tested positive for other causative agents on objective serologic testing, however, never to this agent. Therefore, the medical records failed to demonstrate any evidence to any degree of medical certainty to causally relate Mr. Christian's condition to soldering fumes in work environment. There are other causes of this condition, some of which Mr. Christian has been exposed to and demonstrate objective evidence of this exposure. Therefore, as stated above, there is no substantive medical evidence to causally relate Mr. Christian's pulmonary condition to the work environment.

All opinions contained in this report are to a reasonable degree of medical certainty

If you have any further questions, please feel free to contact my office.

Sincerely,

Albert Mitsos, M.D.

Albert Mitsos, M.D.

Diplomate, ABFM, BCFT

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American Board of Forensic Medicine

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CURRICULUM VITAE OF ALBERT MITSOS, M.D.

11/16/17

BORN: **August 28, 1953, Chicago, IL**

Consultant/Expert Witness

Causation expert witness in medical malpractice,
General Liability, and Workers' Compensation
cases.

Peer review of workers' compensation and General
Liability claims.

FORENSIC EXPERIENCE:

1982-Present Experience with peer review of workers'
compensation claims, auto liability claims, and
general liability claims.

1989-present Causation Expert

2014-present Expert Witness and Causation Expert in Medical
Malpractice cases

CURRICULUM VITAE OF ALBERT MITSOS, M.D.

- 2 -

1984	Medical claims auditor Fast Motors v. Fireman's Fund Insurance Company.
1992	Medical claims auditor Olsten Corporation v. CNA Insurance Company.
1997	Medical claims auditor Eastern Airlines v. AIG Insurance Company.
1989-Present	Medical peer review of casualty claims for self insured/TPA administered and self insured/self administered corporations.
1989-Present	Casualty claims consultant to self administered corporations.
1991-Present	Teaching consultant to adjusters of self administered corporations.
1992-Present	Medical peer review and consultant to corporations of the Texas Non-subscriber programs.
1991-Present	Medical auditor of claims filed under FELA (Federal Employers' Liability Act)/Railroads
1993-Present	General Liability Expert Witness (Plaintiff and Defense).
1993-Present	Medical Malpractice (Plaintiff and Defense).

Education:

1971-1974	Louisiana State University B.S. Microbiology
1974-1977	The Chicago Medical School M.D.
1977-1982	Cook County Hospital

CURRICULUM VITAE OF ALBERT MITSOS, M.D.

- 3 -

Residency in General Surgery

MEDICAL LICENSURE

Licensure: Illinois-1978

License Number: 36-57690

Board Certifications:

American Board of Forensic Medicine

Board Certified in Forensic Traumatology

Appointments:

Quality Assurance/Utilization Review Committee
Our Lady of the Resurrection Medical Center
1985-1990

Chairman Department of Medical Records
Our Lady of the Resurrection Medical Center
1987-1990

Chief of Surgery
Our Lady of the Resurrection Medical Center
1988-1990

Medical Staff Representative
Our Lady of the Resurrection Medical Center
1988-1990

Medical Executive Committee
Our Lady of the Resurrection Medical Center
1988-1990

PAST HOSPITAL AFFILIATIONS:

1980-1983 Mercy Center Hospital
 Aurora, IL
 Emergency Room Physician

CURRICULUM VITAE OF ALBERT MITSOS, M.D.

- 4 -

1983-1985 Bethesda Hospital
 Evanston, IL
 Staff Surgeon

1983-1991 Our Lady of the Resurrection Hospital
 Chicago, IL
 Staff Surgeon
 Chief of Surgery

Albert Mitsos, M.D.
Diplomate, ABFM, ABFE, AAETS, BCFT
 5675 Port Clinton Road
 Long Grove, IL 60047
 (847) 634-2206
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American Board of Forensic Medicine
American Board of Forensic Examiners
American Academy of Experts in Traumatic Stress
Board Certified in Forensic Traumatology

Curriculum Vitae

Albert George Mitsos, M.D.

Office Address: 5675 RFD
 Long Grove, IL 60047

Direct Phone: (847) 634-2206

Location: Chicago, Illinois

Citizen: United States

Education: Louisiana State University
 1971-1974
 B.S. Microbiology

The Chicago Medical School
 1974-1977
 M.D.

Residency in General Surgery
 Cook County Hospital
 1977-1982

Licensure: Illinois-1978
 License Number: 36-57690

Board Certifications: American Board of Forensic Medicine
 American Board of Forensic Examiners
 American Academy of Experts in Traumatic Stress
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Appointments: Quality Assurance/Utilization Review Committee
Our Lady of the Resurrection Medical Center
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Chairman Department of Medical Records
Our Lady of the Resurrection Medical Center
1987-1990

Chief of Surgery
Our Lady of the Resurrection Medical Center
1988-1990

Medical Staff Representative
Our Lady of the Resurrection Medical Center
1988-1990

Medical Executive Committee
Our Lady of the Resurrection Medical Center
1988-1990

Workers' Compensation:

Experience with peer review of workers' compensation claims, auto liability claims, and general liability claims.
1982-Present

Medical peer review of casualty claims for self insured/TPA administered and self insured/self administered corporations.
1989-Present

Casualty claims consultant to self administered corporations.
1989-Present

Teaching consultant to adjusters of self administered corporations.
1991-Present

Medical peer review and consultant to corporations of the Texas Non-subscriber programs.
1992-Present

Medical auditor of claims filed under FELA (Federal Employers' Liability Act Title 45)/Railroads
1991-Present

Research and development of workers' compensation products for Iameter, Inc.
April, 1993-February, 1994

Performed IME's in Worker's Compensation
1987-Present

Published article "*Finding Pathways to Savings in Worker's Compensation*" in Managing Employee Health Benefits, Vol 4, Issue 3, Spring 1996. Article concerns financial benefits to managing contingent liability claims in worker's compensation.

Published commentary to article concerning managed care in the worker's compensation market. Guides to Managed Care 1999.

Report of:

Industrial Hygiene Sampling

SEW Eurodrive
Lyman, SC

Palmetto EHS Report No: 2017020
Submitted March 17, 2017

Prepared for:

SEW Eurodrive

Prepared By:



Palmetto EHS
www.PalmettoEHS.com

Palmetto EHS, LLC
100 Old Cherokee Rd.
Suite F, Box 163
Lexington, SC 29072
803-462-4404 (Phone)
803-462-4408 (Fax)



Palmetto EHS

www.PalmettoEHS.com

Safety • Industrial Hygiene • OSHA Compliance • Training

March 17, 2017

SEW Eurodrive
1275 Old Spartanburg Hwy
Lyman, SC 29365

Attention: Mr. Wade Blackwell

Reference: **REPORT OF INDUSTRIAL HYGIENE SAMPLING**
Palmetto EHS Report No. 2017020

Dear Mr. Blackwell

Palmetto EHS, LLC (Palmetto EHS) is pleased to provide the enclosed Industrial Hygiene Sampling report for the referenced site. The assessment was conducted on March 1, 2017. The report includes an executive summary, investigative methods, results and conclusions.

This work was performed in general conformance with Palmetto EHS Proposal Number 2017020 dated January 17, 2017. This report is provided for the sole use of SEW Eurodrive. Use of this report by any other parties will be at such party's sole risk and Palmetto EHS disclaims liability for any such use or reliance by third parties. The results presented in this report are indicative of conditions only during the time of the sampling period and of the specific areas referenced.

We appreciate the opportunity to work with you. If you have any questions concerning this report, please call us at (803) 462-4404.

Sincerely,

Palmetto EHS, LLC

Rachel Morgan, MPH, ASP
EHS Specialist



Colleen Eubanks, CIH, CSP, CET
President

Palmetto EHS, LLC | 100 Old Cherokee Rd. Suite F, Box 163
Lexington, SC 29072
803.462.4404 (Phone)
803.462.4408 (Fax)

Table of Contents

Executive Summary	4
Scope of Work	4
Materials and Methods.....	4
Chemical Sampling	4
Results and Discussion	5
Background Information	5
VOCs.....	6
Antimony, Copper, Silver, & Tin	7
Conclusion and Recommendations.....	7
APPENDIX I	8
APPENDIX II	11
APPENDIX III	14

Executive Summary

Palmetto EHS conducted industrial hygiene sampling for various chemicals at SEW Eurodrive in Lyman, SC on March 1, 2017.

The results of the chemical sampling indicated that all of the chemical samples were below the respective Permissible Exposure Limits (PELs) established by the Occupational Safety and Health Administration (OSHA), as well as below the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) and Short Term Exposure Limits (STELs).

Recommendations are provided in the "Conclusions and Recommendations" section of this report.

OSHA requires employers to notify employees of sample results within 15 days of the employer's receipt of results. We recommend using the Exposure Notification Forms (provided in Appendix II of this report) to share exposure results with employees. Employees should sign these forms and they should be maintained as a record of the notification.

Scope of Work

The purpose of the monitoring was to assess employee exposure to various chemicals at SEW Eurodrive in Lyman, SC on March 1, 2017. Samples were collected as full shift personal samples for comparison to the OSHA PELs and ACGIH TLVs. Fifteen-minute personal samples for acetone, ethanol, n-Propyl acetate, isopropyl alcohol, hexane isomers (2,3-Dimethylbutane, 2-Methylpentane, and 3-Methylpentane), methanol, and PGME were also collected for comparison to the respective ACGIH STELs.

Materials and Methods

Chemical Sampling

Air sampling for antimony, copper, silver, and tin were performed using air sampling pumps and chemical specific sampling media. Pumps were pre-calibrated and calibration was also verified after the sampling was complete. Samples were analyzed by *Galson Laboratories Inc.*, which is accredited by the American Industrial Hygiene Association (AIHA).

Air samples for acetone, ethanol, n-Propyl acetate, isopropyl alcohol, hexane isomers (2,3-Dimethylbutane, 2-Methylpentane, and 3-Methylpentane), methanol, PGME, pentane, and n-hexane were collected on Sensors Safety passive diffusion badges affixed to the employee's collar. Personal air samples were collected in the employees' breathing zones. The samples were analyzed by *Sensors Safety*, which is accredited by AIHA.

The analytical methods used are listed below.

Chemical Agent	Analytical Method
Acetone	EPA Method TO-15
Antimony	NIOSH 7300/OSHA ID 125 G
Copper	NIOSH 7300/OSHA ID 125 G
Ethanol	EPA Method TO-15
Hexane Isomers	EPA Method TO-15
Isopropyl Alcohol	EPA Method TO-15
Methanol	NIOSH 2000
1 Methoxy-2-Propanol (PGME)	EPA Method TO-15
n-Hexane	EPA Method TO-15
n-Propyl Acetate	EPA Method TO-15
Pentane	EPA Method TO-15
Silver	NIOSH 7300/OSHA ID 125 G
Tin	NIOSH 7300/OSHA ID 125 G

NIOSH = National Institute of Occupational Safety and Health
 OSHA = Occupational Safety and Health Administration

Results and Discussion

Background Information

The results of the exposure monitoring were compared to the PELs established by OSHA in 29 CFR 1910, General Industry Standard and the ACGIH TLVs. The limits for the chemical agents are as follows:

Agent	OSHA PEL	ACGIH TLV	ACGIH STEL
Acetone	1000 ppm	250 ppm	500 ppm
Antimony	0.5 mg/m ³	0.5 mg/m ³	NA
Copper	0.1 mg/m ³	0.2 mg/m ³	NA
Ethanol	1000 ppm	NA	1000 ppm
Hexane Isomers	NA	500 ppm	1000 ppm

Report: SEW Eurodrive
 Project No. 2017020
 March 17, 2017

Agent	OSHA PEL	ACGIH TLV	ACGIH STEL
Isopropyl Alcohol	400 ppm	200 ppm	400 ppm
Methanol	200 ppm	200 ppm	250 ppm
1 Methoxy-2-Propanol (PGME)	NA	100 ppm	150 ppm
n-Hexane	500 ppm	50 ppm	NA
n-Propyl Acetate	200 ppm	200 ppm	250 ppm
Pentane	1000 ppm	600 ppm	NA
Silver	0.01 mg/m ³	0.01 mg/m ³	NA
Tin	2 mg/m ³	2 mg/m ³	NA

OSHA = Occupational Safety and Health Administration ACGIH = American Conference of Governmental
 Industrial Hygienists PEL = Permissible Exposure Limit TLV = Threshold Limit Value C= Ceiling Limit
 STEL=Short Term Exposure Limit ppm = parts per million AL = Action Level

A summary of the sample results are provided as Appendix I, employee notification forms are provided as Appendix II, and analytical results from the laboratory are provided as Appendix III.

VOCs

Personal exposure monitoring was performed for acetone, ethanol, n-Propyl acetate, isopropyl alcohol, hexane isomers (2,3-Dimethylbutane, 2-Methylpentane, and 3-Methylpentane), methanol, PGME, pentane, and n-hexane on one employee working as an Electronic Repair Supervisor in the Electronics Lab on March 1, 2017. The employee was evaluating and repairing electronics during the sampling period. The employee wears personal protective equipment including safety glasses, a lab coat, steel toed shoes, and cut resistant gloves as necessary for the task. The sample results were below the respective OSHA PELs and ACGIH TLVs for acetone, ethanol, n-Propyl acetate, isopropyl alcohol, hexane isomers (2,3-Dimethylbutane, 2-Methylpentane, and 3-Methylpentane), methanol, PGME, pentane, and n-hexane on the day of the sampling.

Fifteen minute samples were also collected for acetone, ethanol, n-Propyl acetate, isopropyl alcohol, hexane isomers (2,3-Dimethylbutane, 2-Methylpentane, and 3-Methylpentane), methanol, and PGME for comparison to the respective ACGIH STELs. During the STEL sampling period, the employee was soldering on a circuit board/desoldering a transformer. The sample results were below the respective ACGIH STELs.

Antimony, Copper, Silver, & Tin

Personal exposure monitoring was performed for antimony, copper, silver, and tin on one employee working as an Electronic Repair Supervisor in the Electronics Lab on March 1, 2017. The employee was evaluating and repairing electronics during the sampling period. The employee wears personal protective equipment including safety glasses, a lab coat, steel toed shoes, and cut resistant gloves as necessary for the task. The sample results were below the respective OSHA PELs and ACGIH TLVs for antimony, copper, silver, and tin on the day of the sampling.

Conclusion and Recommendations

The results of the monitoring indicate the following:

- The results of the chemical sampling indicated that all of the chemical samples were below the respective OSHA PELs, ACGIH TLVs, and ACGIH STELs.
- OSHA requires employers to notify employees of sample results within 15 days of the employer's receipt of results.
 - o We recommend using the Exposure Notification Forms (provided in Appendix II of this report) to share exposure results with employees. Employees should sign these forms and they should be maintained as a record of the notification.

Report: SEW Eurodrive
Project No. 2017020
March 17, 2017

APPENDIX I

Summary of Monitoring Results

Report: SEW Eurodrive
 Project No. 2017020
 March 17, 2017

Date	Area/Position	Sample No.	Employee	Time (Min.)	Agent	Result (TWA)	OSHA PEL	ACGIH TLV
Acetone								
3/1/17	Field Blank	714A1	---	---	Acetone	---	1000 ppm	250 ppm TWA 500 ppm STEL
3/1/17	Electronics Lab	715A1 TWA	Garrett Cheek	420	Acetone	0.65 ppm	1000 ppm	250 ppm TWA
3/1/17	Electronics Lab	716A1 STEL	Garrett Cheek	15	Acetone	12.4 ppm	NA	500 ppm STEL
Antimony								
3/1/17	Field Blank	M-1	---	---	Antimony	---	0.5 mg/m ³	0.5 mg/m ³
3/1/17	Electronics Lab	M-2	Garrett Cheek	420	Antimony	LDL	0.5 mg/m ³	0.5 mg/m ³
Copper								
3/1/17	Field Blank	M-1	---	---	Copper	---	0.1 mg/m ³	0.2 mg/m ³
3/1/17	Electronics Lab	M-2	Garrett Cheek	420	Copper	LDL	0.1 mg/m ³	0.2 mg/m ³
Ethanol								
3/1/17	Field Blank	714A1	---	---	Ethanol	---	1000 ppm	1000 ppm STEL
3/1/17	Electronics Lab	715A1 TWA	Garrett Cheek	420	Ethanol	0.16 ppm	1000 ppm	NA
3/1/17	Electronics Lab	716A1 STEL	Garrett Cheek	15	Ethanol	LDL	NA	1000 ppm STEL
Hexane Isomers								
3/1/17	Field Blank	714A1	---	---	2,3-Dimethylbutane 2-Methylpentane 3-Methylpentane	---	NA	500 ppm TWA 1000 ppm STEL
3/1/17	Electronics Lab	715A1 TWA	Garrett Cheek	420	2,3-Dimethylbutane 2-Methylpentane 3-Methylpentane	0.30 ppm 1.75 ppm 0.29 ppm	NA	500 ppm 500 ppm 500 ppm
3/1/17	Electronics Lab	716A1 STEL	Garrett Cheek	15	2,3-Dimethylbutane 2-Methylpentane 3-Methylpentane	4.3 ppm 23.6 ppm 3.9 ppm	NA	1000 ppm 1000 ppm 1000 ppm
Isopropyl Alcohol								
3/1/17	Field Blank	714A1	---	---	Isopropyl Alcohol	---	400 ppm	200 ppm TWA 400 ppm STEL
3/1/17	Electronics Lab	715A1 TWA	Garrett Cheek	420	Isopropyl Alcohol	LDL	400 ppm	200 ppm TWA
3/1/17	Electronics Lab	716A1 STEL	Garrett Cheek	15	Isopropyl Alcohol	LDL	NA	400 ppm STEL
Methanol								

Report: SEW Eurodrive
 Project No. 2017020
 March 17, 2017

3/1/17	Field Blank	595A1	—	—	Methanol	—	200 ppm	200 ppm TWA 250 ppm STEL
3/1/17	Electronics Lab	593A1 TWA	Garrett Cheek	420	Methanol	LDL	200 ppm	200 ppm TWA
3/1/17	Electronics Lab	594A1 STEL	Garrett Cheek	15	Methanol	LDL	NA	250 ppm STEL
1-Methoxy-2-Propanol (PGME)								
3/1/17	Field Blank	714A1	—	—	1-Methoxy-2-Propanol	—	NA	100 ppm TWA 150 ppm STEL
3/1/17	Electronics Lab	715A1 TWA	Garrett Cheek	420	1-Methoxy-2-Propanol	LDL	NA	100 ppm TWA
3/1/17	Electronics Lab	716A1 STEL	Garrett Cheek	15	1-Methoxy-2-Propanol	LDL	NA	150 ppm STEL
n-Hexane								
3/1/17	Field Blank	714A1	—	—	n-Hexane	—	500 ppm	50 ppm
3/1/17	Electronics Lab	715A1	Garrett Cheek	420	n-Hexane	LDL	500 ppm	50 ppm
N-Propyl Acetate								
3/1/17	Field Blank	714A1	—	—	N-Propyl Acetate	—	200 ppm	200 ppm TWA 250 ppm STEL
3/1/17	Electronics Lab	715A1 TWA	Garrett Cheek	420	N-Propyl Acetate	LDL	200 ppm	200 ppm TWA
3/1/17	Electronics Lab	716A1 STEL	Garrett Cheek	15	N-Propyl Acetate	LDL	NA	250 ppm STEL
Pentane								
3/1/17	Field Blank	714A1	—	—	Pentane	—	1000 ppm	600 ppm
3/1/17	Electronics Lab	715A1	Garrett Cheek	420	Pentane	LDL	1000 ppm	600 ppm
Silver								
3/1/17	Field Blank	M-1	—	—	Silver	—	0.01 mg/m ³	0.01 mg/m ³
3/1/17	Electronics Lab	M-2	Garrett Cheek	420	Silver	LDL	0.01 mg/m ³	0.01 mg/m ³
Tin								
3/1/17	Field Blank	M-1	—	—	Tin	—	2 mg/m ³	2 mg/m ³
3/1/17	Electronics Lab	M-2	Garrett Cheek	420	Tin	LDL	2 mg/m ³	2 mg/m ³

Report: SEW Eurodrive
Project No. 2017020
March 17, 2017

APPENDIX II

Employee Exposure Notification Forms

Report: SEW Eurodrive
 Project No. 2017020
 March 17, 2017

EMPLOYEE EXPOSURE NOTIFICATION FORM

Employee: Garrett Cheek

Employer: SEW Eurodrive

Location/Task: Electronics Lab

The results of your exposure evaluation performed by Palmetto EHS are provided below. The results indicate exposure below all of the regulatory limits. Your cooperation was greatly appreciated. If you have any questions concerning your results, please contact your supervisor or the Safety Department.

