Richard Thiel, PE

Thiel Engineering

Richard Thiel, P. E., the founder and president of our company, Thiel Engineering, has over thirty years of experience in containment design applications for geotechnical projects, waste containment, secondary containment of fuel, and leach mining applications. Mr. Thiel also has extensive experience in feasibility evaluation, permitting, and design and construction of waste facilities and surface impoundments. Before specializing in containment system design, Mr. Thiel participated in the design of several large rock-fill, clay-core dams.

His professional involvement in the field includes these additional services:

- designing containment liner systems with soils, geosynthetics, piping, and ancillary facilities
- evaluating and designing liquid and leachate management systems including pump stations, pipe lines, bioreactor programs, storage ponds, tanks, and treatment systems
- carrying out geotechnical site reconnaissance and resource investigations as well as construction quality assurance (CQA)
- geotechnical engineering for slope stability and foundation design
- permitting and assisting in developing containment systems regulations for waste and other regulated materials
- testifying as an expert witness
- reviewing peer designs
- conducting economic evaluations
- performing failure analyses

Relevant project experience:

Instructor Experience

Instructor for the ASCE short course on Design of Waste Containment Liner and Final Cover Systems, as well as several other courses. See “Conferences and Teaching Courses” for a complete list.

Engaged by the California State Water Resources Control Board in 2015 for 2-year contract to develop training course curriculum and to provide Geosynthetic Liner and Cover Design training services to Water Board staff. Contract renewed for additional 2 years in 2019-20.

Design, Construction, and Project-Management Experience

Project manager, designer, and CQA management for new 13.5-acre Cell 8 at the Cowlitz County Headquarters landfill; project included landfill gas, storm water, and road infrastructure upgrades. (2016-2018). This was followed by design of 13.7 acre Cell 9 in 2019.

Recognized national expert for fueling depot secondary containment lining systems for BNSF railroad tasked with providing design review services and CQA services directly to BNSF as well as to its general civil consulting engineers on dozens of facilities nationwide from 2007 to the present (2019).

Engineer for Lane County Solid Waste Management division of Public Works Department; provided annual opinions of cost for landfill closure and thirty-year post-closure period; designed new 1.3 MM gallon leachate holding tank, new pump station, and integrated piping infrastructure (2013-2016); provided permitting, design and construction management for 9 acre piggyback liner system for Phase V-B (2014-15); provided permitting and design for 17 acre closure of Phase III landfill (2009); provided permitting, design and construction management for 17 acre double-lined Phase V landfill cell and pump station (2007); provided permitting, design and construction management for 19 acre closure of Phase I/II landfill using innovative 2-season construction approach (2006-2007); provided past master planning for that site as well as site fill and master planning (2006) at their Short Mountain Landfill; assisted with resolution and trial testing of reverse-osmosis leachate treatment plant including residuals management (2003-2015). In addition, coordinated ground water monitoring, landfill gas systems, annual volume estimates for waste and leachate, leachate management planning, and construction services for their active and closed landfill facilities around Lane County (2003-2015). Closure and post-closure cost estimates (2003-2018). Continuing services for 3-year contract starting in 2019 for landfill master planning, floating cover rehabilitation in leachate pond, new 1-mile haul road, new 90’ steel girder bridge over swale, and new cell design.

Provided subconsulting services for US Bureau of Land Management regarding of final cover system design and construction, and CQA assistance, for closure of Bayer-Monsanto Blackfoot Bridge phosphate mine overburden cover in Idaho (2013-2019).

Consultant for review of slope deformation issues due to waves on 5 very large lined reservoirs (totally approx. 350 acres) in southern California (2017-18).

Consultant to another engineering firm to perform design calculations, coordinate geotechnical testing, peer review of construction drawings and specifications, and advice for CQA for 35-acre landfill closure utilizing composite cover liner system at site in Morgan County, Alabama (2017).

Expert reviewer for lining and monofilling of wastewater treatment ponds and solids in northeast Portland, OR as subconsultant to Brown & Caldwell. CQA Certifying Engineer for lining sludge monofill for the City of Portland’s Triangle Lake Wastewater Treatment Plant (2013), and CQA for lining Phases 3 and 4 settlement lagoons (2015). Continued consulting services on project design, construction, and pond operations (2015-2017). CQA Certifying Engineer for cover liner system on the sludge monofill for the City of Portland’s Triangle Lake Wastewater Treatment Plant (2019).

Provided detailed post-closure care cost estimate to allow buyer and seller of newly-closed industrial landfill to consummate transfer of property to the Willamalane Parks District near Eugene, Oregon (2017).

Provided slope stability analyses, peer review of construction design drawings and specifications, design calculations, and CQA review of shear strength testing for Cell 7 construction at the Dry Creek landfill near Medford, Oregon (2017).

Provided project constructability review and letter of opinion regarding design and performance of mining tailings pile base liner design for project in Michigan (2017).

Consultant for lining system design for gypsum stacks in Brazil (2016).

Engineer for permitting, design, and construction of water-balance cover for 25-acre old landfill in Cody, WY (2016).

Project manager, designer, and CQA management for new thirteen-acre Cell 7 at the Cowlitz County Headquarters landfill; project included landfill gas, storm water, and road infrastructure upgrades. (2014-2016)

Design engineer and CQA certifying engineer for water-balance final cover, including silva-culture considerations, for old forest products 45-acre landfill in NW Washington; project permitting through construction CQA (2013-16).

Project manager and designer for new Cell 6 at the Cowlitz County Headquarters landfill; provided fast-track design and CQA management and certification for new 2.5-acre cell to allow the new owner to begin operations and followed immediately with a six-acre cell addition; concurrently provided overall client services for new landfill gas flare and header system design and construction and air permitting and risk evaluation. (2013-2014)

Engineer for new master plan and re-permitting to change regional forest-products industrial landfill in SW Washington to regional county-owned MSW (Municipal Solid Waste) landfill; work included coordinating with SEPA requirements, revising engineering report including slope stability analyses and alternative liner demonstration, estimating development costs, and following closure and post-closure procedure. Permitting and preliminary engineering work occurred from 2011 to 2013.

Solid waste engineer consultant for the Coffin Butte Regional Landfill in Benton County, Oregon for 20 years from 1995 to 2014. Provided services to plan, permit, design, and provided construction certification services for 6 new double-lined landfill cells, 5 landfill closures, two new double-lined leachate ponds, floating covers and inflated cover for leachate ponds, leachate evaporation system, four leachate pump stations and pipelines, permitting and design for a direct/reverse osmosis leachate treatment facility complete with residuals management program, master plan updates, stormwater management plans and infrastructure design, geotechnical investigations and analyses for all of the above.

Engineer for Preliminary Engineering and Design Report (2012) for new sixteen-mile 8”-dia leachate force main and pump station; performed hydraulic analyses, pump selection, pump station design, pipeline alignment and profile design, and preliminary construction cost estimate to transfer leachate from Headquarters Landfill in the Mt. Saint Helens Tree Farm to the POTW in Kelso, Washington; work included evaluations of alternative alignments, preliminary evaluation of soils and geologic hazards, evaluation of methods of construction, cost estimates, and support for SEPA process; continuing working as Quality Control reviewer for final design in 2013. Pipeline had successful startup in March 2015.

Engineer for development of proprietary under-slab methane collection system for construction around the City of Los Angeles. (2013)

Engineer for preparation of landfill master plan, design engineer for ACAP (Alternative Covers Assessment Program) closure for existing landfill, and design engineer for construction drawings for first and second cells of new landfill Phases 1 and 2 for Johnson County in Wyoming near Buffalo, WY. Assisted with preparation of project contract documents 2014, and construction inspections which was successfully completed in 2015.

Reviewer of slope stability for 140-acre, 420-foot high silver/gold heap on composite liner system in Nevada (2013).

Expert design peer review and construction certifying engineer for 150-acre valley-style heap-leach pad for Carlota Copper Company in Miami, AZ; project review and CQA involved composite GCL and 80-mil LLDPE liner over 175 acres, double liner with leak detection system over 15 acres, two double-lined ponds, 90-million gallon double-lined containment pond, HDPE lining of concrete tanks for the SX/EW process solutions, and storm-water improvements for contact- and non-contact waters. (2008-2011). Consulted on site closure options (2013).

Reviewer of master-plan layout for new Waste Management Facility (WMF) on Grand Cayman Island; Thiel Engineering's master-plan suggestions were accepted for moving forward with the project, and Thiel Engineering provided support to the EIS process. (2012-2013)

Provider of engineering design drawings for secondary leak detection and collection system below concrete roll-off container pads used below public dumping Z-walls at Oregon central valley landfill; also provided construction design and specifications for storm-water pump station and force main to transfer storm-water collected from these pads to the leachate ponds (2012).

Provider of CQA services for landfill liner installation in Vietnam. (2012)

Engineer of record for engineering design and operations plan to permit two double-lined ponds in McKinley, New Mexico for the temporary storage and evaporation of by-product waste water from a proposed facility that uses in-situ leaching for the extraction of uranium. The liquids to be contained in the ponds would be the concentrate from reverse-osmosis filtration units. The design consisted of two double-lined HDPE ponds, about three acres each (nominally 10 million gallons capacity each, plus 3 ft freeboard), with incorporation of perimeter-mounted liquid atomizers to enhance evaporation. The ponds were designed with special provisions to be constructed over soils that could potentially collapse when saturated. (2009)

Construction certifying engineer for 3.5-acre hazardous waste landfill expansion in eastern Oregon. (2011)

Engineer of record for ACAP permitting for MSW landfill in Spokane, Washington. (2011)

Design reviewer of final cover system and CQA services for geosynthetics installation, on Alcoa triple-lined landfill in Ferndale, Washington (2011). Provided CQA inspection of welding of double liners together in the existing anchor trench in 2014 and 2015.

Provider of construction drawings and specifications for final cover construction of landfill in Wamsutter, WY. (2011)

Provider of expert review and opinion, in conjunction with Dr. Ed Kavazanjian, on controversial final cover project for Tullamarine hazardous waste landfill in Melbourne, Australia. (2011)

Expert witness for litigation of geotechnical aspects of C&D landfill reclamation project in New Mexico. (2010-13)

Certifying engineer for CDF (confined disposal facility) pond liners on Superfund project for the Spring Creek Sediment project near Redding, CA; worked as first-tier contractor under CH2M Hill; provided design review recommendations, construction CQA, and final certification. (2009).

Expert for Defendant in preparation of litigation for failed wastewater treatment pond liner in Idaho. (2010)

Construction certifying engineer and peer reviewer, for six large (75-acre each) lined tertiary treated-water storage ponds for the Los Angeles County Sanitation Districts. The projects, located in the cities of Lancaster and Palmdale, CA involved approximately 3 million cubic yards of embankment, 450 acres of 60- and 80-mil HDPE geomembrane installation, large pipe penetrations, and soil-cement armoring. (2007-2010)

Project manager for water-balance alternative cover to be permitted in central Washington Wenatchee landfill in 2009; tasks involved soil resource investigation, laboratory testing of soil-water characteristics, water-balance modeling, and design and CQA reports for regulatory approval. (2009)

Project manager for ASP-based compost facility design and permitting for Valley Landfills near Corvallis, Oregon. (2009)

Provider of slope stability analysis and review for proposed landfill master plan expansion at the Dry Creek Landfill in Medford, Oregon. (2009-15)

Expert peer reviewer for a superfund landfill closure design of a Weyerhaesuer landfill in Kalamazoo, Michigan. (2008)

Provider of expert testimony on liner systems for a public hearing for a landfill expansion in McMinville, Oregon. (2008)

Engineer for geotechnical investigation and foundation recommendations for gas-to-energy plant at a landfill in eastern Oregon. (2008)

Certifying engineer-of-record for CQA of four-acre composite liner expansion for a landfill near Spokane, Washington. (2008)

Developer of landfill master plan for Park County in Wyoming for an existing landfill site near Cody, Wyoming. (2008)

Expert reviewer of geotechnical investigation, settlement calculations, and stability analyses for a new landfill in Brevard County, Florida.

Developer of preliminary grading and liner system design for a 500-acre system of evaporation ponds for a potash mine in New Mexico. (2008)

Designer and certifying engineer-of-record for sixteen-acre landfill expansion (Cell 5) for the Weyerhaeuser landfill near Longview, Washington. Earthwork was certified in 2008; partial liner construction performed in 2009, remaining work was done in 2011.

Construction certifying engineer for CQA of twenty-acre double-lined evaporation pond for oil-and-gas production water in central Wyoming. (2008)

Design engineer and certifying engineer of record for the following projects: four- acre composite liner expansion for Weyerhaeuser landfill near Longview Washington;

CQA and certifying engineer of record at Columbia Ridge Regional Landfill in Arlington, Oregon for several of their landfill cells and closures as follows:. sixteen-acre composite liner expansion for Module 12 (2007); 33-acre Arlington Landfill Alternative Final Cover System (evapo-transpiration cover, (2006); Module 11 composite liner (2005); twenty-acre landfill cells Module 9A (2002) and Module 9B/10 (2003); Also designer of re-lining system of leachate evaporation pond (2005).

Certifying CQA engineer of record at Chemical Waste Management site near Arlington, Oregon for double-composite liner for 4-ac L-14 Cell 3 hazardous landfill (2011), 4-ac L-14 Cell 2 hazardous landfill (2005), 7-ac L-14 Cell 1 hazardous landfill (2003), 6-ac closure for hazardous waste landfill L-10, 7-ac new cell for haz-waste landfill L-14 Cell 1 (2003); permitting increased slopes and final cover design for three of the site's hazardous waste landfills;

Design engineer for master plan and closure plan update for landfill in Missoula, Montana. (2006)

Peer reviewer and 2005 certifying construction engineer for Los Angeles County Sanitation Districts Calabasas North Ridge Phase 1 Liner System; reviewed plans and specifications and acted as CQA project manager and certifying engineer for 22-acre expansion in conjunction with Vector Engineering; also performed same certifying engineer function for the eighteen-acre expansion at this site in 2006 and again in 2008.