Date	Agent	Result	OSHA PEL	ACGIH TLV
3/1/17	Acetone TWA	0.65 ppm	1000 ppm	250 ppm
3/1/17	Acetone STEL	12.4 ppm	NA	500 ppm
3/1/17	Antimony	LDL	0.5 mg/m ³	0.5 mg/m ³
3/1/17	Copper	LDL	0.1 mg/m ³	0.2 mg/m ³
3/1/17	Ethanol TWA	0.16 ppm	1000 ppm	NA
3/1/17	Ethanol STEL	LDL	NA	1000 ppm
3/1/17	2,3-Dimethylbutane TWA	0.30 ppm	NA	500 ppm
3/1/17	2,3-Dimethylbutane STEL	4.3 ppm	NA	1000 ppm
3/1/17	2-Methylpentane TWA	1.75 ppm	NA	500 ppm
3/1/17	2-Methylpentane STEL	23.6 ppm	NA	1000 ppm
3/1/17	3-Methylpentane TWA	0.29 ppm	NA	500 ppm
3/1/17	3-Methylpentane STEL	3.9 ppm	NA	1000 ppm
3/1/17	Isopropyl Alcohol TWA	LDL	400 ppm	200 ppm
3/1/17	Isopropyl Alcohol STEL	LDL	NA	400 ppm
3/1/17	Methanol TWA	LDL	200 ppm	200 ppm
3/1/17	Methanol STEL	LDL	NA	250 ppm
3/1/17	1-Methoxy-2-Propanol TWA	LDL	NA	100 ppm
3/1/17	1-Methoxy-2-Propanol STEL	LDL	NA	150 ppm
3/1/17	n-Hexane	LDL	500 ppm	50 ppm
3/1/17	n-Propyl Acetate TWA	LDL	200 ppm	200 ppm
3/1/17	n-Propyl Acetate STEL	LDL	NA	250 ppm

Report: SEW Eurodrive

Project No. 2017020

March 17, 2017

Date	Agent	Result	OSHA PEL	ACGIH TLV
3/1/17	Pentane	LDL	1000 ppm	600 ppm
3/1/17	Silver	LDL	0.01 mg/m ³	0.01 mg/m ³
3/1/17	Tin	LDL	2 mg/m ³	2 mg/m ³

Note 1: C = Ceiling Limit
Note 2: TWA = 8-hour Time Weighted Average
Note 3: OSHA = Occupational Safety and Health Administration
Note 4: NA = Not Applicable
Note 5: LDL = Less than detectable limit
Note 6: PEL = Permissible Exposure Limit
Note 7: ACGIH = American Conference of Governmental Industrial Hygienists
Note 8: TLV = Threshold Limit Value
Note 9: ppm = parts per million
Note 10: STEL = Short Term Exposure Limit
Note 11: mg/m³ = milligrams per cubic meter

Employee Signature

Date

Report: SEW Eurodrive
Project No. 2017020
March 17, 2017

APPENDIX III

Analytical Results

Ms. Colleen Eubanks
Palmetto EHS
100 Old Cherokee Rd
Suite F #163
Lexington, SC 29072

March 08, 2017

DOH ELAP #11626
AIHA-LAP #100324

Account# 22560

Login# L400195

Dear Ms. Eubanks:

Enclosed are the analytical results for the samples received by our laboratory on March 02, 2017. All test results meet the quality control requirements of AIHA-LAP and NELAC unless otherwise stated in this report. All samples on the chain of custody were received in good condition unless otherwise noted.

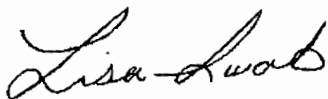
Results in this report are based on the sampling data provided by the client and refer only to the samples as they were received at the laboratory. Unless otherwise requested, all samples will be discarded 14 days from the date of this report, with the exception of IOMs, which will be cleaned and disposed of after seven calendar days.

Current Scopes of Accreditation can be viewed at www.galsonlabs.com in the accreditations section under the "about Galson" tab.

Please contact John Bailey at (888) 432-5227, if you would like any additional information regarding this report. Thank you for using SGS Galson Laboratories.

Sincerely,

SGS Galson Laboratories



Lisa Swab
Laboratory Director

Enclosure(s)

Galson Laboratories, Inc. is now a part of SGS, the world's leading inspection, verification, testing, and certification company. As part of our transition to SGS, you will begin to see some formatting changes with reports that will improve the presentation of data and allow for the transition to the new logo.



GALSON

LABORATORY ANALYSIS REPORT

6601 Kirkville Road
East Syracuse, NY 13057
(315) 432-5227
FAX: (315) 437-0571
www.galsonlabs.com

Client : Palmetto EHS
Site : SEW Eurodrive
Project No. : 2017020
Date Sampled : 01-MAR-17
Date Received : 02-MAR-17

Account No.: 22560
Login No. : L400195
Date Analyzed : 06-MAR-17
Report ID : 984413

Client ID : M-1 Lab ID : L400195-1\$@ Air Volume : NA
Date Sampled : 03/01/17 Date Analyzed : 03/06/17

Parameter	LOQ ug	Total ug	Conc	Units
Antimony	0.90	<0.90	NA	mg/m3
Copper	0.30	<0.30	NA	mg/m3
Silver	0.30	<0.30	NA	mg/m3
Tin	3.0	<3.0	NA	mg/m3

COMMENTS: Please see attached lab footnote report for any applicable footnotes.

Collection Media: MCE MW 37mm Submitted by: SJW/JMR Approved by: JMR
Date : 07-MAR-17 NYS DOH # : 11626 Supervisor: KEG QC by: MLN

< -Less Than mg -Milligrams m3 -Cubic Meters kg -Kilograms NA -Not Applicable ND -Not Detected
> -Greater Than ug -Micrograms l -Liters NS -Not Specified ppm -Parts per Million LOQ-Limit of Quantitation



GALSON

LABORATORY ANALYSIS REPORT

6601 Kirkville Road
East Syracuse, NY 13057
(315) 432-5227
FAX: (315) 437-0571
www.galsonlabs.com

Client : Palmetto EHS
Site : SEW Eurodrive
Project No. : 2017020
Date Sampled : 01-MAR-17
Date Received : 02-MAR-17

Account No.: 22560
Login No. : L400195
Date Analyzed : 06-MAR-17
Report ID : 984413

Client ID : M-2
Date Sampled : 03/01/17

Lab ID : L400195-2\$@ Air Volume : 840 L
Date Analyzed : 03/06/17

Parameter	LOQ ug	Total ug	Conc	Units
Antimony	0.90	<0.90	<0.0011	mg/m3
Copper	0.30	<0.30	<0.00036	mg/m3
Silver	0.30	<0.30	<0.00036	mg/m3
Tin	3.0	<3.0	<0.0036	mg/m3

COMMENTS: Please see attached lab footnote report for any applicable footnotes.

Collection Media: MCE MW 37mm
Date : 07-MAR-17

Submitted by: SJW/JMR
NYS DOH # : 11626

Approved by: JMR
Supervisor: KEG QC by: MLN

< -Less Than mg -Milligrams m3 -Cubic Meters kg -Kilograms NA -Not Applicable ND -Not Detected
> -Greater Than ug -Micrograms l -Liters NS -Not Specified ppm -Parts per Million LOQ-Limit of Quantitation



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LABORATORY FOOTNOTE REPORT

6601 Kirkville Road
East Syracuse, NY 13057
(315) 432-5227
FAX: (315) 437-0571
www.galsonlabs.com

Client Name : Palmetto EHS
Site : SEW Eurodrive
Project No. : 2017020

Date Sampled : 01-MAR-17
Date Received: 02-MAR-17
Date Analyzed: 06-MAR-17

Account No.: 22560
Login No. : L400195

This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Unless otherwise noted below, all quality control results associated with the samples were within established control limits or did not impact reported results.

Note: The findings recorded within this report were drawn from analysis of the sample(s) provided to the laboratory by the Client (or a third party acting at the Client's direction). The laboratory does not have control over the sampling process. The findings herein constitute no warranty of the samples' representativeness of any sampled environment and strictly relate to the samples as they were presented to the laboratory.

Unrounded results are carried through the calculations that yield the final result and the final result is rounded to the number of significant figures appropriate to the accuracy of the analytical method. Please note that results appearing in the columns preceding the final result column may have been rounded and therefore, if carried through the calculations, may not yield an identical final result to the one reported.

The stated LOQs for each analyte represent the demonstrated LOQ concentrations prior to correction for desorption efficiency (if applicable).

Unless otherwise noted below, reported results have not been blank corrected for any field blank or method blank.

L400195 (Report ID: 984413):

Reported results reflect elemental analysis of the requested metals. Certain compounds may not be solubilized during digestion, resulting in data that is biased low.
SOPs: MT-SOP-9(31), im-mwvfilt(27)
OSHA PEL: Copper dust and mist = 1 mg/m³; Copper fume = 0.1 mg/m³

EL400195 (Report ID: 984413):

Due to different digestion requirements, silver and tin should be collected on a separate filter. Results for silver and tin may be biased low.

SL400195-1-2 (Report ID: 984413):

Four out of four blank spikes recovered below control limits (86.6 to 112%) at 82.1-84.2% for Antimony. Sample data for Antimony may be biased low.

< -Less Than	mg -Milligrams	m ³ -Cubic Meters	kg -Kilograms	ppm -Parts per Million	
> -Greater Than	ug -Micrograms	l -Liters	NS -Not Specified	ND -Not Detected	NA -Not Applicable



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East Syracuse, NY 13057
(315) 432-5227
FAX: (315) 437-0571
www.galsonlabs.com

Client Name : Palmetto EHS
Site : SEW Eurodrive
Project No. : 2017020

Date Sampled : 01-MAR-17
Date Received: 02-MAR-17
Date Analyzed: 06-MAR-17

Account No.: 22560
Login No. : L400195

Accuracy and mean recovery data presented below is based on a 95% confidence interval ($k=2$). The estimated accuracy applies to the media, technology, and SOP referenced in this report and does not account for the uncertainty associated with the sampling process. The accuracy is based solely on spike recovery data from internal quality control samples. Where N/A appears below, insufficient data is available to provide statistical accuracy and mean recovery values for the associated analyte.

Parameter	Accuracy	Mean Recovery
Antimony	+/-8.4%	99.1%
Copper	+/-9.6%	103%
Silver	+/-7.8%	104%
Tin	+/-5.8%	100%

Parameter	Method	PEL
Antimony	mod. NIOSH 7300/mod. OSHA ID-125G; ICP/I	0.5 mg/m3 (TWA)
Copper	mod. NIOSH 7300/mod. OSHA ID-125G; ICP/I	Varies, see footnote
Silver	mod. NIOSH 7300/mod. OSHA ID-125G; ICP/I	0.01 mg/m3 (TWA)
Tin	mod. NIOSH 7300/mod. OSHA ID-125G; ICP/I	2 mg/m3 (TWA)

< -Less Than	mg -Milligrams	m3 -Cubic Meters	kg -Kilograms	ppm -Parts per Million	
> -Greater Than	ug -Micrograms	l -Liters	NS -Not Specified	ND -Not Detected	NA -Not Applicable



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6003 Chapel Hill Road, Suite 117 Raleigh, NC 27607 919-278-7737
www.SensorsSafety.com

METHYL ALCOHOL PERSONAL MONITORING BADGE

Laboratory Analysis Report

Badge No.: 593A1

Date Received: 3/2/2017

Facility Information:

SEW Eurodrive
Palmetto EHS
100 Old Cherokee Rd. Suite F #163
Lexington, South Carolina 29072

803-260-3202

Exposure Information:

Date of Exposure: 3/1/2017

Start Time: 08:30:00 AM Stop Time: 03:30:00 PM

Total Time Worn: 7 hours, 0 minutes

Report Date: 3/9/2017

Analysis Date: 3/7/2017

Employee Information:

Employee: Garrett Cheek

Job Title: Electronic Lab Supervisor

Work Area: Electronics

Protective Devices Worn:

N/A

Duties Performed During Monitoring:

N/A

This Laboratory Analysis Report was reviewed with me by my Supervisor on this date:

Employee Signature

Date

Results of Laboratory Analysis

Actual: <0.7 ppm

Time Weighted Average based on Actual time badge was worn

Reviewed by:

J. Bousquet
Jessica Bousquet, Lab Director

Results are not corrected by "blank" samples.

Condition of badge upon receipt: OK

Results given are based on information provided by the customer and are only for items tested.

Monitoring Compliance Information

OSHA: 200 ppm 8 hour TWA

Ref: 29 CFR 1910.1000 "Air Contaminants Z-1 Table"

NIOSH: 250 ppm 15 minute STEL

Monitoring Badge Performance Characteristics

Method of Sample Collection: Sample is collected by diffusion onto a Activated Solid Adsorbent

Method of Sample Analysis: Gas Chromatography; NIOSH Method 2000 with diffusive sampler-ACS SOP II-82

Analysis performed by Advanced Chemical Sensors, Accredited Lab in the U.S.

Employee Notification

Employers are required to notify employees of exposures to hazardous agents within 15 calendar days following the receipt of the monitoring results



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METHYL ALCOHOL PERSONAL MONITORING BADGE

Laboratory Analysis Report

Badge No.: 594A1

Date Received: 3/2/2017

Facility Information:

SEW Eurodrive
Palmetto EHS
100 Old Cherokee Rd. Suite F #163
Lexington, South Carolina 29072

803-260-3202

Exposure Information:

Date of Exposure: 3/1/2017
Start Time: 11:01:00 AM Stop Time: 11:16:00 AM
Total Time Worn: 0 hours, 15 minutes

Report Date: 3/9/2017

Analysis Date: 3/7/2017

Employee Information:

Employee: Garrett Cheek
Job Title: Electronic Lab Supervisor
Work Area: Electronics
Protective Devices Worn:

N/A

Duties Performed During Monitoring:

N/A

This Laboratory Analysis Report was reviewed with me by my Supervisor on this date:

Employee Signature

Date

Results of Laboratory Analysis

15 minute STEL: <23.0 ppm

Short Term Exposure Limit based on 15 minute exposure

Reviewed by:

J. Bousquet
Jessica Bousquet, Lab Director

Results are not corrected by "blank" samples.

Condition of badge upon receipt: OK

Results given are based on information provided by the customer and are only for items tested.

Monitoring Compliance Information

OSHA: 200 ppm 8 hour TWA
Ref: 29 CFR 1910.1000 "Air Contaminants Z-1 Table"
NIOSH: 250 ppm 15 minute STEL

Monitoring Badge Performance Characteristics

Method of Sample Collection: Sample is collected by diffusion onto a Activated Solid Adsorbent
Method of Sample Analysis: Gas Chromatography; NIOSH Method 2000 with diffusive sampler-ACS SOP II-82

Analysis performed by Advanced Chemical Sensors, Accredited Lab in the U.S.

Employee Notification

Employers are required to notify employees of exposures to hazardous agents within 15 calendar days following the receipt of the monitoring results



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ORGANIC VAPORS PERSONAL MONITORING BADGE

Laboratory Analysis Report

Badge No.: 714A1

Date Received: 3/2/2017

Facility Information:

SEW Eurodrive
Palmetto EHS
100 Old Cherokee Rd. Suite F #163
Lexington, South Carolina 29072

803-260-3202

Exposure Information:

Date of Exposure: 3/1/2017
Start Time: N/A Stop Time: N/A
Total Time Worn: N/A

Report Date: 3/16/2017

Analysis Date: 3/9/2017

Employee Information:

Employee: Field Blank
Job Title: N/A
Work Area: N/A
Protective Devices Worn:
N/A

Duties Performed During Monitoring:
N/A

This Laboratory Analysis Report was reviewed with me by
my Supervisor on this date:

Employee Signature

Date

Results of Laboratory Analysis**8-hour TWA**

Acetone: <0.1 ppm

Ethanol: <0.1 ppm

n-Propyl Acetate: <0.05 ppm

Isopropanol: <0.1 ppm

2,3-Dimethylbutane: <0.1 ppm

2-Methylpentane: <0.1 ppm

3-Methylpentane: <0.1 ppm

1 Methoxy-2 Propanol: <0.1 ppm

Pentane: <0.1 ppm

n-Hexane: <0.1 ppm

Time Weighted Average based on 8 hour exposure

Reviewed by:

J. Bousquet
Jessica Bousquet, Lab Director

Results are not corrected by "blank" samples.

Condition of badge upon receipt: Blank analyzed for 8 hours

Results given are based on information provided by the customer and are only for items tested.

Monitoring Badge Performance Characteristics

Method of Sample Collection: Sample is collected by diffusion onto a Physically Activated Solid
Adsorbent Method of Sample Analysis: Gas Chromatography; EPA Method TO-15

Analysis performed by Advanced Chemical Sensors, Accredited Lab in the U.S.

Employee Notification

Employers are required to notify employees of exposures to hazardous agents within
15 calendar days following the receipt of the monitoring results



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ORGANIC VAPORS PERSONAL MONITORING BADGE

Laboratory Analysis Report

Badge No.: 715A1

Date Received: 3/2/2017

Facility Information:

SEW Eurodrive
Palmetto EHS
100 Old Cherokee Rd. Suite F #163
Lexington, South Carolina 29072

803-260-3202

Exposure Information:

Date of Exposure: 3/1/2017

Start Time: 08:30:00 AM Stop Time: 03:30:00 PM

Total Time Worn: 7 hours, 0 minutes

Report Date: 3/16/2017

Analysis Date: 3/9/2017

Employee Information:

Employee: Garrett Cheek

Job Title: Electronic Lab Supervisor

Work Area: Electronics

Protective Devices Worn:

N/A

Duties Performed During Monitoring:

N/A

This Laboratory Analysis Report was reviewed with me by my Supervisor on this date:

Employee Signature

Date

Results of Laboratory Analysis**Actual**

Acetone: 0.74 ppm

Ethanol: 0.18 ppm

n-Propyl Acetate: <0.05 ppm

Isopropanol: <0.1 ppm

2,3-Dimethylbutane: 0.34 ppm

2-Methylpentane: 2.0 ppm

3-Methylpentane: 0.33 ppm

1 Methoxy-2 Propanol: <0.1 ppm

Pentane: <0.1 ppm

n-Hexane: <0.1 ppm

Time Weighted Average based on Actual time badge was worn

Reviewed by:

J. Bousquet
Jessica Bousquet, Lab Director

Results are not corrected by "blank" samples.

Condition of badge upon receipt: OK

Results given are based on information provided by the customer and are only for items tested.

Monitoring Badge Performance Characteristics

Method of Sample Collection: Sample is collected by diffusion onto a Physically Activated Solid

Adsorbent Method of Sample Analysis: Gas Chromatography; EPA Method TO-15

Analysis performed by Advanced Chemical Sensors, Accredited Lab in the U.S.

Employee Notification

Employers are required to notify employees of exposures to hazardous agents within 15 calendar days following the receipt of the monitoring results



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ORGANIC VAPORS PERSONAL MONITORING BADGE

Laboratory Analysis Report

Badge No.: 716A1

Date Received: 3/2/2017

Facility Information:

SEW Eurodrive
Palmetto EHS
100 Old Cherokee Rd. Suite F #163
Lexington, South Carolina 29072

803-260-3202

Exposure Information:

Date of Exposure: 3/1/2017

Start Time: 11:01:00 AM Stop Time: 11:16:00 AM

Total Time Worn: 0 hours, 15 minutes

Report Date: 3/16/2017

Analysis Date: 3/9/2017

Employee Information:

Employee: Garrett Cheek
Job Title: Electronic Lab Supervisor
Work Area: Electronics
Protective Devices Worn:
N/A

Duties Performed During Monitoring:

N/A

This Laboratory Analysis Report was reviewed with me by my Supervisor on this date:

Employee Signature

Date

Results of Laboratory Analysis**15 minute STEL**

Acetone: 12.4 ppm

Ethanol: <3.2 ppm

n-Propyl Acetate: <1.6 ppm

Isopropanol: <3.2 ppm

2,3-Dimethylbutane: 4.3 ppm

2-Methylpentane: 23.6 ppm

3-Methylpentane: 3.9 ppm

1 Methoxy-2 Propanol: <3.2 ppm

Pentane: <3.2 ppm

n-Hexane: <3.2 ppm

Short Term Exposure Limit based on 15 minute exposure

Reviewed by:

J. Bousquet
Jessica Bousquet, Lab Director

Results are not corrected by "blank" samples.

Condition of badge upon receipt: OK

Results given are based on information provided by the customer and are only for items tested.

Monitoring Badge Performance Characteristics

Method of Sample Collection: Sample is collected by diffusion onto a Physically Activated Solid

Adsorbent Method of Sample Analysis: Gas Chromatography; EPA Method TO-15

Analysis performed by Advanced Chemical Sensors, Accredited Lab in the U.S.

Employee Notification

Employers are required to notify employees of exposures to hazardous agents within 15 calendar days following the receipt of the monitoring results



SAFETY DATA SHEET

Issuing Date 16-May-2014

Revision Date 05-Aug-2016

Revision Number 2

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

GHS product identifier

Product Name Dykem Remover and Prep Aerosol

Other means of identification

Part Number 82038

Formula Code 8947A

Synonyms None

Recommended use of the chemical and restrictions on use

Recommended Use Remover & Cleaner, Aerosol

Uses advised against No information available

Supplier's details

Supplier Address
ITW PRO BRANDS
805 E. Old 56 Highway
Olathe, KS 66061
TEL: 1-800-443-9536

Emergency telephone number

Emergency Telephone Number 800-535-5053 Infotrac

2. HAZARDS IDENTIFICATION

Classification

This chemical is considered hazardous according to the OSHA Hazard Communication Standard 2012 (29 CFR 1910.1200).

Serious Eye Damage/Eye Irritation	Category 2
Specific Target Organ Systemic Toxicity (Single Exposure)	Category 3
Flammable aerosols	Category 1
Gases under pressure	Compressed gas

GHS Label elements, including precautionary statements

Emergency Overview

Signal Word**Danger****Hazard Statements**

- Causes serious eye irritation
- May cause drowsiness or dizziness
- Extremely flammable aerosol
- Contains gas under pressure; may explode if heated



Appearance Clear, Cloudy White,
Colorless.

Physical State Aerosol.

Odor Sweet, Solvent.

Precautionary Statements**Prevention**

- Wash face, hands and any exposed skin thoroughly after handling.
- Wear eye/face protection.
- Avoid breathing dust/fume/gas/mist/vapors/spray.
- Use only outdoors or in a well-ventilated area.
- Keep away from heat/sparks/open flames/hot surfaces - No smoking.
- Do not spray on an open flame or other ignition source
- Pressurized container: Do not pierce or burn, even after use.

General Advice

- None

Eyes

- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- If eye irritation persists: Get medical advice/attention.

Inhalation

- IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
- Call a POISON CENTER or doctor/physician if you feel unwell.

Storage

- Store in a well-ventilated place. Keep container tightly closed.
- Store locked up.
- Protect from sunlight. Do not expose to temperatures exceeding 50 °C/122 °F
- Protect from sunlight

Disposal

- Dispose of contents/container to an approved waste disposal plant.

Hazard Not Otherwise Classified (HNOC)

Not applicable.

Other information

0% of the mixture consists of ingredient(s) of unknown toxicity.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS-No	Weight %	Trade secret
Acetone	67-64-1	30-60	*
Ethanol	64-17-5	10-30	*
Petroleum gases, liquified, sweetened	68476-86-8	10-30	*
n-Propyl acetate	109-60-4	1-5	*
Isopropyl alcohol	67-63-0	1-5	*

*The exact percentage (concentration) of composition has been withheld as a trade secret

4. FIRST AID MEASURES

Description of necessary first-aid measures

General Advice	Show this safety data sheet to the doctor in attendance. If symptoms persist, call a physician.
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Remove contact lenses, if applicable, and continue flushing. Keep eye wide open while rinsing. If symptoms persist, call a physician.
Skin Contact	Wash off immediately with plenty of water. If skin irritation persists, call a physician. Clothing frozen to the skin should be thawed before being removed.
Inhalation	Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. If symptoms persist, call a physician.
Ingestion	Rinse mouth. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Drink plenty of water. Consult a physician if necessary.
Protection of First-aiders	Use personal protective equipment. Remove all sources of ignition.