Certifying construction engineer for the following construction projects: North Marion County Disposal Facility Cell 3 closure near Salem, Oregon. (2005)

Certifying construction engineer for double-lined evaporation pond for natural gas production water at site near Big Piney, Wyoming. (2005)

Design engineer for five-acre composite lined landfill expansion in Missoula, Montana. (2005)

Design engineer and permitting of leachate land application and leachate re-introduction to landfill for Crook County landfill site near Prineville, Oregon. (2005)

Consultant for final closure and abandonment of sludge ponds and adjacent landfill for Weyerhaeuser paper mill shut-down in southern Oregon. (2004)

Design engineer for projects for the following projects: new ten-acre composite lined landfill in Missoula, Montana. (2004)

Design engineer for twenty-acre landfill cell near Roosevelt, Washington. (2004)

Design and construction certifying engineer for ten-acre composite liner landfill expansion for Crook County near Prineville, Oregon. (2003)

Design and construction certifying engineer for closure of Pope & Talbot wood-waste landfill near Oakridge, Oregon. (2001 and 2003)

Design peer reviewer and construction certifying engineer for Los Angeles County Sanitation Districts, Puente Hills Phase five-liner system, a twenty- acre expansion consisting mostly of 1.5:1 slopes and narrow benches, having an encapsulated GCL liner design, and costing $7.5 million. (2003)

Design and construction certifying engineer for 3.5-acre double-lined landfill cell at Coffin Butte landfill near Corvallis, Oregon. (2003)

Operational and design consultant and advisor for Lane County, Oregon solid-waste division. (2003 and ongoing)

Design and construction certifying engineer for twenty-acre composite landfill liner and three acre double-lined ash monofill cell for Regional Disposal Corporation near Roosevelt, Washington. (2003)

Design and construction certifying engineer for ten-acre composite liner for pulp and paper landfill for Weyerhaeuser landfill near Longview, Washington. (2003)

Expert consultant and provider of sealed calculations regarding slope stability for double-liner landfill expansion utilizing encapsulated GundSeal for Brunner landfill site near Zelionople, Pennsylvania. (2002)

Design engineer and certifying construction engineer for nine-acre landfill closure at the Weyerhaeuser Regional Landfill in western Washington. (2002)

Certifying CQA engineer of record for six-acre double-lined ash monofill utilizing encapsulated GCL and electric leak detection in Marion County, Oregon. (2002)

Design engineer and certifying construction engineer for twenty-acre composite landfill liner expansion at the Roosevelt Regional Landfill (Area 10) in eastern Washington. (2002)

Certifying CQA engineer of record for four-acre landfill Phase IV Cell 2 expansion in The Dalles, Oregon using GCL composite liner. (2002)

Reviewer of closure and post-closure costs for Short Mountain Landfill in Lane County, Oregon. (2001)

On-going peer-reviewer for engineering firms in California, Oregon, and Washington.

Certifying engineer-of-record for closure construction of two MSW landfill sites in Lassen Co., California. (2002)

Design and construction engineer for repair of leaking pond liner in Classical Chinese Garden, Portland, Oregon.

Design engineer and certifying construction engineer for twenty-acre composite landfill liner expansion and double-lined ash monofill, at the Roosevelt Regional Landfill in eastern Washington (Area 9 and Ash Stage F1). (2001)

Lead author of Gundseal Design Manual, the most comprehensive guide in the industry for designing with GCL liners; co-authors included Dr. Dave Daniel, Mr. Richard Erickson, Dr. Ed Kavazanjian, and Dr. J.P. Giroud. (Published in September 2001).

Geosynthetics design expert and engineer of record to perform hydraulic and slope stability calculations to achieve design approval for alternative GCL double-liner system for two landfills in Pennsylvannia. (2001)

Geosynthetics design expert to achieve alternate GCL liner design approval for Marion County, Oregon ash monofill. (2001)

Geosynthetic expert subconsultant to design exposed geomembrane cover for two Yolo County experimental bioreactor cells.

Certifying CQA engineer of record for five-acre landfill Phase IV Cell 1 expansion in The Dalles, Oregon using GCL composite liner, including three acres double-lined with leak detection that was verified using electric leak location techniques. (completed July 2001)

Geosynthetics expert consultant providing design for slope stability analyses and material specifications and directing construction materials acceptance testing for the Dry Creek Landfill Cell 3 construction in southern Oregon.

Expert witness for dispute resolution regarding multi-million square foot cover installation for site remediation; issues involved geomembrane wrinkle management and allowable defects.

Design engineer and certifying construction engineer for four-acre composite landfill liner expansion (Cell B) at the Weyerhaeuser Regional Landfill in western Washington. (2000)

Design engineer and certifying construction engineer for twenty-acre composite landfill liner expansion (Area 8)at the Roosevelt Regional Landfill in eastern Washington. (2000)

CQA engineer of record for clay-composite landfill liner expansion at the Wasco Landfill in The Dalles, Oregon. (Phase IIIC – 1999).

CQA engineer of record for fifteen-acre composite landfill liner expansion at the Roosevelt Regional Landfill in eastern Washington (Area 7 – 1999).

Engineer and CQA officer for new eight-acre, triple-lined landfill cell at the Coffin Butte regional landfill. The new cell, constructed in 1999, includes a unique temporary sump, custom-specified geomembranes for slope stability, and a double-nonwoven GCL.

Project manager for public recycling facility at the Gaffin Road transfer station in east Salem, Oregon; project included nine-foot high geosynthetic reinforced soil retaining wall for public tipping.

Expert peer reviewer for final closure design and construction of the Cowlitz County landfill in southwestern Washington.

Project manager for selection, procurement, permitting, and installation of state-of-the-art direct-osmosis leachate management system at the Coffin Butte landfill. This multi-million dollar project began in 1995 with a review of over twenty leachate treatment options, followed by four field-scale pilot plant studies. Final project included an 8,000 sq. ft. building underlain by a liner and leak detection system, four-million gallon double-lined surge pond, and first-of-its-kind inflatable cover over the surge pond to keep out rain water.

Expert witness for two confidential projects involving failures associated with geomembrane liners. (1998 and 1999)

Preparer of design and construction documents, coordinator for permitting, and CQA engineer of record for a new three-acre double-lined landfill cell at Coffin Butte landfill. (1997)

Manager of fast-track permitting, design, and construction, and CQA of leachate pond embankment raise with a composite liner at the Coffin Butte landfill. (1996)

Preparer of design and construction documents, coordinator for permitting, and CQA for a thirteen-acre geomembrane closure at Coffin Butte landfill. (1996)

Expert peer reviewer for geosynthetic composite liner design and stability for a large canyon landfill incorporating 1.5:1 side slopes over 100 feet high in Ventura County, California (Toland Road).

Director of an audit of a new geomembrane manufacturing line for two major national solid waste companies.

Preparer of pro-forma economic analysis for consideration of a new landfill for Waste Control Systems, Inc. in western Oregon.

Consultant, engineering, and CQA services to Weyerhaeuser Corporation regarding landfill design and operations for their Headquarters solid waste facility in Washington.

Evaluator for closure options for Weyerhaeuser North Bend landfill in Oregon.

Preparer of pro-forma economic analysis for consideration of a new landfill for Weyerhaeuser in North Bend, Oregon; prepared new landfill design and permit application package for the DEQ; engineer of record during construction of the first three-acre Cell 3A in 1997 and the second three-acre Cell 3B in 1999.

Provider of expert sub-consultant services for liner and underdrain design at the BFI Keller Canyon facility in California.

Geosynthetics and slope stability subconsultant to EMCON for the City of Willits landfill closure design. Design involved innovative PVC/geotextile composite covered by exposed coarse rock on slopes as steep as 2:1. Special design precautions were developed against the effect of gas pressures on the slope stability.

Expert consultant and witness related to large-scale landfill cover slope stability failure in the Midwest; responsibilities included determination of cause of failure and the proposal and review of remedial solutions.

Preparer of rock quarry master plan and reclamation permitting for S2F Corporation of Albany, Oregon. The rock quarry end use is anticipated to be a landfill.

Peer review and economic evaluator of landfill design for Rogue Waste Systems, Inc. in southern Oregon.

Expert peer reviewer of landfill designs for regional Minnesota engineering firm (Wenck Associates).

Expert peer reviewer for United Waste Systems, Inc.; peer reviews were primarily related to five different landfill cover and bottom liner designs prepared by other consultants.

Provider of expert technical and economic evaluation of numerous alternative liner designs for large Bay Area canyon landfill (BFI Corinda Los Trancos), especially with regard to geosynthetic clay liners (GCLs) in lieu of the prescriptive compacted clay composite; work involved orchestrating product development and testing for several manufacturers.

Project manager for new cell design for Chiquita Canyon Landfill near Los Angeles, California; project involved construction plans, specifications, and construction quality assurance manual. This was one of the first projects in California to use a GCL in the full base liner as a Subtitle D alternative.

Client director for several Sanifill projects over an eighteen-month period for two landfills in Oregon (Hillsboro and Northern Wasco); directed activities related to permitting, final design, and construction. Projects included land use (support role) and wetlands permitting (support role), new cell permitting, two new cell designs, final cover design, operations plans, and CQA.

Project manager for the siting, permitting, design, and construction of a large complex pulp sludge and inert waste landfill and infrastructure for the Weyerhaeuser Company in southwest Washington. The project was complex, requiring more than twenty permits and four years to complete. Significant features included the following: a comprehensive siting study that evaluated over 35 sites in a thirty-mile radius; public opposition issues; highly variable volcanic soil conditions; a complex groundwater regime; the need for a rail facility for waste unloading and leachate loading; a three-acre double-lined leachate lagoon; a 320-acre composite lined landfill with a complete underdrain system and innovative geomembrane specifications; large storm water control structures; ten acres of created wetlands; new off-channel fish ponds; and a stream relocation with the creation of 1,500 feet of fish channel habitat. The landfill will be constructed in two-year cells and have a life ranging from 30 to 50 years. The planned capacity is 50 million cubic yards. Full-time construction resident engineer for $10 million construction project that included the first eighteen-acre cell and landfill infrastructure at the site.

Designer and peer reviewer for composite liner and subdrain system construction drawings and specifications for Ox Mountain Landfill near San Francisco, California; project elements included designing amended soil, geomembrane composite liner on 2:1 slopes, and underdrain system for side-slope seeps.

Project advisor for GCL liner design for Kiefer Landfill (two consecutive years of construction).

Project manager and lead engineer for unique landfill closure for Louisiana Pacific. Design for this Ukiah, California site converted closed landfill into a vineyard. Technical justification was provided by a closed-loop groundwater interception pond and slurry wall where the groundwater was used for vineyard irrigation during the summer.

Project manager and engineer of record for design and construction of 37-acre landfill closure for Cowlitz County, Washington; project utilized first-of-its-kind 60-mil very low density polyethylene geomembrane with a co-extruded 6-mil white veneer.

Lead project engineer for the design of the Columbia Ridge Regional Landfill and Leachate Evaporation Pond near Arlington, Oregon. Evaluated geotechnical resources and stability; designed the landfill composite liner and leachate evaporation pond; prepared the engineers' cost estimate; supervised project geotechnicians, project specifications, and site permitting; conducted field test fills; and authored design reports.

Engineering task manager for the design and construction of an eight-acre partial landfill closure for the Coffin Butte Regional Landfill near Corvallis, Oregon.

Project manager for evaluation of postclosure monitoring and maintenance program for a closed fifteen-acre landfill in Yamhill County, Oregon. Issues included landfill gas, cover vegetation, side slope seeps, storm water control, and ground and surface water monitoring.

Client director for final design of ten-acre composite landfill liner and three-acre double-lined leachate lagoon for Coffin Butte Regional Landfill.

Design reviewer for 190-acre St. Johns Landfill cover reclamation plan in Portland, Oregon; work involved evaluating impacts of proposed vegetation on the cover design. Design suggestions were made that saved METRO about $2.5 million in construction costs.

Lead project engineer for permitting design drawings for two major hazardous waste landfills in central California. Designs included double composite base liners, a leachate collection and removal system, leak detection systems, and composite-cover lining systems.

Preparer of permit engineering drawings for three one-acre hazardous waste surface impoundments for Chemical Waste Management in central California, featuring a triple-lining system consisting of bottom and top composite liners with an intermediate synthetic liner.

Project manager for economic evaluation, preliminary design, and permitting for a new county landfill in Clatsop County, Oregon; work included projecting tipping rates over a twenty-year period. Design included an innovative liner system that set an alternate regulatory standard in western Oregon.

Project manager for feasibility evaluation of a single-purpose, composite-lined landfill to take wastes from a magazine recycling paper mill in western-central Oregon; prepared preliminary design alternatives and life-cycle cost estimates spanning the entire project, from permitting through postclosure care.

Project manager for landfill development, operations, and closure plans for the Coos County, Oregon ash monofill.

Project manager for structural design of a 3,000 sq. ft. transfer station near Raymond, Washington; designed eighteen-foot high concrete retaining wall, slabs, and drains and coordinated metal building procurement.

Project manager for geotechnical evaluation of sixteen miles of existing private railroad; work included assessing drainage, slope stability, and landslides.

Engineer of record for construction certification of an eight-acre composite liner landfill expansion for the Cowlitz County Landfill in Washington.

Resident engineer during construction of the $2 million Module 1 landfill composite liner and leachate evaporation pond at the Columbia Ridge Regional Landfill.

Geotechnical engineer for evaluation of stability and settlement considerations for vertical expansion of a 25-acre landfill built over 200 feet of unconsolidated, saturated marine sediments; work included managing a field testing program including cone penetrometers, field vane shear testing, and extensive sampling for laboratory testing.

Project manager for the design of a municipal solid-waste compost storage facility liner for the Portland, Oregon Metropolitan Service District.

Geotechnical engineer responsible for providing foundation and retaining wall design parameters for Metro Household Hazardous Waste Facility in Oregon City, Oregon.

Lead project engineer for a process and surface water management system design at the Bohemia Lumber Company in Grass Valley, California; project included a double-lined surface impoundment, run-on control, a concrete diversion pipeline, and discharge alternatives.

Lead geotechnical engineer for a landfill investigation at Clover Flat Landfill in Napa County, California; project included field reconnaissance, rock core drilling, and laboratory testing. Performed rock slope stability analyses and assessed various liner design and construction alternatives.

Lead project engineer for the design of a synthetic-lined surface impoundment for San Diego Gas and Electric Company; project completed using computer-aided drafting and design tools.

Evaluator of cyclone efficiency for tailings sand separation at Chino mines in New Mexico.