Most important symptoms/effects, acute and delayed

Most Important Symptoms/Effects Eye irritation/reactions. Drowsiness. Dizziness.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to Physician Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media

Carbon dioxide (CO₂). Dry chemical. Alcohol-resistant foam.

Unsuitable Extinguishing Media No information available.

Specific Hazards Arising from the Chemical

Flammable. Flash back possible over considerable distance. Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks). Ruptured cylinders may rocket.

Explosion Data

Sensitivity to Mechanical Impact	None.
Sensitivity to Static Discharge	Yes.

Protective Equipment and Precautions for Firefighters

In the event of fire and/or explosion do not breathe fumes

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal Precautions Evacuate personnel to safe areas. Use personal protective equipment. Ensure adequate ventilation. Remove all sources of ignition. Keep people away from and upwind of spill/leak. Take precautionary measures against static discharges. Pay attention to flashback. Contents under pressure

Environmental Precautions

Environmental Precautions Prevent further leakage or spillage if safe to do so. Prevent product from entering drains. Do not flush into surface water or sanitary sewer system.

Methods and materials for containment and cleaning up

Methods for Containment Prevent further leakage or spillage if safe to do so

Methods for Cleaning Up Take up with sand or other noncombustible absorbent material and place into containers for later disposal

7. HANDLING AND STORAGE

Precautions for safe handling

Handling Wear personal protective equipment. Avoid contact with skin, eyes and clothing. Keep away from open flames, hot surfaces and sources of ignition. Take precautionary measures against static discharges. Use only in an area containing flame proof equipment. Do not breathe vapors or spray mist. Ensure adequate ventilation. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded. Use only in area provided with appropriate exhaust ventilation. Do not eat, drink or smoke when using this product. Contents under pressure. Empty containers pose a potential fire and explosion hazard. Do not cut, puncture or weld containers.

Conditions for safe storage, including any incompatibilities

Storage Keep containers tightly closed in a cool, well-ventilated place. Keep away from heat and sources of ignition. Keep out of the reach of children. Do not store above 49°C / 120.2°F

Incompatible Products Strong oxidizing agents. Strong acids. Strong reducing agents. Strong alkalis.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Acetone 67-64-1	STEL: 750 ppm TWA: 500 ppm	TWA: 1000 ppm TWA: 2400 mg/m ³ (vacated) TWA: 750 ppm (vacated) TWA: 1800 mg/m ³ (vacated) STEL: 2400 mg/m ³ The acetone STEL does not apply to the cellulose acetate fiber industry. It is in effect for all other sectors (vacated) STEL: 1000 ppm	IDLH: 2500 ppm 10% LEL TWA: 250 ppm TWA: 590 mg/m ³
Ethanol 64-17-5	STEL: 1000 ppm	TWA: 1000 ppm TWA: 1900 mg/m ³ (vacated) TWA: 1000 ppm (vacated) TWA: 1900 mg/m ³	IDLH: 3300 ppm 10% LEL TWA: 1000 ppm TWA: 1900 mg/m ³
Isopropyl alcohol 67-63-0	STEL: 400 ppm TWA: 200 ppm	TWA: 400 ppm TWA: 980 mg/m ³ (vacated) TWA: 400 ppm (vacated) TWA: 980 mg/m ³ (vacated) STEL: 500 ppm (vacated) STEL: 1225 mg/m ³	IDLH: 2000 ppm 10% LEL TWA: 980 mg/m ³ TWA: 400 ppm STEL: 500 ppm STEL: 1225 mg/m ³

n-Propyl acetate 109-60-4	STEL: 250 ppm TWA: 200 ppm	TWA: 200 ppm TWA: 840 mg/m ³ (vacated) TWA: 200 ppm (vacated) TWA: 840 mg/m ³ (vacated) STEL: 250 ppm (vacated) STEL: 1050 mg/m ³	IDLH: 1700 ppm TWA: 200 ppm TWA: 840 mg/m ³ STEL: 250 ppm STEL: 1050 mg/m ³
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Immediately Dangerous to Life or Health. ACGIH TLV: American Conference of Governmental Industrial Hygienists - Threshold Limit Value. OSHA PEL: Occupational Safety and Health Administration - Permissible Exposure Limits. NIOSH IDLH:

Other Exposure Guidelines Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992).

Appropriate engineering controls

Engineering Measures Showers
Eyewash stations
Ventilation systems

Individual protection measures, such as personal protective equipment

Eye/Face Protection Avoid contact with eyes. Risk of contact, wear: Goggles.
Skin and Body Protection Rubber gloves.
Respiratory Protection No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn.
Hygiene Measures When using, do not eat, drink or smoke. Provide regular cleaning of equipment, work area and clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical State	Aerosol.	Appearance	Clear, Cloudy White, Colorless.
Odor	Sweet, Solvent.	Odor Threshold	No information available.

<u>Property</u>	<u>Values</u>	<u>Remarks/ - Method</u>
pH	No data available	None known
Melting Point/Range	No data available	None known
Boiling Point/Boiling Range	56.11 °C / 133 °F	None known
Flash Point	No data available	None known
Evaporation rate		None known
Flammability (solid, gas)	No data available	None known
Flammability Limits in Air		
upper flammability limit	No data available	
lower flammability limit	No data available	
Vapor Pressure	No data available	None known
Vapor Density	> 1 (air = 1)	None known
Specific Gravity	No data available	None known
Water Solubility	Soluble in water.	None known
Solubility in other solvents	No data available	None known
Partition coefficient: n-octanol/water	No data available	None known
Autoignition Temperature	No data available	None known
Decomposition Temperature	No data available	None known
Viscosity	Water thin	None known

Flammable Properties EXTREMELY FLAMMABLE

Explosive Properties No data available
Oxidizing Properties No data available

Other information

VOC Content (%) 100.000002384186
VOC (g/l) 388 g/l

10. STABILITY AND REACTIVITY

Reactivity

No data available

Chemical stability

Stable under recommended storage conditions

Possibility of hazardous reactions

None under normal processing.

Hazardous Polymerization

Hazardous polymerization does not occur.

Conditions to avoid

Heat, flames and sparks. Temperatures above 49 °C / 120.2 °F. Incompatible products.

Incompatible materials

Strong oxidizing agents. Strong acids. Strong reducing agents. Strong alkalis.

Hazardous decomposition products

Carbon oxides.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information

Inhalation

May cause irritation of respiratory tract. May cause drowsiness and dizziness. Intentional misuse by deliberately concentrating and inhaling contents may be harmful or fatal

Eye Contact

Causes serious eye irritation.

Skin Contact

Repeated exposure may cause skin dryness or cracking.

Ingestion

Not an expected route of exposure.

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Acetone	= 5800 mg/kg (Rat)	1700mg/kg (rabbit)	18892 mg/m³
Ethanol	= 7060 mg/kg (Rat)	-	= 124.7 mg/L (Rat) 4 h
Isopropyl alcohol	= 4396 mg/kg (Rat)	12800 mg/kg (Rat) 12870 mg/kg (Rabbit)	72.6 mg/L (Rat) 4 h
n-Propyl acetate	= 9370 mg/kg (Rat)	> 17760 mg/kg (Rabbit)	-

Symptoms related to the physical, chemical and toxicological characteristics

Symptoms

No information available.

Delayed and immediate effects and also chronic effects from short and long term exposure

Sensitization

No information available.

Mutagenic Effects

No information available.

Carcinogenicity

The table below indicates whether each agency has listed any ingredient as a carcinogen. Ethanol has been shown to be carcinogenic in long-term studies only when consumed and abused as an alcoholic beverage.

Chemical Name	ACGIH	IARC	NTP	OSHA
---------------	-------	------	-----	------

Ethanol	A3	Group 1	Known	X
Isopropyl alcohol		Group 3		

ACGIH: (American Conference of Governmental Industrial Hygienists)

A3 - Animal Carcinogen

IARC: (International Agency for Research on Cancer)

Group 3 - Not Classifiable as to its Carcinogenicity to Humans

NTP: (National Toxicity Program)

Known - Known Carcinogen

OSHA: (Occupational Safety & Health Administration)

X - Present

Reproductive Toxicity

No information available.

STOT - single exposure

No information available.

STOT - repeated exposure

No information available.

Chronic Toxicity

Ethanol has been shown to be a reproductive toxin only when consumed as an alcoholic beverage. Ethanol has been shown to be carcinogenic in long-term studies only when consumed as alcoholic beverage.

Target Organ Effects

Respiratory system. Eyes. Skin. Central nervous system (CNS).

Aspiration Hazard

No information available.

Numerical measures of toxicity - Product

Acute Toxicity 0% of the mixture consists of ingredient(s) of unknown toxicity.

The following values are calculated based on chapter 3.1 of the GHS document:

LD50 Oral 7251 mg/kg; Acute toxicity estimate

LD50 Dermal 836601 mg/kg; Acute toxicity estimate

Inhalation mg/L

dust/mist 452.8 mg/L; Acute toxicity estimate

Vapor 3634.7 mg/L; Acute toxicity estimate

12. ECOLOGICAL INFORMATION

Ecotoxicity

The environmental impact of this product has not been fully investigated.

Chemical Name	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Daphnia Magna (Water Flea)
Acetone 67-64-1		LC50 96 h: 4.74 - 6.33 mL/L (Oncorhynchus mykiss) LC50 96 h: 6210 - 8120 mg/L static (Pimephales promelas) LC50 96 h: = 8300 mg/L (Lepomis macrochirus)	EC50 = 14500 mg/L 15 min	EC50 48 h: 10294 - 17704 mg/L Static (Daphnia magna) EC50 48 h: 12600 - 12700 mg/L (Daphnia magna)
Ethanol 64-17-5		LC50 96 h: 12.0 - 16.0 mL/L static (Oncorhynchus mykiss) LC50 96 h: > 100 mg/L static (Pimephales promelas) LC50 96 h: 13400 - 15100 mg/L flow-through (Pimephales promelas)	EC50 = 34634 mg/L 30 min EC50 = 35470 mg/L 5 min	LC50 48 h: 9268 - 14221 mg/L (Daphnia magna) EC50 24 h: = 10800 mg/L (Daphnia magna) EC50 48 h: = 2 mg/L Static (Daphnia magna)
n-Propyl acetate 109-60-4		LC50 96 h: 56-64 mg/L flow-through (Pimephales promelas) LC50 96 h: 56-64 mg/L static (Pimephales promelas)		EC50 24 h: = 318 mg/L (Daphnia magna)

Isopropyl alcohol 67-63-0	EC50 96 h: > 1000 mg/L (Desmodemus subspicatus) EC50 72 h: > 1000 mg/L (Desmodemus subspicatus)	LC50 96 h: = 11130 mg/L static (Pimephales promelas) LC50 96 h: = 9640 mg/L flow-through (Pimephales promelas) LC50 96 h: > 1400000 µg/L (Lepomis macrochirus)	EC50 48 h: = 13299 mg/L (Daphnia magna)
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Persistence and Degradability No information available

Bioaccumulation

Chemical Name	Log Pow
Acetone	-0.24
Ethanol	-0.32
Petroleum gases, liquified, sweetened	2.8
Isopropyl alcohol	0.05

Other Adverse Effects

No information available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods Dispose of in accordance with federal, state, and local regulations

Contaminated Packaging Do not re-use empty containers.

US EPA Waste Number U002

Chemical Name	RCRA	RCRA - Basis for Listing	RCRA - D Series Wastes	RCRA - U Series Wastes
Acetone - 67-64-1		Included in waste stream: F039		U002

This product contains one or more substances that are listed with the State of California as a hazardous waste.

Chemical Name	California Hazardous Waste
Acetone	Ignitable
Ethanol	Toxic Ignitable
n-Propyl acetate	Toxic Ignitable
Isopropyl alcohol	Toxic Ignitable

14. TRANSPORT INFORMATION

DOT

Proper shipping name Consumer commodity
Hazard Class ORM-D
Reportable Quantity (RQ) Acetone: RQ kg= 4172.79
Description Consumer commodity, ORM-D
Emergency Response Guide Number 126

TDG

UN-Number UN1950
Proper Shipping Name Aerosols
Hazard Class 2.1
Description UN1950, Aerosols, 2.1

MEX

UN-Number UN1950
Proper Shipping Name Aerosols
Hazard Class 2.1
Description UN1950, Aerosols, 2.1

ICAO

UN-Number	UN1950
Proper shipping name	Aerosols
Hazard Class	2.1
Description	UN1950, Aerosols, 2.1

IATA

UN-Number	UN1950
Proper Shipping Name	Aerosols, flammable
Hazard Class	2.1
ERG Code	10L
Description	UN1950, Aerosols, flammable, 2.1

IMDG/IMO

UN-Number	UN1950
Proper Shipping Name	Aerosols
Hazard Class	2
Subsidiary Class	See SP63
EmS No.	F-D, S-U
Description	UN1950, Aerosols, 2.1 (See SP63)

RID

UN-Number	UN1950
Proper Shipping Name	Aerosols
Hazard Class	2
Classification Code	5F
Description	UN1950, Aerosols, 2.1

ADR

UN-Number	UN1950
Proper Shipping Name	Aerosols
Hazard Class	2
Classification Code	5F
Tunnel Restriction Code	(D)
Description	UN1950, Aerosols, 2.1, (D)
ADR/RID-Labels	2.1

ADN

Proper Shipping Name	Aerosols
Hazard Class	2
Classification Code	5F
Special Provisions	190, 327, 344, 625
Description	UN1950, Aerosols, 2.1
Limited Quantity	1 L
Ventilation	VE01, VE04

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL	Complies

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
 DSL/NDL - Canadian Domestic Substances List/Non-Domestic Substances List

U.S. Federal Regulations

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	No

Fire Hazard	Yes
Sudden Release of Pressure Hazard	Yes
Reactive Hazard	No

Clean Water Act

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302):

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs	RQ
Acetone	5000 lb		RQ 5000 lb final RQ RQ 2270 kg final RQ

U.S. State Regulations**California Proposition 65**

This product contains the following Proposition 65 chemicals: Ethyl alcohol is only considered a Proposition 65 developmental hazard when it is ingested as an alcoholic beverage.

Chemical Name	CAS-No	California Prop. 65
Ethanol	64-17-5	Developmental

U.S. State Right-to-Know Regulations

"X" designates that the ingredients are listed on the state right to know list.

Chemical Name	New Jersey	Massachusetts	Pennsylvania	Illinois	Rhode Island
Acetone	X	X	X		X
Ethanol	X	X	X		
Isopropyl alcohol	X	X	X		X
n-Propyl acetate	X	X	X		X

U.S. EPA Label Information

EPA Pesticide Registration Number Not applicable

16. OTHER INFORMATION

NFPA	Health Hazard 2	Flammability 4	Instability 0	Physical and Chemical Hazards -
HMIS	Health Hazard 2	Flammability 4	Physical Hazard 0	Personal Protection X

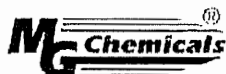
Prepared By Product Stewardship
23 British American Blvd.
Latham, NY 12110
1-800-572-6501

Issuing Date 16-May-2014
Revision Date 05-Aug-2016
Revision Note Change to composition.

General Disclaimer

The information provided on this SDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of Safety Data Sheet



Quality System Certified to ISO 9001:2008

SAI Global File #004008

Burlington, Ontario, Canada

ELECTROSOLVE™ CONTACT CLEANER

409B-AEROSOL

Safety Data Sheet

Section 1 Identification

Product Identifier and Other Means of Identification

Product Name: Electrosolve™ Contact Cleaner

SDS Code: 409B-Aerosol

Related Part # 409B-140G, 409B-340G

Recommended Use and Restriction on Use

Use: Zero-residue contact cleaner

Uses Advised Against: Do not use on live circuits or in presence of ignition source

Details of Manufacturer or Importer

Manufacturer

MG Chemicals
1210 Corporate Drive
Burlington, Ontario L7L 5R6
CANADA

MG Chemicals (Head Office)
9347-193 Street
Surrey, British Columbia V4N 4E7
CANADA

☎ +1-800-340-0772
FAX +1-800-340-0773
E-MAIL support@mgchemicals.com
WEB www.mgchemicals.com

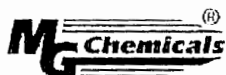
☎ +1-905-331-1396
FAX +1-905-331-2682
E-MAIL info@mgchemicals.com

E-MAIL (Competent Person): sds@mgchemicals.com

Emergency Phone Number

For hazardous material incidents ONLY—leaks, spills, fires, exposures or accidents
USA or CANADA: Call CHEMTREC ☎: **+1-800-424-9300**

For emergencies involving dangerous goods; Collect 24/7
CANADA: Call CANUTEC ☎: **+1-613-996-6666** or ***666** on cellular phones



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SAI Global File #004008

Burlington, Ontario, Canada

ELECTROSOLVE™ CONTACT CLEANER

409B-AEROSOL

Section 2: Hazard(s) Identification

Classification of Hazardous Chemical

GHS Categories

Criteria	Category	Signal Word	Pictograms
Aspiration hazard	1	Danger	Health
Reproductive Toxicity	2	Warning	Health
Flammable Aerosol	2	Warning	Flame
Gas under pressure	Liquefied gas	Warning	Gas cylinder
Skin irritation	2	Warning	Exclamation
Specific Target Organ Toxicity Single Exposure	3	Warning	Exclamation
Environmental Hazard Chronic Aqua. Tox.	3	none	none

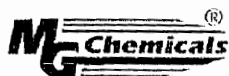
Note: The degree of severity is ranked within each hazard class from

1 (Highest Severity) to up to 5 (Lowest Severity), which is opposite to HMIS and NFPA conventions. Severity category rankings do not allow comparisons between classes.

Label Elements

Signal Word	DANGER
Pictograms	Hazard Statements
	H304: May be fatal if swallowed and enters airways H361: Suspected of damaging fertility or the unborn child
	H223: Flammable aerosol
	H280: Contains gas under pressure: may explode if heated

Section continued on the next page



Quality System Certified to ISO 9001:2008

SAI Global File #004008
Burlington, Ontario, Canada

ELECTROSOLVE™ CONTACT CLEANER

409B-AEROSOL

Continued...

Pictograms	Hazard Statements
	H315: Causes skin irritation H336: May cause drowsiness and dizziness
No symbol mandated	H412: Harmful to aquatic life with long lasting effects
Prevention	Precautionary Statements
P102	Keep out of reach of children.
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P261	Avoid breathing mist/vapors/spray.
P271	Use only outdoors or in a well-ventilated area.
P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P211	Do not spray on an open flame or other ignition source.
P251	Do not pierce or burn, even after use.
P280	Wear protective gloves/protective clothing/eye protection.
P264	Wash hands thoroughly after handling.
P273	Avoid release to the environment.
Response	Precautionary Statements
P308 + P313	IF exposed or concerned: Get medical advice/attention.
P301 + P310, P331	IF SWALLOWED: Immediately call a POISON CENTER/doctor. Do NOT induce vomiting.
P302 + P352	IF ON SKIN: Wash with plenty water.
P332 + P313	If skin irritation occurs: Get medical advice/attention.
P362 + P364	Take off contaminated clothing and wash it before reuse.
P304 + P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P312	Call a POISON CENTER/doctor if you feel unwell.

Section continued on the next page



Quality System Certified to ISO 9001:2008

SAI Global File #004008

Burlington, Ontario, Canada

ELECTROSOLVE™ CONTACT CLEANER

409B-AEROSOL

Continued...

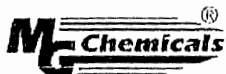
Storage	Precautionary Statements
P410 + P412	Protect from sunlight. Do not expose to temperatures exceeding 50 °C [122 °F].
P403	Store in well-ventilated place.
P405	Store locked up.
Disposal	Precautionary Statements
P501	Dispose of contents/container in accordance to local/regional/international regulations.

Hazards Not Otherwise Classified

Other Criteria	Hazard Statements/Precautionary Statement	Signal Word	Pictograms
Defats skin	Repeated exposure may cause skin dryness or cracking.	None	None

Section 3: Composition/Information on Ingredients

CAS #	Chemical Name	%(weight)
811-97-2	1,1,1,2-tetrafluoroethane	25%
107-83-5	methyl-2-pentane	30-38%
96-14-0	methyl-3-pentane	11-15%
79-29-8	dimethyl-2,3-butane	11-15%
75-83-2	dimethyl-2,2-butane	7-11%
109-66-0	pentane	4-8%
110-54-3	n-hexane	1-4%



Quality System Certified to ISO 9001:2008

SAI Global File #004008
Burlington, Ontario, Canada

ELECTROSOLVE™ CONTACT CLEANER

409B-AEROSOL

Section 4 First Aid Measures

<i>Exposure Condition</i>	<i>GHS Code/Symptoms/Precautionary Statements</i>
IF SWALLOWED	P301 + P310, P331, P308 + P313
Immediate Symptoms	<i>nausea, weakness, headache, abdominal pain, drowsiness, dizziness, unconsciousness</i>
Response	Immediately call a POISON CENTER/doctor. Do NOT induce vomiting. IF exposed or concerned: Get medical advice/attention.
IF ON SKIN	P302 + P352, P332 + P313, P362 + P364, P308 + P313
Immediate Symptoms	<i>dry skin, redness, irritation</i>
Response	Wash with plenty of water. If skin irritation occurs: Get medical advice/attention. IF exposed or concerned: Get medical advice/attention. Take off contaminated clothing and wash it before reuse.
IF INHALED	P304 + P340, P312, P308 + P313
Immediate Symptoms	<i>nausea, weakness, headache, drowsiness, dizziness, unconsciousness</i>
Response	Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor if you feel unwell. IF exposed or concerned: Get medical advice/attention.
IF IN EYES	P305 + P351 + P338, P308 + P313
Immediate Symptoms	<i>redness</i>
Response	Rinse cautiously with water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF exposed or concerned: Get medical advice/attention.