Legal

Expert forensic engineer for Plaintiff in failure of 8 acres of landfill cover that occurred during construction in state of Michigan. Provided **expert opinion and forensic engineering** analyses. (1995)

Expert for Plaintiff in mediation of failed secondary liner below chrome plating plant in Pacific Northwest. Documents review and one day of **mediation**. (1998)

Expert for Defendant in mediation of failed potable water reservoir liner in Reno area. Documents review, written expert opinion, and one day of **mediation**. (2003)

Percipient witness for Defendant in a cover slide on geosynthetics during construction. One day **deposition**. (2003)

Expert for Defendant in preparation of litigation for failed wastewater treatment pond liner in South Carolina. Documents review and full-day **deposition**. (2004)

Expert for Defendant in mediation and preparation of litigation for claim of unsatisfactory cover design for landfill. Claim was that cover did not meet seismic stability standard. Performed documents review, engineering analyses and expert report, participated in one day of **mediation**, and one day of **deposition**. (2004-05)

Expert for Defendant (contractor) in failed waste-water pond liner for winery. One day **deposition**. (2006)

Expert for Plaintiff in landfill soil cover slide in west-central California. Provided letter of expert **opinion**. (2008)

Expert for Plaintiff in earthwork construction for dairy pond; fee dispute in central California. Work involved **review and mediation assistance**. (2008)

Expert for Defendant (contractor) of failed landfill liner slope in Montana. Work involved mediation of dispute and resolution through expert review of design and testing and **expert opinion**. (2008)

Expert for Defendant in Florida landfill permitting. Provided courtroom expert **testimony** regarding landfill stability for permit expansion application. (2010)

Expert for Plaintiff, a municipal Idaho wastewater treatment plant, related to failed wastewater treatment liner system. (2010-11)

Expert for Defendant (engineer) regarding disputed standard of care regarding soil reclamation from C&D site in a western state; work involved field investigation, development of **expert opinions**, and preparation for deposition. (2010-12)

Court-ordered Expert for all parties regarding disputed repair options for single-lined wastewater pond built in zone of high ground water. Interviewed all parties and review records, and prepared Expert Report of opinion. (2015)

Expert for Defendant (manufacturer) regarding claims for MQC and production standards for PVC roll goods. Provided Expert Report. (2016)

Expert for Defendant (Installer) regarding claims for defective HDPE tank liner installation. Provided Expert Report. (2017)

Hired as expert by Plaintiff (Owner) to support claim against the engineer regarding design errors and omissions related to landfill final cover construction in Florida. Role was transitioned to **mediator** acting neutrally between all parties (Contractor, Engineer, and Owner). Managed and conducted successful mediation that resulted in settlement agreements between all parties. (2019)

Expert for Plaintiff (Owner) regarding claims for landfill slope stability failure in eastern U.S. (2019). Provided expert rebuttal report and **deposition**.

Education

M.S., Civil Engineering (emphasis in geomechanics), University of Wisconsin, Milwaukee
B.S., Civil Engineering (emphasis in structural and geotechnical subjects), University of Wisconsin, Milwaukee
Extensive participation as a student in continuing education courses and conferences over entire career.

Professional Registrations and Affiliations

Registered Professional Civil Engineer in California, Oregon, Washington, Wyoming, New Mexico, and Arizona (expired registrations in Pennsylvania, Kansas, Montana, and Florida)
Registered Geotechnical Engineer in Oregon
American Society of Civil Engineers (and the associated Geo-Institute)
American Society for Testing and Materials (member of committee D35 for over 20 years, resigned in 2017)
North American Geosynthetics Society
International Geosynthetics Society

Conferences and Teaching Courses

Lead speaker for 2-day workshop in Syracuse, NY hosted by NY-DEP and IFAI on the subject of landfill liner and cover design, July 16-17, 2019.

Webinar Presenter, Jan 30 2018, 1.5-hour nationally-available webinar on the subject of "Design of Geomembrane Lined Ponds" for NAGS.

Instructor, 2017, one-day course at IFAI "Geosynthetics 2017" Conference in March, 2017, Orlando, FL. Course subject: *Design of Waste Containment Liner and Final Closure Systems*.

Instructor, 2015, one-day course at IFAI "Geosynthetics 2015" Conference in February 15, 2015, Portland, Oregon. Course subject: *Design of Waste Containment Liner and Final Closure Systems*.

Instructor, 2014, two-day course on landfill liner and cover system design, taught in conjunction with TRI Laboratories, in Sao Paulo, Brazil, May 28-29.

Instructor, 2013, one-day course at IFAI "Geosynthetics 2013" Conference in April 2013, Long Beach, California. Course subject: *Design of Waste Containment Systems*.

Instructor, 2001 to 2012, for ASCE two-day Short Course on *Design of Waste Containment Liner and Final Closure Systems* presented 2-4 times per year at major cities across the nation.

Instructor, 2012, half-day course at Geoamericas Conference in Lima, Peru (on behalf of CETCO) May 2012; also member of GM Seam discussion lead by Ian Peggs.

Instructor, 2011, half-day course for the Landfill Interest Group in South Africa, October 2011, Durban, South Africa. Course subject: *Slope Stability of Lined Containment Systems*.

Instructor, 2011, one-day course at IFAI/ASCE "Geofrontiers" Conference in March 2011, Dallas, TX. Course subject: *Design of Waste Containment Systems*.

Instructor, 2010, one-day course at 9th International Conference on Geosynthetics in May 2010, Guaruja, Brazil. Course subject: *Geosynthetics in Mining*.

Instructor, 2010, half-day course at 9th International Conference on Geosynthetics in May 2010, Guaruja, Brazil. Course subject: *Slope Stability of Lined Containment Systems*.

Instructor, 2009, half-day course at IFAI Geo '09 Conference in Salt Lake City, February 2009.

Instructor, 2008, one-day course at IFAI Geoamericas Conference in Cancun, March 2008.

Instructor, 2008, one-day course at IFAI Geosynthetics Conference in January 2008, Washington, DC. Course subject: *Design of Waste Containment Systems*.

Instructor, March 2006, one-day course at University of Nevada-Reno on *Design of Waste Containment Systems*.

Instructor, 2004, one-day course at Boise State University (0.8 CEUs) on *Design of Waste Containment Systems*.

Instructor, GSE Seminar *Geosynthetics for Advanced Solutions*, Seattle, October 2000

Instructor, GSE in-house training seminar, Spearfish, Wyoming, May 1999

Instructor, IFAI short course on *Design of Liner Systems*, Geo '03, February 2003, Atlanta.

Instructor, CETCO *GCL University*, presented December 2003 for CETCO in-house training in Chicago; June 2004, Madison; November 2004, Sacramento; May 2006, Atlanta; May 2010, Phoenix (for DEQ); January 2011, Reno; April 2012, Washington DC, August 2012, Costa Mesa California.

Instructor, TENAX drainage course, Concord, California, November 2003; Irvine, December 2003.

Chairman for "Geosynthetics 2019" held in Houston, TX, Feb 11-13, 2019.

Chairman for "Geosynthetics 2001" held in Portland, Oregon, February 2001.

Chairman for "Geosynthetics '99" held in Boston, Massachusetts, April 1999.

On the technical organizing committees for "Geo '07" held in Washington DC, January 2007 and "Geoamericas '08" held in Cancun, March 2008.

Technical Co-Chairman for "Geosynthetics '97" held in Long Beach, California, March 1997.

Publications and Presentations

Thiel, R. (2019) “Evaluating a Leachate Pond Geomembrane After 25 Years of Service”. *Geosynthetics Magazine,* Feb/Mar 2019, V37 N1, pp. 12-19.

Thiel, R. and Gatrell, D. (2019) “Geocomposite Lamination Strength Design and Testing: A New Approach”. Presented and published in proceedings for Geosynthetics Conference, February 10-13, 2019, Houston, TX, Industrial Fabrics Association International.