Quality System Certified to ISO 9001:2008

SAI Global File #004008

Burlington, Ontario, Canada

ELECTROSOLVE™ CONTACT CLEANER

409B-AEROSOL

Section 5: Fire-Fighting Measures

Extinguishing Media	In case of fire: Use dry chemical, carbon dioxide, chemical foam, or water spray to extinguish. Use water spray to cool containers.
Specific Hazards	Aerosols containers may erupt with force at temperatures above 50 °C [122 °F]. Produces irritating and toxic fumes in fires or in contact with hot surfaces. The vapors are heavier than air and may accumulate in low-lying areas. Vapors may travel long distances and ignite at an ignition source, which can cause a flashback or an explosion. Prevent fire-fighting wash from entering waterway or sewer system.
Combustion Products	Produces carbon oxides (CO, CO₂), halogenated compounds, and hydrogen fluorides.
Fire-Fighter	Wear self-contained breathing apparatus and full fire-fighting turn-out gear.

Section 6: Accidental Release Measures

Personal Protection	See personal protection recommendations in Section 8.
Precautions for Response	Avoid breathing the mist/spray/vapors. Remove or keep away all sources of extreme heat or open flames.
Environmental Precautions	Avoid releasing to the environment. Prevent spill from entering drains and waterways.
Containment Methods	Not applicable
Cleaning Methods	Collect liquid in a sealable, solvent-resistant container. Sprinkle inert absorbent compound onto spill, then sweep into the container. Wash spill area with soap and water to remove the last traces of residue.
Disposal Methods	Dispose of spill waste according to Section 13.



Quality System Certified to ISO 9001:2008

SAI Global File #004008

Burlington, Ontario, Canada

ELECTROSOLVE™ CONTACT CLEANER

409B-AEROSOL

Section 7: Handling and Storage

Prevention

Keep out of reach of children.

Obtain special instructions before use. Do not handle until all safety precautions have been read and understood.

Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Avoid breathing mist/vapors/spray. Use only outdoors or in a well-ventilated area.

Do not pierce or burn, even after use.

Handling

Do not spray on an open flame or other ignition source.

Use only outdoors or in a well-ventilated area.

Wear protective gloves/protective clothing/eye protection.

Wash hands thoroughly after handling.

Avoid release to the environment.

Storage

Protect from sunlight. Do not expose to temperatures exceeding 50 °C [122 °F].

Store in well ventilated place.

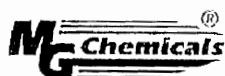
Store locked up.

Section 8: Exposure Controls/Personal Protection

Substances with Occupational Exposure Limit Values

Chemical Name	Country/ Provinces	Long Term Exposure Limits (PEL)	Short Term Exposure Limits (STEL)
1,1,1,2-tetrafluoroethane	MG Chemicals ^{a)} ACGIH U.S.A. OSHA PEL Canada	1 000 ppm Not established Not established Not established	Not established Not established Not established Not established
methyl-2-pentane Hexane isomers (except n-Hexane)	ACGIH U.S.A. OSHA PEL Canada AB Canada BC Canada ON Canada QC	500 ppm (500 ppm) ^{b)} 500 ppm 200 ppm 500 ppm 500 ppm	1 000 ppm (1 000 ppm) ^{b)} 1 000 ppm Not established 1 000 ppm 1 000 ppm

Section continued on the next page



Quality System Certified to ISO 9001:2008

SAI Global File #004008

Burlington, Ontario, Canada

ELECTROSOLVE™ CONTACT CLEANER**409B-AEROSOL***Continued...*

Chemical Name	Country/ Provinces	Long Term Exposure Limits (PEL)	Short Term Exposure Limits (STEL)
methy1-3-pentane <i>Hexane isomers (except n-Hexane)</i>	ACGIH U.S.A. OSHA PEL Canada AB Canada BC Canada ON Canada QC	500 ppm (500 ppm) ^{b)} 500 ppm 200 ppm 500 ppm 500 ppm	1 000 ppm (1 000 ppm) ^{b)} 1 000 ppm Not established 1 000 ppm 1 000 ppm
dimethyl-2,3-butane <i>Hexane isomers (except n-Hexane)</i>	ACGIH U.S.A. OSHA PEL Canada AB Canada BC Canada ON Canada QC	500 ppm (500 ppm) ^{b)} 500 ppm 200 ppm 500 ppm 500 ppm	1 000 ppm (1 000 ppm) ^{b)} 1 000 ppm Not established 1 000 ppm 1 000 ppm
dimethyl-2,2-butane <i>Hexane isomers (except n-Hexane)</i>	ACGIH U.S.A. OSHA PEL Canada AB Canada BC Canada ON Canada QC	500 ppm (500 ppm) ^{b)} 500 ppm 200 ppm 500 ppm 500 ppm	1 000 ppm (1 000 ppm) ^{b)} 1 000 ppm Not established 1 000 ppm 1 000 ppm
pentane	ACGIH U.S.A. OSHA PEL Canada AB Canada BC Canada ON Canada QC	1000 ppm 1000 ppm 600 ppm 600 ppm 600 ppm 120 ppm	Not established Not established Not established Not established 750 ppm Not established
n-hexane	ACGIH U.S.A. OSHA PEL Canada AB Canada BC Canada ON Canada QC	50 ppm ^{c)} 50 ppm 50 ppm 20 ppm ^{c)} 50 ppm ^{c)} 50 ppm	Not established Not established Not established Not established Not established Not established

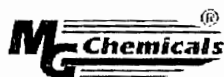
Note: Ingredients are listed in descending weight contribution order (from greatest to least). The ACGIH¹, OSHA (Table Z-1), and Canadian provinces exposure limits were consulted. Limits from RTECS database² and data from suppliers' SDS were also consulted. Short term exposure limits (STEL) are for 15 min and long term permissible exposure limits (PEL) for 8 h.

a) MG Chemicals recommended limit corresponding to prevalent international threshold values

b) Value vacated (retracted) under court order, but still in effect in some states.

c) Skin – significant exposure through skin route

Section continued on the next page



Quality System Certified to ISO 9001:2008

SAI Global File #004008

Burlington, Ontario, Canada

ELECTROSOLVE™ CONTACT CLEANER

409B-AEROSOL

Engineering Controls

Ventilation

Keep airborne concentrations below the occupational exposure limits (OEL).

Personal Protective Equipment

Eye protection

Wear appropriate protective eyeglasses or chemical safety goggles.

Recommendation: Ensure that glasses have side shields for lateral protection.

Skin Protection

For likely contacts, use of protective butyl rubber or other chemically resistant gloves.

For incidental contacts, use nitrile or other chemically resistant gloves.

Respiratory Protection

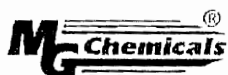
For over-exposures up to 10 x OEL of mist/vapors/spray, wear respirator such as a half-mask respirator with organic vapor cartridges.

Above 10 x OEL, use a positive-pressure, air-supplied respirator or a self-contained breathing apparatus.

RECOMMENDATION: Consult your local safety supply store to ensure that your respirator has a NIOSH (U.S.) approved filter cartridges appropriate for the ingredients listed in Section 3. The respirator should be fitted to the employee by a professional. Ensure vapor cartridges are stored in sealed plastic bags when not being used.

General Hygiene Considerations

Wash hands thoroughly with water and soap after handling.



Quality System Certified to ISO 9001:2008

SAI Global File #004008

Burlington, Ontario, Canada

ELECTROSOLVE™ CONTACT CLEANER

409B-AEROSOL

Section 9: Physical and Chemical Properties

Physical State	Liquid, in an aerosol format	Lower Flammability Limit	1%
Appearance	Colorless	Upper Flammability Limit	7%
Odor	Mild hydrocarbon	Vapor Pressure @20 °C	33 kPa [250 mmHg]
Odor Threshold	Not available	Vapor Density (Air =1)	2.98
pH	Not available	Specific Gravity @15.5 °C	0.66
Freezing/Melting Point	Not available	Solubility in Water	Immiscible
Boiling Point	52 °C [125 °F]	Partition Coefficient	Not available
Flash Point ^{a)}	-29 °C [-20 °F]	Auto-ignition Temperature	Not available
Evaporation Rate	0.8 (Ether = 1)	Decomposition Temperature	Not available
Flammability (solid, gas)	Not available	Viscosity @40 °C	<20.5 mm ² /s

a) Closed cup flash point

Section 10: Stability and Reactivity

Reactivity	Not available
Chemical Stability	Chemically stable at normal temperatures and pressures
Conditions to Avoid	Temperatures above 50 °C [122 °F], open flames, and incompatible substances
Incompatibilities	Strong oxidizing agents, alkali or alkali earth metals, powdered aluminum, zinc, magnesium, and beryllium
Polymerization	Will not occur
Decomposition	Will not decompose under normal conditions. For thermal decomposition, see combustion products in Section 5.

**ELECTROSOLVE™ CONTACT CLEANER****409B-AEROSOL****Section 11 Toxicological Information****Routes of Exposure**

Eye Contact, Ingestion, Inhalation, and Skin Contact

Symptoms Summary

Eyes	May cause redness.
Inhalation	May cause nausea, weakness, headache, drowsiness, dizziness, unconsciousness
Ingestion	May cause nausea, weakness, headache, abdominal pain, drowsiness, dizziness, unconsciousness (also see inhalation symptoms).
Skin	May cause dry skin, redness, and irritation.
Chronic	Prolonged or repeated exposure may cause skin dryness, cracking, as well as defatting the skin. Ingestion or inhalation of paint material, mist, or vapor during pregnancy may increase the chances fetal death and developmental defects.

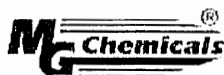
Acute Toxicity (Lethal Exposure Concentrations)

Chemical Name	LD50 oral	LD50 dermal	LC50 inhalation
1,1,1,2-tetrafluoroethane	Not available	Not available	1 500 g/m ³ 4 h Rat
methyl-2-pentane	Not available	Not available	3 125 ppm 4 h Rat ^{a)}
methyl-3-pentane	Not available	Not available	Not available
dimethyl-2,3-butane	Not available	Not available	Not available
dimethyl-2,2-butane	Not available	Not available	Not available
pentane	>2 000 mg/kg Rat	Not available	>20 mg/L Rat 4 h (vapor)
n-hexane	15 480 mg/kg Rat	>1.3 g/kg Rabbit ^{a)}	627 000 ppm 3 min Rat

Note: Toxicity data from the RTECS² and ECHA databases were consulted. The data from supplier (M)SDS were also consulted.

a) Data from supplier (M)SDS

Section continued on the next page



Quality System Certified to ISO 9001:2008

SAI Global File #004008

Burlington, Ontario, Canada

ELECTROSOLVE™ CONTACT CLEANER

409B-AEROSOL

Other Toxicological Effects

Skin corrosion/irritation	Causes skin irritation.
Serious eye damage/irritation	Based on available data, the classification criteria are not met.
Sensitization (allergic reactions)	Based on available data, the classification criteria are not met.
Carcinogenicity (risk of cancer)	Based on available data, the classification criteria are not met.
Mutagenicity (risk of heritable genetic effects)	Based on available data, the classification criteria are not met.
Reproductive Toxicity (risk to sex functions)	The n-hexane component was found to harm fetus in animal studies.
Teratogenicity (risk of fetus malformation)	Harm to fetus found in animal studies.
STOT-single exposure	The hexane isomers may affect the central nervous system.
STOT-repeated exposure	Based on available data, the classification criteria are not met.
Aspiration hazard	Mixture is a class 1 aspiration hazard. It contains over 33% class 1 aspiration hazard components and has a mixture viscosity of <20.5 mm ² /s at 40 °C.

Section 12: Ecological Information

Ecological classifications are based on the IMDG/GHS criteria in conjunction with ecotoxicological data from our suppliers, the European Chemical Agency database (<http://echa.europa.eu>), and other reliable sources.

Similar mixtures of isoalkanes C6-C7 with <5% n-hexane have a LC50 of 11.4 mg/L for rainbow trout (*Oncorhynchus mykiss*) 96 h, and an EL50 of 3.0 mg/L water flea (*Daphnia magna*) 48 h.

Acute Ecotoxicity

Category 2

Toxic to aquatic life

Avoid release to the environment.

Section continued on the next page



Quality System Certified to ISO 9001:2008

SAI Global File #004008

Burlington, Ontario, Canada

ELECTROSOLVE™ CONTACT CLEANER

409B-AEROSOL

Chronic Ecotoxicity

Category 3

Harmful to aquatic life with long lasting effects

Avoid release to the environment. Collect spillage.

Biodegradability

Not available

Other Effects

Actual VOC (Volatile Organic Compounds) content according to the US (EPA) and Canadian (CEPA) authorities.

Actual VOC = 75% [495 g/L]

Section 13: Disposal Information

Dispose of contents in accordance with all local, regional, national, and international regulations.

Section 14: Transport Information

Ground

Refer to TDG regulations (Canadian Transportation of Dangerous Goods regulations);
USA CFR 49 Regulations (Parts 100 to 185).

Limited Quantity



UN number: UN1950

Shipping Name: AEROSOL,
flammable

Class: 2.1

Packing Group: Not applicable

Marine Pollutant: Yes

Section continued on the next page



Quality System Certified to ISO 9001:2008

SAI Global File #004008

Burlington, Ontario, Canada

ELECTROSOLVE™ CONTACT CLEANER

409B-AEROSOL

Air

Refer to ICAO-IATA Dangerous Goods Regulations.

Limited Quantity

See package
instruction Y203

Max Net Qty/Pkg
30 kg G



UN number: UN1950

Shipping Name: AEROSOL,
flammable

Class: 2.1

Packing Group: Not applicable

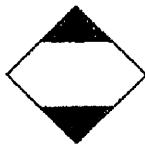
Marine Pollutant: Yes



Sea

Refer to IMDG regulations.

Limited Quantity



UN number: UN1950

Shipping Name: AEROSOL,
flammable

Class: 2.1

Packing Group: Not applicable

Marine Pollutant: Yes

Note: Shipper must be appropriately trained and certified before involvement with the transport of dangerous goods.

Section 15: Regulatory Information

Canada

Domestic Substance List (DSL) / Non-Domestic Substance Lists (NDSL)

All hazardous ingredients are listed on the DSL.

Industry and Science Canada

MG Labels products intended for the workplace to conform to WHMIS labeling regulations. Product identification, net quantity declaration, minimum printing type size heights, and packaging of this product are in compliance.

Health Canada

Products produced by MG Chemicals intended for retail display conform to the Canadian Consumer Labeling Regulations.

Section continued on the next page



Quality System Certified to ISO 9001:2008

SAI Global File #004008

Burlington, Ontario, Canada

ELECTROSOLVE™ CONTACT CLEANER

409B-AEROSOL

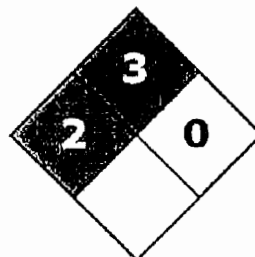
USA

Other Classifications

HMIS® RATING

HEALTH:	* 2
FLAMMABILITY:	3
PHYSICAL HAZARD:	0
PERSONAL PROTECTION:	

NFPA® 704 CODES



Approximate HMIS and NFPA Risk Ratings Legend:

0 (Low or none); 1 (Slight); 2 (Moderate); 3 (Serious); 4 (Severe)

CAA (Clean Air Act, USA)

This product does not contain any class 1 ozone depleting substances.

This product does not contain any class 2 ozone depleting substances.

This product does not contain products that are listed as hazardous air pollutants.

EPCRA (Emergency Planning and Right to Know Act, USA, 40 CFR 372.45)

This product contains n-hexane (CAS# 110-54-3) which has a 5,000 lb reporting quantity requirements in section 313 Title III of the SARA of 1986 and 40 CFR part 372.

TSCA (Toxic Substances Control Act of 1976, USA)

All substances are TSCA listed.

California Proposition 65 (Chemicals known to cause cancer or reproductive toxicity, June 06, 2014 revision, USA).

This product does not contain any substances known to be listed in California.

Europe

RoHS (Restriction of Hazardous Substances Directive)

This product does not contain any lead, cadmium, mercury, hexavalent chromium, PBB's, or PBDE's, and complies with European RoHS regulations.

WEEE (Waste Electrical and Electronic Equipment Directive)

This product is not a piece of electrical or electronics equipment, and is therefore not governed by this regulation.



Quality System Certified to ISO 9001:2008

SAI Global File #004008

Burlington, Ontario, Canada

ELECTROSOLVE™ CONTACT CLEANER

409B-AEROSOL

Section 16: Other Information

SDS Prepared by Michel Hachey
Date of Review 08 February 2016
Supersedes 09 May 2013
Reason for Changes: Change in composition and reclassification in compliance with HCS 2012 and WHMIS 2015 due to supplier revision.

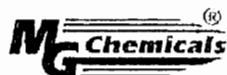
Reference

- 1) ACGIH 2013 TLVs and BEIs: Based on the documentation of the threshold limit values for chemical substances and physical agents & biological exposure indices, American Conference of Governmental of Industrial Hygienist Cincinnati, OH (2013).
- 2) All toxicological data were checked against the RTECS (Registry of Toxic Effects of Chemical Substances®)

Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists (USA)
ECHA	European Chemicals Agency
EU	European Union
EC50	Half maximal effective concentration
EL50	Half maximal effective loading
IARC	International Agency for Research on Cancer
NOELR	No observable effect loading ratio
NTP	National Toxicology Program
GHS	Globally Harmonized System of Classification of Labeling of Chemicals
LC50	Lethal Concentration 50%
LCLo	Lowest published lethal concentration
LD50	Lethal Dose 50%
OEL	Occupational Exposure Limit
PEL	Permissible Exposure Limit
SDS	Safety Data Sheet
STEL	Short-Term Exposure Limit
TCLo	Lowest published toxic concentration
TWA	Time Weighted Average
VOC	Volatile Organic Content

Section continued on the next page



Quality System Certified to ISO 9001:2008

SAI Global File #004008

Burlington, Ontario, Canada

ELECTROSOLVE™ CONTACT CLEANER

409B-AEROSOL

Technical Queries Contact us regarding any questions, improvement suggestions, or problems with this product. Application notes, instructions, and FAQs are located at www.mgchemicals.com.

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Disclaimer This material safety data sheet is provided as an information resource only. M.G. Chemicals, Ltd. believes the information contained herein is accurate and compiled from reliable sources. It is the responsibility of the user to query and verify any information seeming suspect where doubt on the validity may exist. The buyer assumes all responsibility of using and handling the product in accordance with local, regional, national, and international regulations.

Safety Data Sheet (1907/2006/EC)

Material: 60003095

**WACKER® SILICONE PASTE P 12
HEAT SINK COMPOUND**

Version: 4.1 (GB)

Date of print: 09.10.2015

Date of last alteration: 15.06.2015

SECTION 1: Identification of the substance/mixture and of the company/undertaking**1.1 Product identifier****Commercial product name:** **WACKER® SILICONE PASTE P 12
HEAT SINK COMPOUND****1.2 Relevant identified uses of the substance or mixture and uses advised against**

Use of substance / preparation:

Industrial.

Auxiliary agent for: electronic

1.3 Details of the supplier of the safety data sheet

Manufacturer/distributor:

Street/POB-No.:

State/postal code/city:

Telephone:

Telefax:

Wacker Chemie AG

Hanns-Seidel-Platz 4

D 81737 München

+49 89 6279-0

+49 89 6279-1770

Information about the Safety Data Sheet:

Telephone

Telefax

eMail

+49 8677 83-4888

+49 8677 886-9722

WLCP-MSDS@wacker.com

1.4 Emergency telephone number**Emergency Information (German):****Emergency Information (internat.):****Plant fire brigade****National Response Center****+49 8677 83-2222****+49 621 60-43333****SECTION 2: Hazards identification****2.1 Classification of the substance or mixture**

Not a hazardous substance or mixture.

Classification (67/548/EEC, 1999/45/EC):

Not a hazardous substance or mixture.

2.2 Label elements**Labelling (GHS):**

No labeling according to GHS required.

Special identification instructions:

Safety data sheet available on request.

2.3 Other hazards

No data available.

SECTION 3: Composition/information on ingredients**3.1 Substances**

not applicable

3.2 Mixtures**3.2.1 Chemical characterization (preparation)**

Polydimethylsiloxane and auxiliary

Safety Data Sheet (1907/2006/EC)

Material: 60003095

WACKER® SILICONE PASTE P 12
HEAT SINK COMPOUND

Version: 4.1 (GB)

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3.2.2 Hazardous ingredients

Type	CAS No.	EC-No. REACH no.	Material	Content %	Classification*	Comment
INHA	1314-13-2	215-222-5 01-2119463881-32	zinc oxide	>25 – <70	N; R50/53 Aquatic Acute 1; H400 Aquatic Chronic 1; H410	[1] M = 1

Type: INHA: ingredient, VERU: impurity

[1] = Hazardous or environmentally harmful substance; [2] = substance with a Community workplace exposure limit; [3] = PBT substance; [4] = vPvB substance; [5] = SVHC-candidate (substance of very high concern).

M = M-factor for acute aquatic toxicity

*Classification codes are explained in section 16.

SECTION 4: First aid measures**4.1 Description of first aid measures****General information:**

In case of accident or if you feel unwell seek medical advice (show label or SDS where possible).

After inhalation:

Material cannot be inhaled under normal conditions.

After contact with the skin:

Wipe off excess material with cloth or paper. Wash with plenty of water or water and soap. In the event of a visible skin change or other complaints, seek medical advice (show label or SDS where possible).

After contact with the eyes:

Rinse immediately with plenty of water. Seek medical advice in case of continuous irritation.

After swallowing:

Give several small portions of water to drink. Do not induce vomiting.

4.2 Most important symptoms and effects, both acute and delayed

Any relevant information can be found in other parts of this section.

4.3 Indication of any immediate medical attention and special treatment needed

Further toxicology information in section 11 must be observed.

SECTION 5: Firefighting measures**5.1 Extinguishing media****Suitable extinguishing media:**

water mist, extinguishing powder, alcohol-resistant foam, carbon dioxide, sand.

Extinguishing media which must not be used for safety reasons:

water jet.

5.2 Special hazards arising from the substance or mixture

-

5.3 Advice for firefighters**Special protective equipment for fire fighting:**

Use respiratory protection independent of recirculated air. Keep unprotected persons away.

Safety Data Sheet (1907/2006/EC)

Material: 60003095

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SECTION 6: Accidental release measures**6.1 Personal precautions, protective equipment and emergency procedures**

No special measures required

6.2 Environmental precautions

Prevent material from entering sewers or surface waters.

6.3 Methods and material for containment and cleaning up

Scoop up large quantities after dusting surfaces with sand or Fuller's earth to prevent sticking. Sweep or scrape up the spilled material and place in an appropriate chemical waste container. Clean any slippery coating that remains using a detergent / soap solution or another biodegradable cleaner. Apply sand or other inert granular material to improve traction.

6.4 Reference to other sections

Relevant information in other sections has to be considered. This applies in particular for information given on personal protective equipment (section 8) and on disposal (section 13).

SECTION 7: Handling and storage**7.1 Precautions for safe handling****Precautions for safe handling:**

No special protective measures required.

Precautions against fire and explosion:

No special precautions against fire and explosion required.

7.2 Conditions for safe storage, including any incompatibilities**Conditions for storage rooms and vessels:**

none known

Advice for storage of incompatible materials:

not applicable

Further information for storage:

Keep container tightly closed. Store in a dry and cool place.

7.3 Specific end use(s)

No data available.

SECTION 8: Exposure controls/personal protection**8.1 Control parameters****Maximum airborne concentrations at the workplace:**

not applicable

8.2 Exposure controls**8.2.1 Exposure in the work place limited and controlled****General protection and hygiene measures:**

Observe standard industrial hygiene practices for the handling of chemical substances. Do not eat or drink when handling.

Personal protection equipment:**Respiratory protection**

not required.

Hand protection

Recommendation: Protective gloves made of butyl rubber. Gloves suitable for up to 60 minutes' use. The selection of appropriate gloves not only depends on the material, but also on other quality characteristics, and may vary depending on the manufacturer. Please observe information from your glove supplier in terms of permeability and breakthrough time.

Safety Data Sheet (1907/2006/EC)

Material: 60003095

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Eye protection

Recommendation: protective goggles .

8.2.2 Exposure to the environment limited and controlled

Prevent material from entering surface waters and soil.

SECTION 9: Physical and chemical properties**9.1 Information on basic physical and chemical properties****General information:**

Physical state / form paste
Colour white
Odour odourless

Important information about the protection of health, safety and the environment:

Property:	Value:	Method:
Melting point / melting range	not applicable	
Boiling point / boiling range	not applicable	
Flash point.....	not applicable	
Ignition temperature	> 400 °C	(DIN 51794)
Lower explosion limit (LEL)	not applicable	
Upper explosion limit (UEL).....	not applicable	
Vapour pressure.....	not applicable	
Density	2,1 g/cm ³ at 25 °C, at 1013 hPa	(ISO 1183-1 A)
Water solubility / miscibility.....	virtually insoluble at 20 °C	
pH-Value	not applicable	
Viscosity (dynamic)	not applicable	

9.2 Other information

Thermal decomposition..... > 250 °C

SECTION 10: Stability and reactivity**10.1 – 10.3 Reactivity; Chemical stability; Possibility of hazardous reactions**

If stored and handled in accordance with standard industrial practices no hazardous reactions are known.

Relevant information can possibly be found in other parts of this section.

10.4 Conditions to avoid

none known

10.5 Incompatible materials

none known

10.6 Hazardous decomposition products

If stored and handled properly: none known . Measurements have shown the formation of small amounts of formaldehyde at temperatures above about 150 °C (302 °F) through oxidation.

SECTION 11: Toxicological information**11.1 Information on toxicological effects****11.1.1 Acute toxicity****Assessment:**

Based on the available data acute toxic effects are not expected after single oral exposure.

Safety Data Sheet (1907/2006/EC)

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Date of last alteration: 15.06.2015

Product details:

Route of exposure	Result/Effect	Species/Test system	Source
oral	LD ₅₀ : > 2000 mg/kg	rat	Conclusion by analogy

11.1.2 Skin corrosion/irritation**Assessment:**

For this endpoint no toxicological test data is available for the whole product.

11.1.3 Serious eye damage / eye irritation**Assessment:**

For this endpoint no toxicological test data is available for the whole product.

11.1.4 Respiratory or skin sensitization**Assessment:**

For this endpoint no toxicological test data is available for the whole product.

11.1.5 Germ cell mutagenicity**Assessment:**

For this endpoint no toxicological test data is available for the whole product.

11.1.6 Carcinogenicity**Assessment:**

For this endpoint no toxicological test data is available for the whole product.

11.1.7 Reproductive toxicity**Assessment:**

For this endpoint no toxicological test data is available for the whole product.

11.1.8 Specific target organ toxicity (single exposure)**Assessment:**

For this endpoint no toxicological test data is available for the whole product.

11.1.9 Specific target organ toxicity (repeated exposure)**Assessment:**

For this endpoint no toxicological test data is available for the whole product.

11.1.10 Aspiration hazard**Assessment:**

Based on the physical-chemical properties of the product no aspiration hazard must be expected.

SECTION 12: Ecological information**12.1 Toxicity****Assessment:**

Assessment based on ecotoxicological tests with similar products under consideration of the physical-chemical properties: For this product no effects on aquatic organisms, relevant for classification, are expected.

Product details:

Result/Effect	Species/Test system	Source
ErC50: > 100 mg/l	static Desmodesmus subspicatus (72 h)	Conclusion by analogy OECD 201

Safety Data Sheet (1907/2006/EC)

Material: 60003095

**WACKER® SILICONE PASTE P 12
HEAT SINK COMPOUND**

Version: 4.1 (GB)

Date of print: 09.10.2015

Date of last alteration: 15.06.2015

12.2 Persistence and degradability**Assessment:**

Silicone content: biologically not degradable. Separation by sedimentation.

12.3 Bioaccumulative potential**Assessment:**

No adverse effects expected.

12.4 Mobility in soil**Assessment:**

For the product as a whole, no test data is available.

12.5 Results of PBT and vPvB assessment

No data available.

12.6 Other adverse effects

none known

SECTION 13: Disposal considerations**13.1 Waste treatment methods****13.1.1 Material****Recommendation:**

Material that cannot be used, reprocessed or recycled should be disposed of in accordance with Federal, State, and local regulations at an approved facility. Depending on the regulations, waste treatment methods may include, e.g., landfill or incineration.

13.1.2 Uncleaned packaging**Recommendation:**

Completely discharge containers (no tear drops, no powder rest, scraped carefully). Containers may be recycled or re-used. Observe local/state/federal regulations. Uncleaned packaging should be treated with the same precautions as the material.

13.1.3 Waste Disposal Legislation Ref.No.(EC)

It is not possible to determine a waste code for this product in accordance with the European Waste Catalogue (EWC) since it is only possible to classify it according to how it is used by the customer. The waste code is to be determined within the EU in liaison with the waste-disposal operator.

SECTION 14: Transport information**14.1 – 14.4 UN number; UN proper shipping name; Transport hazard class(es); Packing group****Road ADR:**

Valuation Not regulated for transport

Railway RID:

Valuation Not regulated for transport

Transport by sea IMDG-Code:

Valuation Not regulated for transport

Air transport ICAO-TI/IATA-DGR:

Valuation Not regulated for transport

14.5 Environmental hazards

Hazardous to the environment: no

14.6 Special precautions for user

Relevant information in other sections has to be considered.

Safety Data Sheet (1907/2006/EC)

Material: 60003095

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14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code

Bulk transport in tankers is not intended.

SECTION 15: Regulatory information**15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture**

National and local regulations must be observed.

For information on labelling please refer to section 2 of this document.

Relevant regulations:

SI 2002/1689: CHIP Regulations 2002

SI 2002/2677: COSHH Regulations 2002

SI 1999/3242: Management of Health & Safety at Work Regulations 1999

Health & Safety at Work Act 1974

SI 1993/1643: Environmental Protection Act 1993 & Subsidiary Regulations.

Other national and local measures relating to the workplace, pollution control, environmental protection and waste control.

15.2 Chemical safety assessment

Due to the results of the chemical safety assessment, exposure scenarios and identified uses are not of relevance for this safety data sheet.

15.3 Details of international registration status

Relevant information about individual substance inventories, where available, is given below.

South Korea (Republic of Korea)	ECL (Existing Chemicals List): This product is listed in, or complies with, the substance inventory.
Japan	ENCS (Handbook of Existing and New Chemical Substances): This product is listed in, or complies with, the substance inventory.
Australia	AICS (Australian Inventory of Chemical Substances): This product is listed in, or complies with, the substance inventory.
People's Republic of China	IECSC (Inventory of Existing Chemical Substances in China): This product is listed in, or complies with, the substance inventory.
Canada	DSL (Domestic Substance List): This product is listed in, or complies with, the substance inventory.
Philippines	PICCS (Philippine Inventory of Chemicals and Chemical Substances): This product is listed in, or complies with, the substance inventory.
United States of America (USA)	TSCA (Toxic Substance Control Act Chemical Substance Inventory): This product is listed in, or complies with, the substance inventory.
European Economic Area (EEA)	REACH (Regulation (EC) No 1907/2006): General note: the registration obligations for substances imported into the EEA or manufactured within the EEA by the supplier mentioned in section 1 are fulfilled by the said supplier. The registration obligations for substances imported into the EEA by customers or other downstream users must be fulfilled by the latter.

SECTION 16: Other information**16.1 Material**

The details in this document are based on the state of our knowledge at the time of revision. They do not constitute an assurance of the described product properties in terms of statutory warranty requirements.

The providing of this document to a recipient does not relieve the recipient of his or her responsibility toward compliance with all laws and stipulations applicable to the product. This applies in particular to the further sale or distribution of the product or substances or items containing the product, in other jurisdictions and with regard to the protection of third-party intellectual property rights. If the described product is processed or mixed with other substances or materials, the details stated in this document cannot be conferred to the resultant new product unless this has been expressly mentioned. If the product is repackaged, the recipient is obligated to additionally provide the required safety-related information.

All deliveries are subject to the WACKER SILICONES Health Care Policy, which is available at www.wacker.com.

Safety Data Sheet (1907/2006/EC)

Material: 60003095

**WACKER® SILICONE PASTE P 12
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Version: 4.1 (GB)

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16.2 Further information:

Commas appearing in numerical data denote a decimal point. Vertical lines in the left-hand margin indicate changes compared with the previous version. This version supersedes all previous versions.

Explanation of the GHS classification code:

Aquatic Acute 1; H400: Hazardous to the aquatic environment acute, category 1; Very toxic to aquatic life.

Aquatic Chronic 1; H410 Hazardous to the aquatic environment chronic, category 1; Very toxic to aquatic life with long lasting effects.

R-Phrase	Description
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

- End of Safety Data Sheet -

Ventilation Checklist

Yes No

☐ ☐ Have the labels and MSDSs been reviewed to determine if ventilation is a necessary part of protection?

☐ ☐ Are all parts of a local ventilation system inspected regularly?

Hoods (enclose process and capture contaminants):

☐ ☐ Are the correct hoods being used for each process?

☐ ☐ Are the hoods located as close as possible to the source of contamination?

☐ ☐ Do fans draw enough air to control or capture contaminants?

☐ ☐ Is the hood positioned to draw air away from, not toward, faces?

Ducts (carry contaminants from hood):

☐ ☐ Are ducts as straight as possible (no sharp bends)?

☐ ☐ Is air flow balanced among ducts?

☐ ☐ Have inside walls been checked for dirt or dust buildup?

☐ ☐ Have ducts been checked for holes, leaks, or signs of weakness in seams, joints, walls?

Fans (move air through system):

☐ ☐ Do fans have enough power to do the job?

☐ ☐ Are noise levels low enough to avoid noise pollution?

☐ ☐ Are all belts intact and unstressed?

Air cleaners (clean contaminants from air):

☐ ☐ Are filters, precipitators, scrubbers, etc., inspected regularly and cleaned as necessary?

☐ ☐ Do workers know the procedure for reporting any problems, malfunctions, needed repairs immediately?

Test Facility
 Test Location Laboratory
 Test Date 29-Sep-16
 Barometric Pressure 28.92
 Location Elevation (ft) 940
 Station Baro. Press. (in Hg) 28.8978
 Station Location Elevation (ft) 718

Laboratory Hood Name	Sampling	Duct Diameter (in)	Door Open Width (ft)	Door Open Height (ft)	Door Opening Area (ft ²)	Duct Air Temp (°F)	Static Stack Pressure (P _s) (in Hg)	Duct Volumetric Flow Rate (ft ³ /min)
	1					65.0		
	2					65.0		
	3					65.0		
	4					65.0		
	5					65.0		
	6					65.0		
	7					65.0		
	8					65.0		
	Average	#DIV/0!				65.0	#DIV/0!	#DIV/0!
	1					65.0		
	2					65.0		
	3					65.0		
	4					65.0		
	5					65.0		
	6					65.0		
	7					65.0		
	8					65.0		
	Average	#DIV/0!				65.00	0.028	#DIV/0!
	1					65.0		
	2					65.0		
	3					65.0		
	4					65.0		
	5					65.0		
	6					65.0		
	7					65.0		
	8					65.0		
	Average	#DIV/0!				65.00	0.048	#DIV/0!
	1					65.0		
	2					65.0		
	3					65.0		
	4					65.0		
	5					65.0		
	6					65.0		
	7					65.0		
	8					65.0		
	Average	#DIV/0!				65.00	0.055	#DIV/0!
	1					65.0		
	2					65.0		
	3					65.0		
	4					65.0		
	5					65.0		
	6					65.0		
	7					65.0		
	8					65.0		
	Average	#DIV/0!				65.00	0.031	#DIV/0!
	1					65.0		
	2					65.0		
	3					65.0		
	4					65.0		
	5					65.0		
	6					65.0		
	7					65.0		
	8					65.0		
	Average	#DIV/0!				65.00	0.038	#DIV/0!
	1					65.0		
	2					65.0		
	3					65.0		
	4					65.0		

Laboratory Hood Name	Sampling	Duct Diameter	Door Open Width	Door Open Height	Door Opening Area	Duct Air Temp	Static Stack Pressure (P _s)	Duct Volumetric Flow Rate
		(in)	(ft)	(ft)	(ft ²)	(°F)	(in Hg)	(ft ³ /min)
	5					65.0		
	6					65.0		
	7					65.0		
	8					65.0		
	Average	#DIV/0!	#DIV/0!	#DIV/0!	0.21	65.00	0.029	#DIV/0!
								#DIV/0!
	1							0.0
	2							0.0
	3							0.0
	4							0.0
	5				0.00			0.0
	6							0.0
	7							0.0
	8							0.0
	Average	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	0.0
	1						0.000	0.0
	2						0.000	0.0
	3						0.000	0.0
	4						0.000	0.0
	5				0.00		0.000	0.0
	6						0.000	0.0
	7						0.000	0.0
	8						0.000	0.0
	Average	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	0.0
	1						0.000	0.0
	2						0.000	0.0
	3						0.000	0.0
	4						0.000	0.0
	5				0.00		0.000	0.0
	6						0.000	0.0
	7						0.000	0.0
	8						0.000	0.0
	Average	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	0.0
	1						0.000	0.0
	2						0.000	0.0
	3						0.000	0.0
	4						0.000	0.0
	5				0.00		0.000	0.0
	6						0.000	0.0
	7						0.000	0.0
	8						0.000	0.0
	Average	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	0.00	0.0
	1						0.000	0.0
	2						0.000	0.0
	3						0.000	0.0
	4						0.000	0.0
	5				0.00		0.000	0.0
	6						0.000	0.0
	7						0.000	0.0
	8						0.000	0.0
	Average	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	0.0

Section 1. Identification

GHS product identifier	: Soder-Wick® Rosin Desoldering Braid
Chemical name	: Rosin coating, braided copper wire.
Other means of identification	: Soder-Wick® Rosin, Soder-Wick Rosin® SD, Soder-Wick® Rosin BGA. Various cod based on size and flux type, including but not limited to:50, 80, 90 Series (All Part Numbers)
Product type	: Solid.

Relevant identified uses of the substance or mixture and uses advised against

Not applicable.

Supplier's details	: ITW Chemtronics 8125 Cobb Center Drive Kennesaw, GA 30152 Tel. 770-424-4888 or toll free 800-645-5244
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Emergency telephone number (with hours of operation)	: Chemtrec - 1-800-424-9300 or collect 703-527-3887 24/7
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Section 2. Hazards identification

OSHA/HCS status	: While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200), this MSDS contains valuable information critical to the safe handling and proper use of the product. This MSDS should be retained and available for employees and other users of this product.
Classification of the substance or mixture	: Not classified. Percentage of the mixture consisting of ingredient(s) of unknown toxicity: 100%

GHS label elements

Signal word	: No signal word.
Hazard statements	: No known significant effects or critical hazards.
<u>Precautionary statements</u>	
Prevention	: Not applicable.
Response	: Not applicable.
Storage	: Not applicable.
Disposal	: Not applicable.
Hazards not otherwise classified	: None known.

Section 3. Composition/information on ingredients

Substance/mixture	: Mixture
Chemical name	: Rosin coating, braided copper wire.
Other means of identification	: Soder-Wick® Rosin, Soder-Wick Rosin® SD, Soder-Wick® Rosin BGA. Various cod based on size and flux type, including but not limited to:50, 80, 90 Series (All Part Numbers)

CAS number/other identifiers

Section 3. Composition/information on ingredients

Product code : Soder-Wick® Rosin, Soder-Wick Rosin® SD, Soder-Wick® Rosin BGA. Various cod based on size and flux type, including but not limited to: 50, 80, 90 Series (All Part Numbers)

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

- Eye contact** : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.
- Inhalation** : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.
- Skin contact** : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.
- Ingestion** : Wash out mouth with water. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

- Eye contact** : May cause eye irritation.
- Inhalation** : May be irritating to eyes, skin and respiratory system. May cause sensitization by inhalation.
- Skin contact** : May cause skin irritation. May cause sensitization by skin contact. May cause allergic skin reactions with repeated exposure.
- Ingestion** : No known significant effects or critical hazards.

Over-exposure signs/symptoms

- Eye contact** : Adverse symptoms may include the following:
irritation
redness
- Inhalation** : Adverse symptoms may include the following:
respiratory tract irritation
May cause sensitization by inhalation.
- Skin contact** : Adverse symptoms may include the following:
irritation
sensitizer
May cause allergic reactions in certain individuals.
- Ingestion** : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

- Notes to physician** : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.
- Specific treatments** : No specific treatment.
- Protection of first-aiders** : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

- Suitable extinguishing media** : Use an extinguishing agent suitable for the surrounding fire.
- Unsuitable extinguishing media** : None known.

Specific hazards arising from the chemical : Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities.

Methods and materials for containment and cleaning up

Small spill : Move containers from spill area. Vacuum or sweep up material and place in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid release to the environment.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

None.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Use a properly fitted, particulate filter respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Solid. [Metal.]

Color : Copper.

Odor : wood rosin

Odor threshold : Not available.

pH : Not available.

Melting point : Not available.

Boiling point : 318°C (604.4°F)

Section 9. Physical and chemical properties

Burning time	: Not available.
Burning rate	: Not available.
Evaporation rate	: Not available.
Flammability (solid, gas)	: Not available.
Lower and upper explosive (flammable) limits	: Not available.
Vapor pressure	: Not available.
Vapor density	: Not available.
Relative density	: Not available.
Solubility	: Not available.
Solubility in water	: Not available.
Partition coefficient: n-octanol/water	: Not available.
Auto-ignition temperature	: Not available.
Decomposition temperature	: Not available.
SADT	: Not available.
Viscosity	: Not available.

Section 10. Stability and reactivity

Reactivity	: No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	: The product is stable.
Possibility of hazardous reactions	: Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	: No specific data.
Incompatible materials	: Reactive or incompatible with the following materials: Strong oxidizing agents
Hazardous decomposition products	: Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Not available.

Irritation/Corrosion

Not available.

Conclusion/Summary

Skin	: May cause sensitization by skin contact.
Eyes	: May cause mild eye irritation.
Respiratory	: May cause sensitization by inhalation. Inhalation of this material may cause sensitive individuals to develop eczema and/or occupational asthma.

Sensitization

Not available.

Section 11. Toxicological information

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

- | | |
|---------------------|---|
| Eye contact | : May cause eye irritation. |
| Inhalation | : May be irritating to eyes, skin and respiratory system. May cause sensitization by inhalation. |
| Skin contact | : May cause skin irritation. May cause sensitization by skin contact. May cause allergic skin reactions with repeated exposure. |
| Ingestion | : No known significant effects or critical hazards. |

Symptoms related to the physical, chemical and toxicological characteristics

- | | |
|---------------------|---|
| Eye contact | : Adverse symptoms may include the following:
irritation
redness |
| Inhalation | : Adverse symptoms may include the following:
respiratory tract irritation
May cause sensitization by inhalation. |
| Skin contact | : Adverse symptoms may include the following:
irritation
sensitizer
May cause allergic reactions in certain individuals. |
| Ingestion | : No specific data. |

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

- | | |
|------------------------------------|------------------|
| Potential immediate effects | : Not available. |
| Potential delayed effects | : Not available. |

Long term exposure

- | | |
|------------------------------------|------------------|
| Potential immediate effects | : Not available. |
| Potential delayed effects | : Not available. |

Potential chronic health effects

Not available.

Section 11. Toxicological information

Carcinogenicity	: No known significant effects or critical hazards.
Mutagenicity	: No known significant effects or critical hazards.
Teratogenicity	: No known significant effects or critical hazards.
Developmental effects	: No known significant effects or critical hazards.
Fertility effects	: No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Not available.

Mobility in soil

Soil/water partition coefficient (K_{oc}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Dispose of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT Classification	TDG Classification	Mexico Classification	ADR/RID	IMDG	IATA
UN number	Not regulated.	Not regulated.	Not regulated.	Not regulated.	Not regulated.	Not regulated.
UN proper shipping name	Wire	Wire	Wire	Wire	Wire	Wire

Section 14. Transport information

Transport hazard class(es)	-	-	-	-	-	-
Packing group	-	-	-	-	-	-
Environmental hazards	No.	No.	No.	No.	No.	No.
Additional information	Not regulated.	Not regulated.	Not regulated.	Not regulated.	Not regulated.	Not regulated.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption:** Not determined
United States inventory (TSCA 8b): All components are listed or exempted.
Clean Water Act (CWA) 307: copper

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Not applicable.