Thiel, R. (2018) “Geocomposite Lamination Strength Standard Test Method – Time for an Update”. *Geosynthetics Magazine,* Aug/Sep 2018,V36 N4, pp. 36-43.

McDougall, J.R., Fleming, I.R., Thiel, R., Dewaele, P., Parker, D., and Kelly, D. (2018) ”Estimating degradation-related settlement in two landfill-reclaimed soils by sand-salt analogues”, *Waste Management* periodical, Elsevier, V77, pp 294-303 (available online April 26, 2018)

Thiel, R. (2018) “Design of Exposed Geomembrane Lined Ponds – Controlling uplifting gas bubbles – Part III”. *Geosynthetics Magazine,* Apr/May 2018,V36, N2, pp. 10-18.

Thiel, R. (2018) “Design of Exposed Geomembrane Lined Ponds – Controlling uplifting gas bubbles – Part II”. *Geosynthetics Magazine,* Feb/Mar 2018,V36, N1, pp. 36-42.

Thiel, R. (2017) “Design of Exposed Geomembrane Lined Ponds – Controlling uplifting gas bubbles – Part I”. *Geosynthetics Magazine,* Oct/Nov 2017,V35, N5, pp. 42-49.

Thiel, R. (2016) “Recommendations for Design of Exposed Geomembrane-Lined Ponds to Control Uplifting Gas Pressures”. Proceedings of Eurogeo6 conference, Sep 25-28, 2016, Ljubljana, Slovenia, pp. 947-958.

Thiel, R. (2016) “Suggested Practice in USA for Geomembrane Wrinkles in Bottom Liners for Waste and Mine Stacks”. Proceedings of Eurogeo6 conference, Sep 25-28, 2016, Ljubljana, Slovenia, pg. 291.

Thiel, R. (2016) "Analysis of Stresses and Strains in Pond Geomembrane Gas Bubbles". Proceedings of ASCE Geo-Chicago 2016 conference, August 14-18, 2016, Chicago, IL, 12 p.

Thiel, R., Kavazanjian, E., and Wu, X., "Design Considerations for Slip Interfaces on Steep-Wall Liner Systems" Proceedings for Tenth International Conference on Geosynthetics (ICG 10), Berlin, Germany, Sep 21-25, 2014. Reprinted in *Geosynthetics Magazine,* Feb/Mar 2015,V33, N1, pp. 24-33.

Thiel, R. (2013) "A 25-Year Perspective on Waste Containment Liner and Cover System Designs with Geosynthetics." Proceedings of the 25th Annual GRI Conference, Geosynthetics 2013 Conference, in coordination with IFA, Long Beach, CA, April 2013.

McDougall, J.R., Fleming, I.R., Thiel, R., Dewaele, P., Parker, D., and Kelly, D. (2013) "Mass loss and volume change: from sand-salt analogues to MSW", Proceedings of CPEG 2013 – Coupled Phenomena in Environmental Geotechnics, Associazione Geotecnica Italiana (Editor)

Rowe, K., Brachman, R. W. I., Irfan, H., Smith, M.E., and Thiel, R. (2013), "Effect of underliner on geomembrane strains in heap leach applications", Geotextiles and Geomembranes, (2013), V40-10-13, 37-47

Thiel, R. (2012) Presentation entitled *HDPE Seam Defects We Cannot See,* for the "Panel Discussion on Structure, Testing, and Performance of HDPE Seams" conducted at the GeoAmericas Geosynthetics Conference held in Lima, Peru, May 2-5, 2012.

Thiel, R. (2012) Presentation entitled *Design of Landfill Liner and Cover Systems: An International Perspective,* for the NW Regional SWANA Symposium, Troutdale, Oregon, April 20, 2012.

Thiel, R. (2011) "Discussion of 'Modification to Translational Failure Analysis of Landfills Incorporating Seismicity'" ASCE Journal of Geotechnical and Geoenvironmental Engineering, V137, N12, Dec. 2011, pp. 1299-1300.

Thiel, R. (2011) Presentation entitled *Evaluation of Appropriate Landfill Final Cover Parameters,* for the IWMSA and GIGSA organizations, held in Midrand, South Africa, Oct 21, 2011.

Thiel, R. and Giroud, J.P. (2011) "Important Considerations for Leakage Control of Exposed Geomembrane-Lined Ponds" Proceedings for Sardinia '11 Thirteenth International Landfill Symposium, Oct. 2011.

Abdelaal, F., Rowe, R.K., Smith, M., Brachman, R.W.I., and Thiel, R. (2012) "Antioxidant Depletion from HDPE and LLDPE Geomembranes without HALS in an Extremely Low pH

Solution", Second Pan American Geosynthetics Conference & Exhibition, GeoAmericas 2012, Lima, Perú - May 2012

Abdelaa**l,** F., Rowe, R.K., Smith, M. and Thiel, R. (2011) "OIT depletion in HDPE geomembranes used in contact with solutions having very high and low pH", 14th Pan-American conference of Soil Mechanics and Geotechnical Engineering, Toronto, October, paper #483 , CD-ROM, 7p.

Fox, P.J., Ross, J.D., Sura, J.M. , and Thiel, R. (2011). "Geomembrane Damage Due to Static and Cyclic Shearing Over Compacted Gravelly Sand". Geosynthetics International, V18N05, Oct., pp. 272-279.

Thiel, R. and Rowe, K. (2010) "Technical Developments related to the Problem of GCL Panel Shrinkage when placed below an Exposed Geomembrane." , SKZ, Wurzburg, Germany, Proceedings for the 3rd International Symposium on Geosynthetic Clay Liners, Sep 15-16, 2010, Würzburg, Germany, pp 93-102.

Thiel, R. (2010) "Optimization of Anchor Trench Design for Solar Evaporation Ponds." Proceedings for the 9th International Conference on Geosynthetics, May 2010, Garuja, Brazil.

Rowe, K., Bostwick, L., and Thiel, R. (2010) "Shrinkage Characteristics of heat-tacked GCL seams", Geotextiles and Geomembranes, Volume 28, Issue 4, August 2010, Pages 352–359.

Thiel, R. (2009) "Case History of Small Community Evaluation to Long-Haul vs. Manage a Small Landfill." Proceedings for Sardinia '09 Twelfth International Landfill Symposium, Oct. 2009.

Thiel, R. (2009) "A Note Regarding Interpreting Cohesion (or Adhesion) and Friction Angle in Direct Shear Tests", Geotechnical Fabrics Report, VXX, NX, mm 2009, pp. __-__ (submitted and accepted for publication Jan 2009).

Thiel, R. and Thiel, C. (2009) "GCL Shrinkage - A Possible Solution", Geotechnical Fabrics Report, V27N1, Feb-Mar 2009, pp. 10-21.

Thiel, R. and DeJarnett, G. (2009) "Guidance on the Design and Construction of Leak-Resistant Geomembrane Boots and Attachments to Structures", GRI Session of the IFAI-sponsored conference, Geo 2009, Salt Lake City, Feb 2009.

Thiel, R. (2009) "Post-Construction Landfill Liner Failure and Lessons Learned", IFAI, Geo 2009, Salt Lake City, Feb 2009.

Rowe, K., Bostwick, L., and Thiel, R. (2009) "GCL Shrinkage and the potential benefits of heat-tacked GCL seams", IFAI, Geo 2009, Salt Lake City, Feb 2009.