Composition/information on ingredients

No products were found.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	copper	7440-50-8	90 - 98
Supplier notification	copper	7440-50-8	90 - 98

Section 15. Regulatory information

State regulations

- Massachusetts : The following components are listed: COPPER
New York : The following components are listed: Copper
New Jersey : The following components are listed: COPPER
Pennsylvania : The following components are listed: COPPER FUME; ROSIN CORE SOLDER
PYROLYSIS PRODUCTS

Canada inventory : All components are listed or exempted.

International regulations

- International lists : **Australia inventory (AICS):** All components are listed or exempted.
China inventory (IECSC): All components are listed or exempted.
Japan inventory: Not determined.
Korea inventory: All components are listed or exempted.
Malaysia Inventory (EHS Register): All components are listed or exempted.
New Zealand Inventory of Chemicals (NZIoC): All components are listed or exempted.
Philippines inventory (PICCS): All components are listed or exempted.
Taiwan inventory (CSNN): Not determined.

Chemical Weapons : Not listed

Convention List Schedule
I Chemicals

Chemical Weapons : Not listed

Convention List Schedule
II Chemicals

Chemical Weapons : Not listed

Convention List Schedule
III Chemicals

Section 16. Other information

Hazardous Material Information System (U.S.A.)

	1
Flammability	0
	1

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on SDSs under 29 CFR 191.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)



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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA

Section 16. Other information

History

Date of printing	: 5/17/2013.
Date of issue/Date of revision	: 5/17/2013.
Date of previous issue	: 5/16/2013.
Version	: 2.01
Key to abbreviations	: ATE = Acute Toxicity Estimate BCF = Bioconcentration Factor GHS = Globally Harmonized System of Classification and Labelling of Chemicals IATA = International Air Transport Association IBC = Intermediate Bulk Container IMDG = International Maritime Dangerous Goods LogPow = logarithm of the octanol/water partition coefficient MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) UN = United Nations
References	: Not available.

☑ Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Material Safety Data Sheet



CircuitWorks® Rosin Flux Remover Pen

1. Product and company identification

Product name : CircuitWorks® Rosin Flux Remover Pen
Supplier : ITW Chemtronics
8125 Cobb Center Drive
Kennesaw, GA 30152
Tel. 770-424-4888 or toll free 800-645-5244
Synonym : CW9200
Trade name : CircuitWorks® Rosin Flux Remover Pen
Manufacturer : ITW Chemtronics
8125 Cobb Center Drive
Kennesaw, GA 30152
Tel. 770-424-4888 or toll free 800-645-5244
Code : CW9200
MSDS # : 3113
Validation date : 6/27/2013.
Print date : 6/27/2013.
In case of emergency : Chemtrec - 1-800-424-9300 or collect 703-527-3887
24/7
Product type : Liquid.

2. Hazards identification

Emergency overview

Physical state : Liquid.
Color : Clear. Colorless.
Odor : Pleasant, ester-like.
Signal word : WARNING!
Hazard statements : FLAMMABLE LIQUID AND VAPOR. CAUSES EYE IRRITATION. MAY CAUSE SKIN IRRITATION. CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE. BASED ON ANIMAL DATA.
Precautionary measures : Do not breathe vapor or mist. Use only with adequate ventilation. Do not eat, drink or smoke when using this product. Avoid contact with eyes, skin and clothing. Keep away from heat, sparks and flame. Keep container tightly closed. Wash thoroughly after handling.
OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Potential acute health effects

Inhalation : Harmful by inhalation. At very high concentrations, can displace the normal air and cause suffocation from lack of oxygen.
Ingestion : Harmful if swallowed. Irritating to mouth, throat and stomach.
Skin : Slightly irritating to the skin.
Eyes : Severely irritating to eyes. Risk of serious damage to eyes.

Potential chronic health effects

Chronic effects : Contains material that may cause target organ damage, based on animal data.
Carcinogenicity : No known significant effects or critical hazards.
Mutagenicity : No known significant effects or critical hazards.
Teratogenicity : No known significant effects or critical hazards.

2. Hazards identification

- Developmental effects** : No known significant effects or critical hazards.
- Fertility effects** : No known significant effects or critical hazards.
- Target organs** : Contains material which may cause damage to the following organs: blood, kidneys, lungs, liver, spleen, upper respiratory tract, skin, central nervous system (CNS), eye, lens or cornea.

Over-exposure signs/symptoms

- Inhalation** : Adverse symptoms may include the following:
dizziness/vertigo
drowsiness/fatigue
headache
unconsciousness

- Ingestion** : Adverse symptoms may include the following:
Irritating to mouth, throat and stomach.
nausea or vomiting

- Skin** : Adverse symptoms may include the following:
irritation
redness

- Eyes** : Adverse symptoms may include the following:
pain or irritation
watering
redness

- Medical conditions aggravated by over-exposure** : Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (Section 11)

3. Composition/information on ingredients

Name	CAS number	%
Isopropyl alcohol	67-63-0	60 - 80
propyl acetate	109-60-4	3 - 10
1-methoxy-2-propanol	107-98-2	1 - 5

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

4. First aid measures

- Eye contact** : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.
- Skin contact** : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.
- Inhalation** : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.
- Ingestion** : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.
- Protection of first-aiders** : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

4. First aid measures

Notes to physician : No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

5. Fire-fighting measures

Flammability of the product : Flammable liquid. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.

Extinguishing media

Suitable : Use dry chemical, CO₂, water spray (fog) or foam.

Not suitable : Do not use water jet.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
metal oxide/oxides

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6. Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8).

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods for cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

7. Handling and storage

- Handling** : Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use non-sparking tools. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.
- Storage** : Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8. Exposure controls/personal protection

Ingredient	Exposure limits
Isopropyl alcohol	ACGIH TLV (United States, 3/2012). STEL: 400 ppm 15 minutes. TWA: 200 ppm 8 hours. NIOSH REL (United States, 1/2013). STEL: 1225 mg/m³ 15 minutes. STEL: 500 ppm 15 minutes. TWA: 980 mg/m³ 10 hours. TWA: 400 ppm 10 hours. OSHA PEL (United States, 6/2010). TWA: 980 mg/m³ 8 hours. TWA: 400 ppm 8 hours. OSHA PEL 1989 (United States, 3/1989). STEL: 1225 mg/m³ 15 minutes. STEL: 500 ppm 15 minutes. TWA: 980 mg/m³ 8 hours. TWA: 400 ppm 8 hours.
propyl acetate	ACGIH TLV (United States, 3/2012). STEL: 1040 mg/m³ 15 minutes. STEL: 250 ppm 15 minutes. TWA: 835 mg/m³ 8 hours. TWA: 200 ppm 8 hours. NIOSH REL (United States, 1/2013). STEL: 1050 mg/m³ 15 minutes. STEL: 250 ppm 15 minutes. TWA: 840 mg/m³ 10 hours. TWA: 200 ppm 10 hours. OSHA PEL (United States, 6/2010). TWA: 840 mg/m³ 8 hours. TWA: 200 ppm 8 hours. OSHA PEL 1989 (United States, 3/1989). STEL: 1050 mg/m³ 15 minutes.

8. Exposure controls/personal protection

1-methoxy-2-propanol	STEL: 250 ppm 15 minutes. TWA: 840 mg/m³ 8 hours. TWA: 200 ppm 8 hours. ACGIH TLV (United States, 3/2012). STEL: 553 mg/m³ 15 minutes. STEL: 150 ppm 15 minutes. TWA: 369 mg/m³ 8 hours. TWA: 100 ppm 8 hours. NIOSH REL (United States, 1/2013). STEL: 540 mg/m³ 15 minutes. STEL: 150 ppm 15 minutes. TWA: 360 mg/m³ 10 hours. TWA: 100 ppm 10 hours. OSHA PEL 1989 (United States, 3/1989). STEL: 540 mg/m³ 15 minutes. STEL: 150 ppm 15 minutes. TWA: 360 mg/m³ 8 hours. TWA: 100 ppm 8 hours.
Recommended monitoring procedures	: If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment. Reference should be made to appropriate monitoring standards. Reference to national guidance documents for methods for the determination of hazardous substances will also be required.
Engineering measures	: Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.
Hygiene measures	: Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.
<u>Personal protection</u>	
Respiratory	: Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.
Hands	: Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.
Eyes	: Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.
Skin	: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

8. Exposure controls/personal protection

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

9. Physical and chemical properties

Physical state : Liquid.
Flash point : Closed cup: 12°C (53.6°F) [Tagliabue.]
Color : Clear. Colorless.
Odor : Pleasant, ester-like.
Boiling/condensation point : 82°C (179.6°F)
Vapor pressure : 4.4 kPa (33 mm Hg) [room temperature]
Vapor density : >1 [Air = 1]
Evaporation rate : <1 (butyl acetate = 1)

10. Stability and reactivity

Chemical stability : The product is stable.
Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.
Incompatible materials : Reactive or incompatible with the following materials:
oxidizing materials
Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

11. Toxicological information

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Isopropyl alcohol	LD50 Dermal	Rabbit	12800 mg/kg	-
	LD50 Oral	Rat	5000 mg/kg	-
propyl acetate	LD50 Oral	Rat	9370 mg/kg	-
1-methoxy-2-propanol	LD50 Dermal	Rabbit	13 g/kg	-
	LD50 Oral	Rat	6600 mg/kg	-

Conclusion/Summary : Not available.

Chronic toxicity

Conclusion/Summary : Not available.

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
Isopropyl alcohol	Eyes - Moderate irritant	Rabbit	-	24 hours 100 milligrams	-
	Eyes - Moderate irritant	Rabbit	-	10 milligrams	-
	Eyes - Severe irritant	Rabbit	-	100 milligrams	-
	Skin - Mild irritant	Rabbit	-	500 milligrams	-
propyl acetate	Eyes - Mild irritant	Rabbit	-	24 hours 500 milligrams	-
	Skin - Mild irritant	Rabbit	-	500	-

11. Toxicological information

1-methoxy-2-propanol	Eyes - Mild irritant	Rabbit	-	milligrams 24 hours 500	-
	Skin - Mild irritant	Rabbit	-	milligrams 500 milligrams	-

Conclusion/Summary : Not available.

Sensitizer

Conclusion/Summary : Not available.

Carcinogenicity

Conclusion/Summary : Not available.

Classification

Product/ingredient name	OSHA	IARC	NTP	ACGIH	EPA	NIOSH
Isopropyl alcohol	-	3	-	A4	-	None.
propyl acetate	-	-	-	-	-	None.
1-methoxy-2-propanol	-	-	-	-	-	None.

Mutagenicity

Conclusion/Summary : Not available.

Teratogenicity

Conclusion/Summary : Not available.

Reproductive toxicity

Conclusion/Summary : Not available.

12. Ecological information

Ecotoxicity : No known significant effects or critical hazards.

Aquatic ecotoxicity

Product/ingredient name	Result	Species	Exposure
Isopropyl alcohol	Acute LC50 1400000 to 1950000 µg/l Marine water	Crustaceans - Crangon crangon	48 hours
propyl acetate	Acute LC50 1400000 µg/l Acute LC50 60000 to 64000 µg/l Fresh water	Fish - Gambusia affinis Fish - Pimephales promelas	96 hours 96 hours

Conclusion/Summary : Not available.

Persistence/degradability

Conclusion/Summary : Not available.

Other adverse effects : No known significant effects or critical hazards.

13. Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff or contact

13. Disposal considerations

with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14. Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
DOT Classification	-	Consumer commodity ORM-D	ORM-D	-		Use ORM-D Label
TDG Classification	-	Consumer commodity ORM-D	ORM-D	-		-
Mexico Classification	-	Consumer commodity ORM-D	ORM-D	-		-
ADR/RID Class	UN1993	FLAMMABLE LIQUID, N.O.S.	3	II		<u>Special provisions</u> 640 (D) <u>Tunnel code</u> (D/E)
IMDG Class	UN1993	FLAMMABLE LIQUID, N.O.S.	3	II		-
IATA-DGR Class	UN1993	FLAMMABLE LIQUID, N.O.S.	3	II		-

PG* : Packing group

15. Regulatory information

HCS Classification : Flammable liquid
Irritating material
Target organ effects

U.S. Federal regulations : **TSCA 8(a) PAIR**: hexamethyldisiloxane
TSCA 8(a) CDR Exempt/Partial exemption: Not determined
United States inventory (TSCA 8b): All components are listed or exempted.

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

15. Regulatory information

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Fire hazard
Immediate (acute) health hazard
Delayed (chronic) health hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
Isopropyl alcohol	60 - 80	Yes.	No.	No.	Yes.	Yes.
propyl acetate	3 - 10	Yes.	No.	No.	No.	Yes.
1-methoxy-2-propanol	1 - 5	Yes.	No.	No.	No.	Yes.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	Isopropyl alcohol	67-63-0	60 - 80
Supplier notification	Isopropyl alcohol	67-63-0	60 - 80

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

State regulations

Massachusetts : The following components are listed: ISOPROPYL ALCOHOL; N-PROPYL ACETATE; PROPYLENE GLYCOL METHYL ETHER

New York : None of the components are listed.

New Jersey : The following components are listed: ISOPROPYL ALCOHOL; 2-PROPANOL; n-PROPYL ACETATE; ACETIC ACID, PROPYL ESTER; PROPYLENE GLYCOL MONOMETHYL ETHER; 1-METHOXY-2-PROPANOL

Pennsylvania : The following components are listed: 2-PROPANOL; ACETIC ACID, PROPYL ESTER; 2-PROPANOL, 1-METHOXY-

Canada inventory : All components are listed or exempted.

International regulations

International lists

: **Australia inventory (AICS)**: All components are listed or exempted.

China inventory (IECSC): All components are listed or exempted.

Japan inventory: All components are listed or exempted.

Korea inventory: All components are listed or exempted.

Malaysia Inventory (EHS Register): Not determined.

New Zealand Inventory of Chemicals (NZIoC): All components are listed or exempted.

Philippines inventory (PICCS): All components are listed or exempted.

Taiwan inventory (CSNN): Not determined.

Chemical Weapons : Not listed

Convention List Schedule I Chemicals

Chemical Weapons : Not listed

Convention List Schedule II Chemicals

Chemical Weapons : Not listed

Convention List Schedule III Chemicals

16. Other information

Label requirements : FLAMMABLE LIQUID AND VAPOR. CAUSES EYE IRRITATION. MAY CAUSE SKIN IRRITATION. CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE. BASED ON ANIMAL DATA.

Hazardous Material :
Information System (U.S.A.)

Flammability	3
Health	1
Instability/Reactivity	1
Special	

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection :
Association (U.S.A.)



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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Date of printing : 6/27/2013.

Date of issue : 6/27/2013.

Date of previous issue : 6/27/2013.

Version : 3

Prepared by : Not available.

☑ Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Safety Data Sheet

according to 1907/2006/EC, Article 31

Printing date: 25.11.2009

Revision: 25.11.2009

Product details:

Trade name: **4900 Lead Free Solder Sn96 (SAC 305)**

Application of the substance / the preparation soldering

Supplier/Manufacturer:

MG Chemicals
9347 - 193rd Street
Surrey, B.C., Canada
V4N 4E7

1-800-201-8822 - 0

1-604-888-3084 - 0

Distributor:

Solid State Supplies Ltd.
Eastlands Lane
Paddock Wood
Kent, TN12 6BU
United Kingdom
Telephone: +44 (0) 1892 836836

www.ssspic.com

Email competent person: sonja.fischer@kft.de

Information department:

See supplier/manufacturer

Technical Support: Phone 1-604-888-3084 - 128

For updates on this SDS please download from www.mgchemicals.com

Emergency information: National Poisons Information Centre Tel.: +44 (0)870 6006266

2. Hazards identification

Hazard description: not applicable

Information pertaining to particular dangers for man and environment:

According to current European laws and regulations the product is not dangerous or toxic material (based on the available data).

Classification system:

The classification was made according to the latest editions of the EC-lists, and expanded using company data and specialized literature.

GHS label elements

Safety data sheet available on request.

3. Composition/information on ingredients

Chemical characterization

Description: Mixture of the substances listed below with nonhazardous additions.

Dangerous components:

CAS: 7440-31-5 tin

91-97%

EINECS: 231-141-8

CAS: 7440-22-4 silver

2.7-4.2%

EINECS: 231-131-3

Additional information For the wording of the listed risk phrases refer to section 16.

Safety Data Sheet

according to 1907/2006/EC, Article 31

Printing date: 25.11.2009

Revision: 25.11.2009

Trade name: 4900 Lead Free Solder Sn96 (SAC 305)

(Contd. of page 1)

- **General information:** No special measures required.
- **After inhalation:**
Inhalation of product is unlikely.
In case of complaints possibly caused by vapours provide fresh air.
If symptoms persist consult a doctor.
- **After skin contact:**
Immediately wash with water and soap and rinse thoroughly.
Generally the product does not irritate the skin.
MOLTEN PRODUCT: Immediately cool skin burns with water and cold packs for at least 15 minutes. Do not put ice directly on the skin. Do not attempt to remove solidified product from the skin, as damage may result. Get immediate medical attention.
- **After eye contact:**
Eye contact is unlikely. If particles get into the eye remove as customary for foreign bodies.
MOLTEN PRODUCT: Cool burns with plenty of low-pressure water. Get immediate medical attention.
- **After swallowing:**
Drink plenty of water, but never give anything to an unconscious person.
Do not induce vomiting.
Call for a doctor immediately.
- **Information for doctor:**
- **The following symptoms may occur:**
After inhalation of high vapour concentration levels:
Headache
Nausea
After the uptake of large quantities:
Insomnia
weakness
Abdominal pain
Constipation
- **Treatment:** Symptomatic treatment

5 Fire fighting measures

- **Suitable extinguishing agents:**
Alcohol resistant foam
Carbon dioxide (CO₂)
Extinguishing powder
Use fire fighting measures that suit the environment.
- **Special hazards caused by the material, its products of combustion or resulting gases:**
Dangerous decomposition product see chapter 10: stability and reactivity
- **Protective equipment:**
Do not inhale combustion vapours.
Wear self-contained respiratory protective device.
- **Additional information:**
Heating leads to pressure increase entailing danger of bursting and explosion. Immediately cool neighbouring packages and containers with sprayed water and, if possible, remove them out of the danger zone

6 Accidental release measures

- **Person-related safety precautions:** Avoid contact with eyes and skin.
- **Measures for environmental protection:** No special measures required.
- **Measures for cleaning/collecting:**
Pick up mechanically.
Send for recovery or disposal in suitable receptacles.
Dispose contaminated material as waste according to item 13.

(Contd. on page 3)

Safety Data Sheet

according to 1907/2006/EC, Article 31

Printing date: 25.11.2009

Revision: 25.11.2009

Trade name: 4900 Lead Free Solder Sn96 (SAC 305)

(Contd. of page 2)

· **Additional information:** No dangerous substances are released.

· Handling

· Information for safe handling:

Avoid contact with eyes and skin.

Avoid inhalation of vapours formed by heated product.

· Information about protection against explosions and fires:



Keep ignition sources away - Do not smoke.

· Storage

· **Requirements to be met by storerooms and receptacles:** Store cool and dry in a well ventilated area.

· **Information about storage in one common storage facility:**

Store away from foodstuffs.

Store away from feed.

· **Further information about storage conditions:** None.

· **Storage class 11** Combustible solids

· Additional information about design of technical systems:

Install appropriate mechanical ventilation.

No further data; see item 7.

· Components with limit values that require monitoring at the workplace:

7440-31-5 tin

OEL (Ireland)

Short-term value: 4 mg/m³Long-term value: 2 mg/m³

7440-22-4 silver

IOELV (European Union) Long-term value: 0.1 mg/m³WEL (Great Britain) Long-term value: 0.1 mg/m³OEL (Ireland) Long-term value: 0.1 mg/m³

IOELV

· **Additional information:** The lists that were valid during the creation were used as basis.

· Personal protective equipment

· General protective and hygienic measures:

Avoid contact with the eyes and skin.

Use skin protection cream for skin protection.

· **Breathing equipment:** Not necessary, if you follow the instructions for use.

· Protection of hands:

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.

Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.

Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· Material of gloves:

For undissolved solid substances following materials may be suitable:

Nitrile rubber (NBR), Butyl rubber (BR), Fluorocarbon rubber (FKM) and Polychloroprene rubber (CR).

The selection of suitable depends upon the material, and also upon the quality of the gloves. The degree of protection will vary from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.

· Penetration time of glove material:

The exact penetration time has to be found out by the manufacturer of the protective gloves and has to be observed.

(Contd.

Safety Data Sheet

according to 1907/2006/EC, Article 31

Printing date: 25.11.2009

Revision: 25.11.2009

Trade name: 4900 Lead Free Solder Sn96 (SAC 305)

(Contd. of page 3)

- Eye protection: Safety glasses
- Body protection: Light weight protective clothing

General Information

Form: Solid.
 Colour: Silver metallic
 Odour: Odourless

Change in condition:

Melting point/Melting range: 1380°C
 Boiling point/Boiling range: not determined

- Flash point: not applicable
- Self ignition temperature: Product is not self-igniting.
- Danger of explosion: Product does not present an explosion hazard.
- Density: 5.9-7.0 g/cm³
- Solubility in / Miscibility with Water: Partly soluble

· Thermal decomposition / conditions to be avoided: No decomposition if used and stored according to specifications.

Materials to be avoided:

Strong acids
 Oxidants

· Dangerous reactions: No dangerous reactions known

Dangerous products of decomposition:

In the case of fire or at high temperatures the formation of the following decomposition products is possible.
 Carbon monoxide and carbon dioxide

Acute toxicity:

· LD/LC50 values that are relevant for classification:

7440-22-4 silver

Oral LOAEL 0.014 mg/kg -bw/day (men)

Dermal LD₅₀ > 5000 mg/kg (mouse)

Primary irritant effect:

· on the skin: No irritating effect.

· on the eye: No irritating effect.

· Sensitization: No sensitizing effects known.

Additional toxicological information:

When used and handled according to specifications, the product does not have any harmful effects according to our experience and the information provided to us.

Ecotoxicological effects:

· Aquatic toxicity: Presently there are no ecotoxicological values available.