Thiel, R. (2008) "Slope Stability Sensitivities of Final Covers", IFAI, GeoAmericas conference, Cancun, Mexico, March 2008.

Thiel, R., Chartres, T. and Hurley, D. (2008) "Case Study: Phased Construction of Final Cover System in Oregon, USA", IFAI, GeoAmericas conference, Cancun, Mexico, March 2008.

Erickson, R., Thiel, R., and Peters, J. (2008) "The Ongoing Quality Issues Regarding Polyethylene Geomembrane Material Manufacturing & Installation", IFAI, GeoAmericas conference, Cancun, Mexico, March 2008.

Thiel, R., Bryk, J., Criley, K., Giroud, J.P., and Erickson, R. (2006) "Laboratory Measurements of GCL Shrinkage Under Cyclic Changes in Temperature and Humidity Conditions", 8th International Conference on Geosynthetics, Yokohama, Japan, September 2006.

Leonards, G., Erickson, R., and Thiel, R. (2007) "Challenges to Emergency Response Hurricane Debris Disposal and the Use of Composite GCLs for Rapid Response Cap Systems", presented and published in proceedings for *Geosynthetics 2007*, Jan 16-19, Washington, DC, Industrial Fabrics Association International.

Thiel, R., Criley, K., and Bryk, J. (2005) "Practical Guidance on Specifying GCL Overlaps to Account for Shrinkage", Geotechnical Fabrics Report, V23, N8, Nov 2005, pp. 20-25.

Thiel, R. And Christie, M. (2005) "Potential Problems Associated With Leachate Recirculation On Landfill Stability", Proceedings of the 19th Annual GRI Conference, presented at the NAGS 2005/GRI 19 Conference, Las Vegas, NV, December 14-16, 2005.

Breitenbach, A.J. and Thiel, R. (2005) " A Tale of Two Conditions: Heap Leach Pad versus Landfill Liner Strengths", Proceedings of the 19th Annual GRI Conference, presented at the NAGS 2005/GRI 19 Conference, Las Vegas, NV, December 14-16 2005.

Smith, M.E., Beck, A., Thiel, R., and Metzler, P. (2005) "Designing for Vertical Pipe Deflection Under High Loads", Proceedings of the 19th Annual GRI Conference, presented at the NAGS 2005/GRI 19 Conference, Las Vegas, NV, December 14-16, 2005.

Thiel, R. (2005) "Observed Benefits and Problems Associated with Leachate Recirculation." Proceedings for Sardinia '05 Tenth International Landfill Symposium, Oct. 2005.

Thiel, R. (2005) "Trends in Landfill Design, Construction, and Operations." Proceedings for NW Regional SWANA Symposium, Troutdale, Oregon, April 2005.

Thiel, R., Richardson, G., and Narejo, D. (2005) "Update on Desiging with Geocomposite Drainage Layers in Landfills – Part 1 of 4: Introduction and Summary of Issues." Geotechnical Fabrics Report, V23, N1, Jan/Feb 2005, pp. 26-29.

Thiel, R. and Narejo, D. (2005) "Update on Designing with Geocomposite Drainage Layers in Landfills – Part 2 of 4: Geocomposites on Bioreactor Landfill Sideslopes to Control Seeps and Gas." Geotechnical Fabrics Report, V23, N2, Mar 2005.

Thiel, R. and Narejo, D. (2005) "Update on Designing with Geocomposite Drainage Layers in Landfills – Part 3 of 4: Specifying Geocomposites in Leachate Collection Systems Accounting for Staged Development." Geotechnical Fabrics Report, V23, N3, 2005.

Thiel, R. and Narejo, D. (2005) "Update on Designing with Geocomposite Drainage Layers in Landfills – Part 4 of 4: Geocomposite Lamination Specifications." Geotechnical Fabrics Report, V23, N4, 2005.

Thiel, R., Beck, A., and Smith, M.E. (2005) "The Value of Geoelectric Leak Detection Services for the Mining Industry." Proceedings of the 18th Annual GRI Conference, accepted for presentation at the ASCE Geofrontiers Conference, Austin, TX, January 2005.

Thiel, R., and Richardson, G. (2005) "Concern for GCL Shrinkage when Installed on Slopes." Proceedings of the 18th Annual GRI Conference, accepted for presentation at the ASCE Geofrontiers Conference, Austin, TX, January 2005.

Thiel, R., and Narejo, D. (2005) "Lamination Strength Requirements for Geonet Drainage Geocomposites." Proceedings of the 18th Annual GRI Conference/ASCE Geofrontiers Conference, Austin, TX, January 2005.

Thiel, R., and Criley, K. (2005) "Hydraulic Conductivity of Partially Prehydrated GCLs Under High Effective Confining Stresses For Three Real Leachates." Proceedings of the ASCE Geofrontiers Conference, Austin, TX, January 2005.

Bachus, R., Narejo, D., Thiel, R., and Soong, T.Y. (2003) *The GSE Drainage Design Manual.* Available from GSE, Houston, TX.

Giroud, J.P., Thiel, R., Kavazanjian, E. (2004) “Hydrated area of a bentonite layer encapsulated between two geomembranes.” *Geosynthetics International,* Vol. 11, No. 4, pp. 589-616.

Thiel, R. and Smith, M.E. (2003) “State of the Practice Review of Heap Leach Pad Design Issues." Proceedings of the 17th Annual GRI Conference Hot Topics in Geosynthetics – IV, presented in Las Vegas, NV, Dec. 15, 2003, Geosynthetics Institute, Folsom, PA.

Thiel, R. and Purdy, S. (2003) "Case History of Exposed Geomembrane Cover for Bioreactor Landfill." Proceedings for Sardinia ’03 Ninth International Landfill Symposium, Oct. 2003.

Thiel, R., Darilek, G., and Laine, D. (2003) “Cutting Holes for Testing vs. Testing for Holes.” Geotechnical Fabrics Report, V21, N5, June/July 2003, pp. 20-23.

Thiel, R. and Gilbert, R. (2003) “Response to Koerner’s Discussion on Use of Peak Shear Strength” Geotechnical Fabrics Report, IFAI, Roseville, MN, August 2003.

Thiel, R. and Maubeuge, Kent von. (2002) “Current Industry Performance and Construction Issues Related to GCLs” Proceedings of the 16th GRI Conference on Hot Topics in Geosynthetics II. Geosynthetic Institute, Folsom, PA, December 16-17, pp. 227-241.

Richardson, G.N., Thiel, R., and Erickson, R.B. (2002) “GCL Design Guidance Series Part III: GCL Installation and Durability.” Geotechnical Fabrics Report, IFAI, Roseville, MN, September, 2002.

Thiel, R., Erickson, R.B. and Richardson, G.N. (2002) “GCL Design Guidance Series Part II: GCL Design for Slope Stability.” Geotechnical Fabrics Report, IFAI, Roseville, MN, August 2002.

Erickson, R.B., Thiel, R., and Richardson, G.N. (2002) “GCL Design Guidance Series Part I: GCL Performance as a Fluid Barrier.” Geotechnical Fabrics Report, IFAI, Roseville, MN, June/July 2002.

Giroud, J.P., Thiel, R.S., Kavazanjian, E., and Lauro, F.J. (2002) “Hydrated Area of a Bentonite Layer Encapsulated Between Two Geomembranes.” Proceedings for the Seventh International Conference on Geosynthetics, Nice, France, Sept 2002.