(Contd. on page 5)

Safety Data Sheet

according to 1907/2006/EC, Article 31

Printing date: 25.11.2009

Revision: 25.11.2009

Trade name: 4900 Lead Free Solder Sn96 (SAC 305)

(Contd. of page 4)

General notes:

Generally not hazardous for water.
According to appendix 4 of VwVwS dated 27.7.2005 (German regulation)

Product:

Recommendation: Disposal according to instructions of local authorities.

Uncleaned packagings:

Recommendation: Disposal must be made according to official regulations.

Land transport ADR/RID (cross-border)

ADR/RID class: -
No hazardous good according to the regulation.

Maritime transport IMDG:

IMDG Class: -
No hazardous good according to the regulation.

Marine pollutant: No

Air transport ICAO-TI and IATA-DGR:

ICAO/IATA Class: -
No hazardous good according to the regulation.

UN "Model Regulation": -

Regulatory information:

Markings according to EC guidelines: Observe the general safety regulations when handling chemicals

Special labelling of certain preparations:

Safety data sheet available for professional user on request.

National regulations**Technical guidance (air):**

Class Share in %

III 97.0

Water hazard class: Generally not hazardous for water.

Other information:

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

Department issuing MSDS:

KFT Chemieservice GmbH
Im Leuschnerpark, 3 D-64347 Griesheim
Postfach 1451 D-64345 Griesheim

Tel.: +49 6155 86829-0 Fax: +49 6155 86829-25

Safety Data Sheet Service: +49 6155 86829-22

Contact: Dr. Sonja Fischer

(Contd. on page 6)

GB

Safety Data Sheet

according to 1907/2006/EC, Article 31

Printing date: 25.11.2009

Revision: 25.11.2009

Trade name: **4900 Lead Free Solder Sn96 (SAC 305)**

(Contd. of page 5)

Abbreviations and acronyms:

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
 RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)
 IMDG: International Maritime Code for Dangerous Goods
 IATA: International Air Transport Association
 IATA-DGR: Dangerous Goods Regulations by the "International Air Transport Association" (IATA)
 ICAO: International Civil Aviation Organization
 ICAO-TI: Technical Instructions by the "International Civil Aviation Organization" (ICAO)
 GHS: Globally Harmonized System of Classification and Labelling of Chemicals
 LC50: Lethal concentration, 50 percent
 LD50: Lethal dose, 50 percent

Sources: MSDS of the supplier

GB

SECTION 1: Identification of the substance/mixture and of the company/undertaking

Trade name: 48 Flux-Cored Lead Free Solder

Relevant identified uses of the substance or mixture and uses advised against

Solder

Professional use of solder

1.3 Details of the supplier of the safety data sheet

This Safety Data Sheet has been updated in accordance with the Globally Harmonized System (GHS).

Manufacturer/Supplier:

Kester Inc.

800 West Thorndale Avenue

Itasca, IL 60143

Tel 00+1 + 630 616 4000

ITW Specialty Materials (Suzhou) Co., Ltd.

Hengqiao Road, Wujiang Economic Development Zone

Suzhou, Jiangsu Province, China 215200

Tel +86 512 82060807

Further information obtainable from: Product Compliance: EHS_Kester@kester.com

1.4 Emergency telephone number:

TRANSPORT EMERGENCY Phone: CHEMTREC (800) 424-9300 (Outside US & Canada): 00+1 +703 527 3887

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008



GHS07

Eye Irrit. 2 H319 Causes serious eye irritation.

Skin Sens. 1 H317 May cause an allergic skin reaction.

STOT SE 3 H335 May cause respiratory irritation.

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008

The product is classified and labelled according to the CLP regulation.

Hazard pictograms



GHS07

Signal word Warning

Hazard statements

H319 Causes serious eye irritation.

H317 May cause an allergic skin reaction.

H335 May cause respiratory irritation.

Precautionary statements

P280 Wear protective gloves / eye protection.

P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.

P301+P330+P331 IF SWALLOWED: rinse mouth. Do NOT induce vomiting.

P302+P352 IF ON SKIN: Wash with plenty of soap and water.

P402 Store in a dry place.

P501 Dispose of contents/container in accordance with local/regional/national/international regulations.

Additional information:

For use in industrial installations only.

Restricted to professional users.

(Continued on page 2)

3B -

Trade name: 48 Flux-Cored Lead Free Solder

(Continued from page 1)

2.3 Other hazards**Results of PBT and vPvB assessment**

PBT: Not applicable.

vPvB: Not applicable.

SECTION 3: Composition/information on ingredients**3.2 Chemical characterisation: Mixtures****Description:** Mixture of substances listed below with nonhazardous additions.**Chemical components:**

CAS: 7440-31-5 EINECS: 231-141-8	TIN (Sn)		>65%
CAS: 65997-06-0	Rosin	⚠ Skin Sens. 1, H317	3.0-5.0%
CAS: 7440-22-4 EINECS: 231-131-3	SILVER (Ag)		^^
CAS: 7440-50-8 EINECS: 231-159-6	COPPER (Cu)		^^
CAS: 7440-36-0 EINECS: 231-146-5	ANTIMONY (Sb)		^^
CAS: 7440-69-9 EINECS: 231-177-4	BISMUTH (Bi)		^^

Additional information:

This solder product does not contain any Substance of Very High Concern (SVHC) on the European Chemicals Agency (ECHA) candidate list.

^^ See Product Alloy Tab

Composition and weight percent of solder alloys varies widely and can be determined by product label.

SECTION 4: First aid measures**4.1 Description of first aid measures****General information:** Follow general first aid procedures.**After inhalation:** Supply fresh air; consult doctor in case of complaints.**After skin contact:** Immediately wash with water and soap and rinse thoroughly.**After eye contact:** Rinse opened eye for several minutes under running water.**After swallowing:** Seek immediate medical advice.**4.2 Most important symptoms and effects, both acute and delayed** No further relevant information available.**4.3 Indication of any immediate medical attention and special treatment needed**

No further relevant information available.

SECTION 5: Firefighting measures**5.1 Extinguishing media****Suitable extinguishing agents:** CO2. Do not use water.**For safety reasons unsuitable extinguishing agents:** Water**5.2 Special hazards arising from the substance or mixture**

In case of fire, the following can be released:

Carbon monoxide (CO)

Nitrogen oxides (NOx)

Carbon dioxide (CO2)

5.3 Advice for firefighters**Protective equipment:** Wear self-contained respiratory protective device.GB
(Continued on page 3)

Trade name: **48 Flux-Cored Lead Free Solder**

(Continued from page 2)

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures Ensure adequate ventilation

6.2 Environmental precautions: Do not allow to enter sewers/ surface or ground water.

6.3 Methods and material for containment and cleaning up:

Dispose contaminated material as waste according to item 13.

6.4 Reference to other sections

See Section 7 for information on safe handling.

See Section 8 for information on personal protection equipment.

See Section 13 for disposal information.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Prevent formation of dust.

Ensure good ventilation/exhaustion at the workplace.

Information about fire - and explosion protection: No special measures required.

7.2 Conditions for safe storage, including any incompatibilities

Storage:

Requirements to be met by storerooms and receptacles: Store in a cool location.

Information about storage in one common storage facility: Not required.

Further information about storage conditions: None.

7.3 Specific end use(s) No further relevant information available.

SECTION 8: Exposure controls/personal protection

Additional information about design of technical facilities: No further data; see item 7.

8.1 Control parameters

Ingredients with limit values that require monitoring at the workplace:

7440-31-5 TIN (Sn)

PEL Long-term value 2 mg/m³ metal

REL Long-term value 2 mg/m³

TLV Long-term value 2 mg/m³ metal

8.2 Exposure controls

Personal protective equipment:

General protective and hygienic measures:

The usual precautionary measures are to be adhered to when handling chemicals.

Keep away from foodstuffs, beverages and feed.

Immediately remove all soiled and contaminated clothing

Wash hands before breaks and at the end of work.

Respiratory protection:

When ventilation is not sufficient to remove fumes from the breathing zone, a safety approved respirator or self-contained breathing apparatus should be worn.

Protection of hands:



Protective gloves

Material of gloves

Nitrile rubber, NBR

(Continued on page 4)

GB

Trade name: **48 Flux-Cored Lead Free Solder**

(Continued from page 3)

Natural rubber, NR

Penetration time of glove material

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

Eye protection: Safety Glasses with Side Shields Required

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

General Information

Appearance:

Form: Solid material
Colour: Silver grey
Odour: Odourless

pH-value: Not applicable.

Change in condition

Melting point/Melting range: 221-245 °C

Flash point: Undetermined.

Flammability (solid, gaseous): Not determined.

Self-igniting: Product is not selfigniting.

Danger of explosion: Product does not present an explosion hazard.

Vapour pressure: Not applicable.

Density at 20 °C: 7.31-7.42 g/cm³

Vapour density: Not applicable.

Solubility in / Miscibility with water: Insoluble.

SECTION 10: Stability and reactivity

10.1 Reactivity

10.2 Chemical stability

Thermal decomposition / conditions to be avoided: No decomposition if used according to specifications.

10.3 Possibility of hazardous reactions: No dangerous reactions known.

10.4 Conditions to avoid: No further relevant information available.

10.5 Incompatible materials: Strong acids, strong oxidizers.

10.6 Hazardous decomposition products: No dangerous decomposition products known.

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Primary irritant effect:

Skin corrosion/irritation: Irritant to skin and mucous membranes.

Serious eye damage/irritation: Smoke during soldering can cause eye irritation.

Additional toxicological information:

The product shows the following dangers according to the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version:

Harmful

(Continued on page 5)

GB

Trade name: **48 Flux-Cored Lead Free Solder**

Irritant

(Continued from page 4)

SECTION 12: Ecological information**12.1 Toxicity****Aquatic toxicity:** No further relevant information available.**Additional ecological information:****General notes:**

Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.

12.5 Results of PBT and vPvB assessment**PBT:** Not applicable.**vPvB:** Not applicable.**SECTION 13: Disposal considerations****13.1 Waste treatment methods****Recommendation**Must not be disposed together with household garbage. Do not allow product to reach sewage system.
Disposal must be made according to official regulations.**Uncleaned packaging:****Recommendation:** Disposal must be made according to official regulations.**SECTION 14: Transport information****14.1 UN-Number**

Not regulated

14.2 UN proper shipping name

Not regulated

IMDG, IATA

Not regulated

14.3 Transport hazard class(es)

Not regulated

ADR, IMDG, IATA**Class**

Not regulated.

14.4 Packing group

Not regulated

14.5 Environmental hazards:

Not applicable.

Marine pollutant:

No

14.6 Special precautions for user

Not applicable.

14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code

Not applicable.

SECTION 15: Regulatory information**15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture**

All ingredients are listed on the following Government Inventories:

China: Inventory of Existing Chemical Substances in China (IECSC)

Korea: Korea Existing Chemicals List (ECL)

Europe: European Inventory of Existing Commercial Chemical Substances (EINECS)

Japan: Inventory of Existing and New Chemical Substances (ENCS)

Philippines: Philippine Inventory of Chemicals and Chemical Substances (PICCS)

USA: TSCA (Toxic Substances Control Act) TSCA Inventory of Chemical Substances

Labelling according to Regulation (EC) No 1272/2008

The product is classified and labelled according to the CLP regulation.

(Continued on page 6)

GB

Trade name: 48 Flux-Cored Lead Free Solder

(Continued from page 5)

Hazard pictograms

GHS07

Signal word Warning**Hazard statements**

H319 Causes serious eye irritation.

H317 May cause an allergic skin reaction.

H335 May cause respiratory irritation.

Precautionary statements

P280 Wear protective gloves / eye protection.

P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.

P301+P330+P331 IF SWALLOWED: rinse mouth. Do NOT induce vomiting.

P302+P352 IF ON SKIN: Wash with plenty of soap and water.

P402 Store in a dry place.

P501 Dispose of contents/container in accordance with local/regional/national/international regulations.

15.2 Chemical safety assessment: A Chemical Safety Assessment has not been carried out.**SECTION 16: Other information**

The information contained herein is based on data considered accurate and is offered solely for information, consideration and investigation. Kester extends no warranties, makes no representations and assumes no responsibility as to the accuracy, completeness or suitability of this data for any purchaser's use. The data on this Safety Data Sheet (SDS) relates only to this product and does not relate to use with any other material or in any process. All chemical products should be used only by, or under the direction of, technically qualified personnel who are aware of the hazards involved and the necessity for reasonable care in handling. Hazard communication regulations require that employees must be trained on how to use a Safety Data Sheet (SDS) as a source for hazard information.

Department issuing MSDS: Product Compliance / EHS Department**Contact:** EHS_Kester@kester.com**Abbreviations and acronyms:**

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)

IMDG: International Maritime Code for Dangerous Goods

IATA: International Air Transport Association

GHS: Globally Harmonised System of Classification and Labelling of Chemicals

EINECS: European Inventory of Existing Commercial Chemical Substances

ELINCS: European List of Notified Chemical Substances

CAS: Chemical Abstracts Service (division of the American Chemical Society)

LC50: Lethal concentration, 50 percent

LD50: Lethal dose, 50 percent

Eye Irrit. 2: Serious eye damage/eye irritation, Hazard Category 2

Skin Sens. 1: Sensitisation - Skin, Hazard Category 1

STOT SE 3: Specific target organ toxicity - Single exposure, Hazard Category 3

* Data compared to the previous version altered.

48 ACTIVATED ROSIN FLUX-CORED LEAD-FREE PRODUCTS INCLUDED IN THIS SDS

Alloy	Diameter	Core	Description	Part #
K100LD	0.02	66	K100LD #66/48 .020 1 LB SPL	2495741401
K100LD	0.025	66	K100LD #66/48 .025 1 LB SPL	2495741406
K100LD	0.031	66	K100LD #66/48 .031 1 LB SPL	2495741402
K100LD	0.04	66	K100LD #66/48 .040 1 LB SPL	2495741405
K100LD	0.05	66	K100LD #66/48 .050 1 LB SPL	2495741404
K100LD	0.062	66	K100LD #66/48 .062 1 LB SPL	2495741400
K100LD	0.062	66	K100LD #66/48 .062 4 LB SPL	2595741400
SAC305	0.01	66	SN96.5AG03CU.5 #66/48 .010 1 LB SPL	2470681415
SAC305	0.015	66	SN96.5AG03CU.5 #66/48 .015 1 LB SPL	2470681407
SAC305	0.02	66	SN96.5AG03CU.5 #66/48 .020 1 LB SPL	2470681401
SAC305	0.025	66	SN96.5AG03CU.5 #66/48 .025 1 LB SPL	2470681406
SAC305	0.031	66	SN96.5AG03CU.5 #66/48 .031 1 LB SPL	2470681402
SAC305	0.04	66	SN96.5AG03CU.5 #66/48 .040 1 LB SPL	2470681405
SAC305	0.05	58	SN96.5AG03CU.5 #58/48 .050 1 LB SPL	2470681408
SAC305	0.05	66	SN96.5AG03CU.5 #66/48 .050 1 LB SPL	2470681404
SAC305	0.05	66	SN96.5AG03CU.5 #66/48 .050 4 LB SPL	2570681404
SAC305	0.062	66	SN96.5AG03CU.5 #66/48 .062 1 LB SPL	2470681400
SAC305	0.062	66	SN96.5AG03CU.5 #66/48 .062 4 LB SPL	2570681400
SAC305	0.093	66	SN96.5AG03CU.5 #66/48 .093 1 LB SPL	2470681411
SAC305	0.093	66	SN96.5AG03CU.5 #66/48 .093 4 LB SPL	2570681411
SN96.5AG3.5	0.04	50	SN96.5AG03.5 #50/48 .040 1 LB SPL	2470401403

SECTION 1: Identification of the substance/mixture and of the company/undertaking

Trade name: 186 Soldering Flux

Application of the substance / the preparation: Soldering Flux

Relevant identified uses of the substance or mixture and uses advised against

Soldering Flux

Professional use of solder

1.3 Details of the supplier of the safety data sheet

This Safety Data Sheet has been updated in accordance with the Globally Harmonized System (GHS).

Manufacturer/Supplier:

Kester Inc.

800 West Thorndale Avenue

Itasca, IL 60143

Tel 00+1 + 630 616 4000

ITW Specialty Materials (Suzhou) Co., Ltd.

Heng Qiao Road

Wujiang Economic Development Zone

Suzhou, Jiangsu, China 215200

Tel +86 512 82060807

Further information obtainable from:

Product Compliance: EHS_Kester@kester.com

1.4 Emergency telephone number:

TRANSPORT EMERGENCY Phone: CHEMTREC (800) 424-9300 (Outside US & Canada): 00+1 +703 527 3887

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008



GHS02 flame

Flam. Liq. 2 H225

Highly flammable liquid and vapour.



GHS07

Eye Irrit. 2 H319

Causes serious eye irritation.

STOT SE 3 H335-H336 May cause respiratory irritation. May cause drowsiness or dizziness.

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008

The product is classified and labelled according to the CLP regulation.

Hazard pictograms



GHS02 GHS07

Signal word Danger

Hazard statements

H225 Highly flammable liquid and vapour.

H319 Causes serious eye irritation.

H335-H336 May cause respiratory irritation. May cause drowsiness or dizziness.

(Continued on page 2)

GB

Trade name: 186 Soldering Flux

(Continued from page 1)

Precautionary statements

- P210 Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
 P280 Wear protective gloves / eye protection.
 P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
 P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
 P302+P352 IF ON SKIN: Wash with plenty of soap and water.
 P403+P233 Store in a well-ventilated place. Keep container tightly closed.
 P501 Dispose of contents/container in accordance with local/regional/national/international regulations.

Additional information:

For use in industrial installations only.

Restricted to professional users.

2.3 Other hazards**Results of PBT and vPvB assessment**

PBT: Not applicable.

vPvB: Not applicable.

SECTION 3: Composition/information on ingredients

Description: Mixture of substances listed below with nonhazardous additions.

Chemical components:

CAS: 67-63-0 EINECS: 200-661-7	Isopropanol ⚠ Flam. Liq. 2, H225 ⚠ Eye Irrit. 2, H319; STOT SE 3, H336	55-70%
CAS: 65997-06-0	Rosin, modified ⚠ Skin Sens. 1, H317	25-40%
CAS: 100-51-6 EINECS: 202-859-9	Benzyl alcohol ⚠ Acute Tox. 4, H302; Acute Tox. 4, H312; Acute Tox. 4, H332	3-5%

Additional information:

For the wording of the listed risk phrases refer to section 16.

This solder product does not contain any Substance of Very High Concern (SVHC) on the European Chemicals Agency (ECHA) candidate list.

SECTION 4: First aid measures**4.1 Description of first aid measures****General information:** Follow general first aid procedures.**After inhalation:** Supply fresh air; consult doctor in case of complaints.**After skin contact:** Immediately wash with water and soap and rinse thoroughly.**After eye contact:** Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.**After swallowing:** Seek immediate medical advice.**4.2 Most important symptoms and effects, both acute and delayed** No further relevant information available.**4.3 Indication of any immediate medical attention and special treatment needed**

No further relevant information available.

SECTION 5: Firefighting measures**5.1 Extinguishing media****Suitable extinguishing agents:** CO₂, powder or water spray. Fight larger fire with alcohol resistant foam.**For safety reasons unsuitable extinguishing agents:** Water with full jet**5.2 Special hazards arising from the substance or mixture**

In case of fire, the following can be released:

Carbon monoxide (CO)

(Continued on page 3)

GB

Trade name: 186 Soldering Flux

(Continued from page 2)

Nitrogen oxides (NO_x)Carbon dioxide (CO₂)

Aliphatic aldehydes

5.3 Advice for firefighters**Protective equipment:** Wear self-contained respiratory protective device.**SECTION 6: Accidental release measures****6.1 Personal precautions, protective equipment and emergency procedures**

Wear protective equipment. Keep unprotected persons away.

Ensure adequate ventilation

Keep away from ignition sources.

6.2 Environmental precautions: Do not allow to enter sewers/ surface or ground water.**6.3 Methods and material for containment and cleaning up:**

Dispose contaminated material as waste according to item 13.

Ensure adequate ventilation.

Do not flush with water or aqueous cleansing agents

Absorb with clay, diatomaceous earth, dry sand, or other inert material. Do not use combustible materials such as sawdust. Place in a chemical waste container. Flush residual with water.

6.4 Reference to other sections

See Section 7 for information on safe handling.

See Section 8 for information on personal protection equipment.

See Section 13 for disposal information.

SECTION 7: Handling and storage**7.1 Precautions for safe handling**

Store in cool, dry place in tightly closed receptacles.

Ensure good ventilation/exhaustion at the workplace.

Prevent formation of aerosols.

Information about fire - and explosion protection:

Keep ignition sources away - Do not smoke.

Protect against electrostatic charges.

7.2 Conditions for safe storage, including any incompatibilities**Storage:****Requirements to be met by storerooms and receptacles:** Store in a cool location.**Information about storage in one common storage facility:** Store away from oxidising agents.**Further information about storage conditions:**

Keep container tightly sealed.

Store in cool, dry conditions in well sealed receptacles.

7.3 Specific end use(s) No further relevant information available.**SECTION 8: Exposure controls/personal protection****Additional information about design of technical facilities:** No further data; see item 7.**8.1 Control parameters****Ingredients with limit values that require monitoring at the workplace:****67-63-0 Isopropanol**PEL Short-term value: 1225 mg/m³, 500 ppmLong-term value: 980 mg/m³, 400 ppm

(Continued on page 4)

GB

Trade name: 186 Soldering Flux

(Continued from page 3)

TWA	Short-term value: 1250 mg/m ³ , 500 ppm Long-term value: 980 mg/m ³ , 400 ppm
WEL	Short-term value: 1250 mg/m ³ , 500 ppm Long-term value: 999 mg/m ³ , 400 ppm

8.2 Exposure controls**Personal protective equipment:****General protective and hygienic measures:**

The usual precautionary measures are to be adhered to when handling chemicals.

Keep away from foodstuffs, beverages and feed.

Immediately remove all soiled and contaminated clothing

Wash hands before breaks and at the end of work.

Avoid contact with the eyes and skin.

Respiratory protection:

When ventilation is not sufficient to remove fumes from the breathing zone, a safety approved respirator or self-contained breathing apparatus should be worn.

Protection of hands:

Protective gloves

Material of gloves

Nitrile rubber, NBR

Natural rubber, NR

Penetration time of glove material

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

Eye protection:

Safety Glasses with Side Shields Required



Face Shield with Safety Glasses when refilling.

SECTION 9: Physical and chemical properties**9.1 Information on basic physical and chemical properties****General Information****Appearance:**

Form: Liquid

Colour: Amber coloured

Odour: Alcohol-like

pH-value: Not determined.

Change in condition

Melting point/Melting range: Undetermined.

Boiling point/Boiling range: 82 °C

Flash point: 18 °C

Ignition temperature: 425 °C

Self-igniting: Product is not selfigniting.

(Continued on page 5)

GB

SAFETY DATA SHEET (SDS)

according to 1907/2006/EC, Article 31

Version number 2

Revision: 05.07.2015

Trade name: 186 Soldering Flux

(Continued from page 4)

Danger of explosion:	Product is not explosive. However, formation of explosive air/vapour mixtures are possible.
Explosion limits:	
Lower:	2.0 Vol %
Upper:	12.0 Vol %
Vapour pressure at 20 °C:	43 hPa
Density at 20 °C:	0.88 g/cm ³
Solubility in / Miscibility with water:	Partly soluble.
Solvent content:	
Organic solvents:	VOC Content 562 g/L

SECTION 10: Stability and reactivity**10.1 Reactivity** No further relevant information available.**10.2 Chemical stability****Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.**10.3 Possibility of hazardous reactions** No dangerous reactions known.**10.4 Conditions to avoid** No further relevant information available.**10.5 Incompatible materials:** Strong acids, strong oxidizers.**10.6 Hazardous decomposition products:**

Carbon monoxide and carbon dioxide

When heated, the solvents are evaporated and rosin may be thermally degraded to liberate aliphatic aldehydes, acids, and terpenes.

SECTION 11: Toxicological information**11.1 Information on toxicological effects****Acute toxicity****LD/LC50 values relevant for classification:****67-63-0 Isopropanol**

Oral	LD50	5045 mg/kg (rat)
Dermal	LD50	12800 mg/kg (rabbit)
Inhalative	LC50/4 h	30 mg/l (rat)

65997-06-0 Rosin, modified

Oral	LD50	> 4000 mg/kg (Rat)
Dermal	LD50	>2500 mg/kg (rabbit)

100-51-6 Benzyl alcohol

Oral	LD50	1230 mg/kg (rat)
Dermal	LD50	2000 mg/kg (rabbit)

Primary irritant effect:**Skin corrosion/irritation** Possible local irritation by contact with flux or fumes.**Serious eye damage/irritation**

Smoke during soldering can cause eye irritation.

Causes serious eye irritation.

Respiratory or skin sensitisation Based on available data, the classification criteria are not met.**CMR effects (carcinogenicity, mutagenicity and toxicity for reproduction)****Germ cell mutagenicity** Based on available data, the classification criteria are not met.

(Continued on page 6)

GB

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SAFETY DATA SHEET (SDS)

according to 1907/2006/EC, Article 31

Printing Date: 05.07.2015

Version number 2

Revision: 05.07.2015

Trade name: 186 Soldering Flux

(Continued from page 5)

Carcinogenicity Based on available data, the classification criteria are not met.**Reproductive toxicity** Based on available data, the classification criteria are not met.**STOT-single exposure**

May cause respiratory irritation. May cause drowsiness or dizziness.

STOT-repeated exposure Based on available data, the classification criteria are not met.**Aspiration hazard** Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

12.1 Toxicity

Aquatic toxicity: No further relevant information available.

Additional ecological information:

General notes:

Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.

12.5 Results of PBT and vPvB assessment

PBT: Not applicable.**vPvB:** Not applicable.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Recommendation

Must not be disposed together with household garbage. Do not allow product to reach sewage system.

Disposal must be made according to official regulations.

European waste catalogue

14 06 03 | other solvents and solvent mixtures

Uncleaned packaging:

Recommendation: Disposal must be made according to official regulations.

SECTION 14: Transport information

14.1 UN-Number

IMDG, IATA

UN1219

14.2 UN proper shipping name

ADR, IMDG, IATA

UN1219, ISOPROPANOL (ISOPROPYL ALCOHOL) mixture, 3,
II

14.3 Transport hazard class(es)

ADR, IMDG, IATA



Class

3 Flammable liquids.

Label

3

14.4 Packing group

ADR, IMDG, IATA

II

14.5 Environmental hazards:

Marine pollutant:

No

14.6 Special precautions for user

Danger code (Kemler):

Not applicable.

33

(Continued on page 7)

GB

Trade name: 186 Soldering Flux

(Continued from page 6)

EMS Number:

F-E,S-D

14.7 Transport in bulk according to Annex II of Marpol and the IBC Code

Not applicable.

Transport/Additional information:

ADR

Limited quantities (LQ)

1L

Excepted quantities (EQ)

Code: E2

Maximum net quantity per inner packaging: 30 ml

Maximum net quantity per outer packaging: 500 ml

Transport category

2

Tunnel restriction code

D/E

IMDG

Limited quantities (LQ)

1L

Excepted quantities (EQ)

Code: E2

Maximum net quantity per inner packaging: 30 ml

Maximum net quantity per outer packaging: 500 ml

UN "Model Regulation":

UN1219, ISOPROPANOL (ISOPROPYL ALCOHOL) mixture, 3, II

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

All ingredients are listed on the following Government Inventories:

China: Inventory of Existing Chemical Substances in China (IECSC)

Korea: Korea Existing Chemicals List (ECL)

Europe: European Inventory of Existing Commercial Chemical Substances (EINECS)

Japan: Inventory of Existing and New Chemical Substances (ENCS)

Philippines: Philippine Inventory of Chemicals and Chemical Substances (PICCS)

USA: TSCA (Toxic Substances Control Act) TSCA Inventory of Chemical Substances

Labelling according to Regulation (EC) No 1272/2008

The product is classified and labelled according to the CLP regulation.

Hazard pictograms



GHS02 GHS07

Signal word Danger

Hazard statements

H225 Highly flammable liquid and vapour.

H319 Causes serious eye irritation.

H335-H336 May cause respiratory irritation. May cause drowsiness or dizziness.

Precautionary statements

P210 Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

P280 Wear protective gloves / eye protection.

P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.

P302+P352 IF ON SKIN: Wash with plenty of soap and water.

P403+P233 Store in a well-ventilated place. Keep container tightly closed.

P501 Dispose of contents/container in accordance with local/regional/national/international regulations.

(Continued on page 8)

GB



SAFETY DATA SHEET (SDS)

according to 1907/2006/EC, Article 31

Printing Date: 05.07.2015

Version number 2

Revision: 05.07.2015

Trade name: 186 Soldering Flux

(Continued from page 7)

15.2 Chemical safety assessment: A Chemical Safety Assessment has not been carried out.

SECTION 16: Other information

The information contained herein is based on data considered accurate and is offered solely for information, consideration and investigation. Kester extends no warranties, makes no representations and assumes no responsibility as to the accuracy, completeness or suitability of this data for any purchaser's use. The data on this Safety Data Sheet (SDS) relates only to this product and does not relate to use with any other material or in any process. All chemical products should be used only by, or under the direction of, technically qualified personnel who are aware of the hazards involved and the necessity for reasonable care in handling. Hazard communication regulations require that employees must be trained on how to use a Safety Data Sheet (SDS) as a source for hazard information.

Abbreviations and acronyms:

RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)
 ICAO: International Civil Aviation Organisation
 ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
 IMDG: International Maritime Code for Dangerous Goods
 IATA: International Air Transport Association
 GHS: Globally Harmonised System of Classification and Labelling of Chemicals
 EINECS: European Inventory of Existing Commercial Chemical Substances
 ELINCS: European List of Notified Chemical Substances
 CAS: Chemical Abstracts Service (division of the American Chemical Society)
 NFPA: National Fire Protection Association (USA)
 LC50: Lethal concentration, 50 percent
 LD50: Lethal dose, 50 percent
 PBT: Persistent, Bioaccumulative and Toxic
 vPvB: very Persistent and very Bioaccumulative
 Flam. Liq. 2: Flammable liquids, Hazard Category 2
 Acute Tox. 4: Acute toxicity, Hazard Category 4
 Eye Irrit. 2: Serious eye damage/eye irritation, Hazard Category 2
 Skin Sens. 1: Sensitisation - Skin, Hazard Category 1
 STOT SE 3: Specific target organ toxicity - Single exposure, Hazard Category 3

* Data compared to the previous version altered.

GB

SAFETY DATA SHEET



ES896BE Flux-Off® No Clean Plus

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Product name : ES896BE Flux-Off® No Clean Plus
Product code : ES896BE
Product description : Fluxing agents Remover.
Product type : Aerosol.
Other means of identification : Remover.

1.2 Relevant identified uses of the substance or mixture and uses advised against

Not applicable.

1.3 Details of the supplier of the safety data sheet

Manufacturer

Chemtronics
8125 Cobb Center Drive
Kennesaw, GA 30152

Tel. 770-424-4888 or toll free 800-645-5244

Distributor

Importer

ITW Contamination Control BV
Saffierlaan 5
VZ-2132 Hoofddorp
The Netherlands

Email: info@itw-cc.com

Tel: +31 88 1307 400
FAX: +31 88 1307 499

e-mail address of person responsible for this SDS : askchemtronics@chemtronics.com

National contact

ITW Contamination Control BV
Saffierlaan 5
VZ-2132 Hoofddorp
The Netherlands

Email: info@itw-cc.com

Tel: +31 88 1307 400
FAX: +31 88 1307 499

1.4 Emergency telephone number

National advisory body/Poison Centre

Telephone number : EMERGENCY HEALTH INFORMATION:
Chemtrec - 1-800-424-9300 or collect 703-527-3887

SECTION 1: Identification of the substance/mixture and of the company/undertaking

Supplier

Telephone number : Chemtronics Product Information: 800-TECH-401 (800-832-4401)
Chemtronics Customer Service: 800-645-5244
Chemtrec 800-424-9300

Hours of operation : Chemtrec - 1-800-424-9300 or collect 703-527-3887
For emergency responders
24/7

Information limitations : EMERGENCY HEALTH INFORMATION:
EMERGENCY SPILL INFORMATION:
Transport information

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Product definition : Mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP/GHS]

Aerosol 1, H222, H229

Skin Irrit. 2, H315

Eye Irrit. 2, H319

STOT SE 3, H336 (Narcotic effects)

Aquatic Chronic 2, H411

The product is classified as hazardous according to Regulation (EC) 1272/2008 as amended.

Ingredients of unknown toxicity : Percentage of the mixture consisting of ingredient(s) of unknown toxicity: 68%

Ingredients of unknown ecotoxicity : Percentage of the mixture consisting of ingredient(s) of unknown hazards to the aquatic environment: 7.5%

Classification according to Directive 1999/45/EC [DPD]

The product is classified as dangerous according to Directive 1999/45/EC and its amendments.

Classification : F; R11
Xi; R36/38
R67
N; R51/53

Physical/chemical hazards : Highly flammable.

Human health hazards : Irritating to eyes and skin. Vapours may cause drowsiness and dizziness.

Environmental hazards : Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

See Section 16 for the full text of the R phrases or H statements declared above.

See Section 11 for more detailed information on health effects and symptoms.

2.2 Label elements

Hazard pictograms :



Signal word : Danger

Hazard statements : Extremely flammable aerosol.
Pressurized container: may burst if heated.
Causes serious eye irritation.
Causes skin irritation.
May cause drowsiness or dizziness.
Toxic to aquatic life with long lasting effects.

Precautionary statements

SECTION 2: Hazards identification

Prevention	: Wear protective gloves. Wear eye or face protection. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Do not spray on an open flame or other ignition source. Do not pierce or burn, even after use. Avoid release to the environment.
Response	: IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or physician if you feel unwell.
Storage	: Protect from sunlight. Do not expose to temperatures exceeding 50 °C/122 °F.
Disposal	: Dispose of contents and container in accordance with all local, regional, national and international regulations.
Hazardous ingredients	: acetone hexane (containing < 5 %n-hexane (203-777-6))
Supplemental label elements	: Pressurised container: protect from sunlight and do not expose to temperature exceeding 50°C. Do not pierce or burn, even after use. Do not spray on a naked flame or any incandescent material. Keep away from sources of ignition - No smoking. Highly flammable. Irritating to eyes and skin. If swallowed, seek medical advice immediately and show this container or label. Repeated exposure may cause skin dryness or cracking. Do not breathe spray. Vapours may cause drowsiness and dizziness. Use only in well-ventilated areas. Toxic to aquatic organisms. Do not empty into drains. Keep out of the reach of children. FOR INDUSTRIAL USE ONLY
Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles	: Not applicable.
Special packaging requirements	
Containers to be fitted with child-resistant fastenings	: Not applicable.
Tactile warning of danger	: Not applicable.

2.3 Other hazards

Other hazards which do not result in classification	: None known.
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SECTION 3: Composition/information on ingredients

3.2 Mixtures : Mixture

Product/ingredient name	Identifiers	%	Classification		Type
			67/548/EEC	Regulation (EC) No. 1272/2008 [CLP]	
acetone	EC: 200-662-2 CAS: 67-64-1 Index: 606-001-00-8	>=35 - <50	F; R11 Xi; R36 R66, R67	Flam. Liq. 2, H225 Eye Irrit. 2, H319 STOT SE 3, H336 (Narcotic effects) Aquatic Chronic 3, H412	[1] [2]
hexane (containing < 5 %n-hexane (203-777-6))	EC: 203-523-4 CAS: 107-83-5 Index: 601-007-00-7	>=25 - <35	F; R11 Xn; R65 Xi; R38 R67 N; R51/53	Flam. Liq. 2, H225 Skin Irrit. 2, H315 STOT SE 3, H336 (Narcotic effects) Asp. Tox. 1, H304 Aquatic Chronic 2, H411	[1]
3-methylpentane	EC: 202-481-4 CAS: 96-14-0 Index: 601-007-00-7	>=15 - <20	F; R11 Xn; R65 Xi; R38 R67 N; R51/53	Flam. Liq. 2, H225 Skin Irrit. 2, H315 STOT SE 3, H336 (Narcotic effects) Asp. Tox. 1, H304 Aquatic Chronic 2, H411	[1]

SECTION 3: Composition/information on ingredients

2,3-dimethylbutane	EC: 201-193-6 CAS: 79-29-8 Index: 601-007-00-7	>=15 - <20	F; R11 Xn; R65 Xi; R38 R67 N; R51/53	Flam. Liq. 2, H225 Skin Irrit. 2, H315 STOT SE 3, H336 (Narcotic effects) Asp. Tox. 1, H304 Aquatic Chronic 2, H411 Not classified.	[2]
carbon dioxide	EC: 204-696-9 CAS: 124-38-9	>=5 - <10	Not classified.		
2,2-dimethylbutane	EC: 200-906-8 CAS: 75-83-2 Index: 601-007-00-7	>=5 - <10	F; R11 Xn; R65 Xi; R38 R67 N; R51/53	Flam. Liq. 2, H225 Skin Irrit. 2, H315 STOT SE 3, H336 (Narcotic effects) Asp. Tox. 1, H304 Aquatic Chronic 2, H411	[1]
methanol	EC: 200-659-6 CAS: 67-56-1 Index: 603-001-00-X	<3	F; R11 T; R23/24/25, R39/23/24/25	Flam. Liq. 2, H225 Acute Tox. 3, H301 Acute Tox. 3, H311 Acute Tox. 3, H331 Skin Irrit. 2, H315 Eye Irrit. 2, H319 STOT SE 1, H370 Aquatic Chronic 3, H412	[1] [2]
n-hexane	EC: 203-777-6 CAS: 110-54-3 Index: 601-037-00-0	>=0.5 - <1	F; R11 Repr. Cat. 3; R62 Xn; R48/20, R65 Xi; R38 R67 N; R51/53 See Section 16 for the full text of the R- phrases declared above.	Flam. Liq. 2, H225 Skin Irrit. 2, H315 Eye Irrit. 2, H319 Repr. 2, H361f (Fertility) STOT SE 3, H336 (Narcotic effects) STOT RE 2, H373 Asp. Tox. 1, H304 Aquatic Chronic 2, H411 See Section 16 for the full text of the H statements declared above.	[1] [2]

There are no additional ingredients present which, within the current knowledge of the supplier, are classified and contribute to the classification of the substance and hence require reporting in this section.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment, are PBTs, vPvBs or Substances of equivalent concern, or have been assigned a workplace exposure limit and hence require reporting in this section.

Type

- [1] Substance classified with a health or environmental hazard
- [2] Substance with a workplace exposure limit
- [3] Substance meets the criteria for PBT according to Regulation (EC) No. 1907/2006, Annex XIII
- [4] Substance meets the criteria for vPvB according to Regulation (EC) No. 1907/2006, Annex XIII
- [5] Substance of equivalent concern

Occupational exposure limits, if available, are listed in Section 8.

SECTION 4: First aid measures

4.1 Description of first aid measures

Eye contact

: Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.

Inhalation

: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If necessary, call a poison center or physician. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or

SECTION 4: First aid measures

- waistband.
- Skin contact** : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.
- Ingestion** : Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. If necessary, call a poison center or physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
- Protection of first-aiders** : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

4.2 Most important symptoms and effects, both acute and delayed

Potential acute health effects

- Eye contact** : Causes serious eye irritation.
- Inhalation** : Harmful by inhalation. Vapours may cause drowsiness and dizziness.
- Skin contact** : Causes skin irritation.
- Ingestion** : Harmful if swallowed. Irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

- Eye contact** : Adverse symptoms may include the following:
pain or irritation
watering
redness
- Inhalation** : Adverse symptoms may include the following:
respiratory tract irritation
coughing
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness
- Skin contact** : Adverse symptoms may include the following:
irritation
redness
- Ingestion** : Adverse symptoms may include the following:
Irritating to mouth, throat and stomach.
nausea or vomiting
stomach pains

4.3 Indication of any immediate medical attention and special treatment needed

- Notes to physician** : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.
- Specific treatments** : No specific treatment.

SECTION 5: Firefighting measures

5.1 Extinguishing media

- Suitable extinguishing media** : Use an extinguishing agent suitable for the surrounding fire.
- Unsuitable extinguishing media** : None known.

5.2 Special hazards arising from the substance or mixture

- Hazards from the substance or mixture** : Extremely flammable aerosol. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. Gas may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back, causing fire or explosion. Bursting aerosol containers may be propelled from a fire at high speed. Runoff to sewer may create fire or explosion hazard. This material is toxic to aquatic life with long lasting effects. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.
- Hazardous thermal decomposition products** : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

5.3 Advice for firefighters

- Special protective actions for fire-fighters** : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.
- Special protective equipment for fire-fighters** : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode. Clothing for fire-fighters (including helmets, protective boots and gloves) conforming to European standard EN 469 will provide a basic level of protection for chemical incidents.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

- For non-emergency personnel** : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. In the case of aerosols being ruptured, care should be taken due to the rapid escape of the pressurised contents and propellant. If a large number of containers are ruptured, treat as a bulk material spillage according to the instructions in the clean-up section. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.
- For emergency responders** : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

6.2 Environmental precautions

- : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities. Collect spillage.

6.3 Methods and materials for containment and cleaning up

- Small spill** : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

SECTION 6: Accidental release measures

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations. Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product.

6.4 Reference to other sections : See Section 1 for emergency contact information.
See Section 8 for information on appropriate personal protective equipment.
See Section 13 for additional waste treatment information.

SECTION 7: Handling and storage

The information in this section contains generic advice and guidance. The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

7.1 Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Pressurised container: protect from sunlight and do not expose to temperature exceeding 50°C. Do not pierce or burn, even after use. Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing gas. Avoid breathing vapour or mist. Avoid release to the environment. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Empty containers retain product residue and can be hazardous.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

7.2 Conditions for safe storage, including any incompatibilities

Store in accordance with local regulations. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Use appropriate containment to avoid environmental contamination.

Seveso II Directive - Reporting thresholds (in tonnes)

Named substances

Name	Notification and MAPP threshold	Safety report threshold
petroleum products - gasoline and naphthas - kerosenes (including jet fuels) - gas oils (including diesel fuels, home heating oils and gas oil blending streams)	2500	25000
methanol	500	5000

Danger criteria

Category	Notification and MAPP threshold	Safety report threshold
P3b: Flammable aerosols NOT containing flammable gases or flammable liquids	5000	50000
E2: Hazardous to the aquatic environment - Chronic 2	200	500
C7b: Highly flammable (R11)	5000	50000
C9ii: Toxic for the environment	200	500

7.3 Specific end use(s)

Recommendations : Not available.

SECTION 7: Handling and storage

Industrial sector specific solutions : Not available.

SECTION 8: Exposure controls/personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker or exposure or environmental releases.

8.1 Control parameters

Occupational exposure limits

Product/ingredient name	Exposure limit values
acetone	EU OEL (Europe, 12/2009). Notes: list of indicative occupational exposure limit values TWA: 1210 mg/m ³ 8 hours. TWA: 500 ppm 8 hours.
carbon dioxide	EU OEL (Europe, 12/2009). Notes: list of indicative occupational exposure limit values TWA: 9000 mg/m ³ 8 hours. TWA: 5000 ppm 8 hours.
methanol	EU OEL (Europe, 12/2009). Absorbed through skin. Notes: list of indicative occupational exposure limit values TWA: 260 mg/m ³ 8 hours. TWA: 200 ppm 8 hours.
n-hexane	EU OEL (Europe, 12/2009). Notes: list of indicative occupational exposure limit values TWA: 72 mg/m ³ 8 hours. TWA: 20 ppm 8 hours.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment. Reference should be made to monitoring standards, such as the following: European Standard EN 689 (Workplace atmospheres - Guidance for the assessment of exposure by inhalation to chemical agents for comparison with limit values and measurement strategy) European Standard EN 14042 (Workplace atmospheres - Guide for the application and use of procedures for the assessment of exposure to chemical and biological agents) European Standard EN 482 (Workplace atmospheres - General requirements for the performance of procedures for the measurement of chemical agents) Reference to national guidance documents for methods for the determination of hazardous substances will also be required.

DNELs/DMELs

No DNELs/DMELs available.

PNECs

No PNECs available

8.2 Exposure controls

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.