Erickson, R. and Thiel, R. (2002) “Design and Application of the Geomembrane Supported GCL as a One-Product Composite Liner.” Presented at the Nuremburg GCL Conference, Feb 2002.

Thiel, R.S. (2001) "Peak vs. Residual Shear Strength for Landfill Bottom Liner Stability Analyses." Proceedings of the 15th Annual GRI Conference Hot Topics in Geosynthetics – II, presented in Houston, TX, Dec. 13, 2001, Geosynthetics Institute, Folsom, PA, pp. 40-70.

Thiel, R.S. and Erickson, R. (2001) "GCL Alternative Liner and Critical Slope Stability – Unique Case History Involving Encapsulated Design Approach." Proceedings for Sardinia '01 Eighth International Landfill Symposium, Oct. 2001.

Thiel, R.S., Daniel, D.E., Erickson, R., Kavazanjian, E., and Giroud, J.P. (2001) *GundSeal Design Manual.* Available from GSE, Houston, TX. September 2001.

Thiel, R.S. (2001) "Unique Inflated Pond Cover Using Reinforced Flexible Polypropylene." Proceedings to Geosynthetics 2001, IFAI, Roseville, MN. Conference held in Portland, OR in February 2001, pp. 337-348.

Richardson, G.N and Thiel, R.S. (2001) "Interface Shear Strength: Part 1 – Geomembrane Considerations." Geotechnical Fabrics Report, Vol. 19, No. 5, pp. 14-19. IFAI, Roseville, MN, June/July 2001. (Part 2 published in August 2001).

Hanson, J.L., Gilbert, R.B., Wright, S.W., and Thiel, R.S. (2001) "Unsaturated Interface Shear Strength Properties for Nonwoven Geotxtiles." Proceedings to Geosynthetics 2001, IFAI, Roseville, MN. Conference held in Portland, OR in February 2001, pp. 135-148.

Thiel, R. and Wall, R. (2000) "Case History: Cost Effective Low-Maintenance Final Cover of Steep Slopes." Geotechnical Fabrics Report (GFR) published by the Industrial Fabrics Association International (IFAI), Roseville, MN, April, 2000.

Thiel, R. (1999) "Design and Testing of a NWNP Geotextile Gas Pressure Relief Layer Below a Geomembrane Cover to Improve Slope Stability." Proceedings for Sardinia '99 Seventh International Landfill Symposium, Vol. III, pp. 343-350, Oct. 1999.

York, R., Thiel, R., and Beaudry, E. (1999) "Full Scale Experience of Direct Osmosis Concentration Applied to Leachate Management." Proceedings for Sardinia '99 Seventh International Landfill Symposium held in Oct. 1999.

Richardson, G.N., Thiel, R.S., and Marr, W.A. "Lessons Learned From the Failure of a GCL/Geomembrane Barrier on a Side Slope Landfill Cover." To be published in Dr. J. P. Giroud's upcoming book tentatively entitled *Lessons Learned from Failures Associated with Geosynthetics*.

Thiel, R.S. (1999) “Design of Gas Pressure Relief Layer Below a Geomembrane Cover to Improve Slope Stability.” Proceedings to Geosynthetics '99 conference held in Boston, MA in April 1999, pp. 235-252. Paper received the Grand Award for the best paper.

Brown, D., Thiel, R., Brummer, C., and Huvane, S. (1999) “Innovative Design and Construction of Landfill Side-Slope Liners in High Seismic Risk Areas, A Case Study.” Proceedings to Geosynthetics '99 conference held in Boston, MA in April 1999, pp. 589-600.

Thiel, R. (1998) “Design Methodology for a Gas Pressure Relief Layer Below a Geomembrane Landfill Cover to Improve Slope Stability.” *Geosynthetics International,* Vol. 5, No. 6, pp. 589-616.

Richardson, G.N., Thiel, R., and Mackey, R. (1998) “Designing with Needle-Punched Reinforced GCLs: Stability Fundamentals.” Geotechnical Fabrics Report, IFAI, Roseville, MN, Oct/Nov 1998.

Peggs, I.D. and Thiel, R.S. (1998) “Selecting a Geomembrane Material.” Proceedings for the Sixth International Conference on Geosynthetics held in Atlanta, GA, March 1998, pp. 381-388.

Liu, C.N., Gilbert, R.B., Thiel, R.S., and Wright, S.G. (1997) “What is an Appropriate Factor of Safety for Landfill Cover Slopes?” Proceedings for Geosynthetics '97 held in Long Beach, CA in March 1997. Sponsored by IFAI, Roseville, MN, pp. 481-496.

Chaney, R.C., Thiel, R., Richardson, G.N., and Cadwallader, M. (1997) “Cyclic Response of Clay-Geomembrane Interfaces and Their Impact on the Seismic Response of Lined Landfills.” Proceedings for Geosynthetics '97 held in Long Beach, CA in March 1997. Sponsored by IFAI, Roseville, MN, pp. 977-988.

Thiel, R.S.; Isham, J.C.; and Girard, K. (1996) " Wood Waste to Wine: A Unique Landfill Closure." Proceedings of the 1996 TAPPI International Environmental Conference held May 5-8, 1996, Orlando, FL.

Thiel, R.S.; Wiese, J.; and Haynes, C. (1995) "Siting, Permitting, Design, and Construction of a Major Forest Products Landfill Facility." Proceedings for the 1995 TAPPI International Environmental Conference held May 7-10, Atlanta, GA, 1995.

Thiel, R.S. and Koerner, R.M. (1994) "Landfill Liner Design." Presentation to regulators and landfill owners in Oregon and Washington, held in Seattle on July 28, 1994.

Thiel, R.S. and Stewart, M.G. (1993) "Geosynthetic Landfill Cover Design Methodology and Construction Experience in the Pacific Northwest." Proceedings for Geosynthetics '93 held in Vancouver, B.C. in April 1993, pp. 1131-1134. Sponsored by IFAI. Paper received award for best environmental paper.

Thiel, R.S. (1993) "Designer's Perspective Using Coextruded Polyethylene Geomembrane Technology." Proceedings of the Sixteenth International Madison Waste Conference. September 22-23, 1993. University of Wisconsin, Madison.

Thiel, R.S. (1993) "Modern Landfill Liner and Cover Design and Construction." Talk presented to the Oregon ASCE Geotechnical Group on November 3, 1993.

Thiel, R.S. and Cadwallader, M. (1993) "Innovative Applications of Coextruded Geomembranes." Presented at the 7th GRI Seminar "Geosynthetic Liner Systems: Innovation, Concerns, and Designs." December 14-15, 1993 at Drexel University.

Thiel, R.S. and Stewart, M.G. (1992) "Field Construction Quality Assurance of Geotextile Installations." Proceedings of the 6th GRI Seminar "QC/QA and CQC/CQA of Geosynthetics." Presented December 12, 1992 at Drexel University.

Thiel, R.S. (1992) "Tipping Rate Analysis: Cost and Development Considerations for Solid Waste Landfills." Proceedings of the ASTSWMO 1992 National Solid Waste Forum in Portland, OR. July 20-22, 1992.

Thiel, R.S. (1992) "Landfill Development Considerations." Oregon State University graduate class presentation for a Solid and Hazardous Waste Management class. Contact: Anna Harding, Ph.D., Assistant Professor. (541) 737-2686.