

# **THERMAL ENERGY SYSTEMS RESILIENCE IN COLD/ARCTIC CLIMATES CONSULTATION FORUM**

**Fairbanks, AK  
January 21-24, 2020**

## **Agenda**

### **Tuesday, January 21 (Cold Climate Research Laboratory, Fort Wainwright)**

- 8:00 Depart Hampton Inn for CRREL by shuttle and rental cars. The CRREL Fairbanks Lab is located at 4070 9th St., Fort Wainwright, Alaska. 907-361-5149
- 9:00 Introduction to the Temperature Decay Test (TDT), its objectives, test protocol and instrumentation of the Building 4070 (CRREL). (Alexander Zhivov, Jonathan Goebel (CERL), Dr. Dayne Broderson (UAF) and William Rose (UIUC)
- 10:00 Discussion of preliminary results of the TDT test data for Building 4070. Dr. Dayne Broderson (UAF) and Dr. Richard Liesen (CERL)
- 11:00 Tour of other TDT buildings on Fort Wainwright (Buildings 3002 and 3013)
- 12:00 Transportation back to Hampton Inn.
- 18:30 Dinner at Pike's Landing on your own (4438 Airport Way). Transportation from Hampton Inn hotel by rental cars and taxis.

### **Wednesday, January 22 (Cold Climate Housing Research Center)**

- 8:00 Registration
- 8:15 Introduction to the Forum:
  - Welcome from the host and housekeeping details (Intro by Robbin Garber-Slaght (CCHRC), & Dr. Alexander Zhivov)
  - Background and objectives – Dr. Alexander Zhivov
- 8:45 Specifics of construction in Arctic climate - Panel Discussion.
  - Ms. Robbin Garber-Slaght (CCHRC) - moderator,
  - Mr. Craig Fredeen (Cold Climate Engineering),
  - Prof. Eva Moller (DTU)
  - Rafal Turek (USACE – CENAN)

- 9:45 [Skype session:](#)  
Mr. Anders Dyrelund (Ramboll, Denmark)  
Dr. Martin Kotal (DTU, Denmark)
- 10:15 Coffee break
- 10:30 Current and best practices of building envelop designs - Panel Discussion:  
Mr. Aaron Cooke (CCHRC) – Moderator  
Dr. Aylin Ozkan (University Toronto, Canada) [via Skype](#)  
Mr. Peter Spafford (ABAA) [via Skype](#)  
Mr. William Rose (UIUC),  
Prof. Eva Moller (DTU, Denmark),  
Mr. Jeffrey Hayner (USACE AK)  
Mr. Lyle Axelarris (Design Alaska)  
Ms. Lorne Ricketts (RDH, Canada)
- 13:00 Lunch
- 14:00 International experiences from Nordic Defense Agencies and sub-Arctic and Arctic infrastructure managers. Panel Discussion.  
Moderator: Mr. Paul Volkman (DASA) - moderator  
Mr. Bill Chedister (Fort Wainwright)  
Mr. Donald Fry (Ellison AFB)  
Mr. Sonny Turpin (JBRE)  
Mr. Lars Truelsen (MOD Denmark)
- 15:15 Major threats and hazards specific for Arctic and resilience of thermal energy systems serving mission critical facilities – Requirements and Best Practices. Panel Discussion:  
Mr. Mark Adams (Fort Wainwright)  
Mr. Don Fry (Eielson AFB)  
Mr. Sonny Turpin (JBER)  
Ms. Andrea Mengual (AECOM)  
Kevin Bjella (CRREL) [via Skype](#)  
Mr. Nick Janssen (Doyon Utilities)
- 16:45 Coffee break
- 17:00 Cold Climate source heat pumps. Dr. Tom Marsik (CCHRC)

- 17:15 Geothermal energy use for heating, cooling and power generation. Mr. Bernie Karl (CHSR)
- 17:45 Departure from CCHRC by Bus for Chena Hot Springs Resort (via Hampton Inn to pick up overnight bags)
- 19:00 Hosted dinner

### **Thursday, January 23 (Chena Hot Springs Resort)**

- 8:30 Introduction to Day 2.
- 8:45 Current and best practices of HVAC system designs – Panel Discussion.  
Mr. Brent Goering (USACE, AK) - moderator  
Robin Rader/Emily Winfield (Design Alaska)  
Mark Frame/ Danny Rauchenstein (PDC Engineers)  
Tom Adams (AFCEC, FL)  
Mr. Steven Taylor (WARE, USA)  
Mr. Craig Fredeen (Cold Climate Engineering)
- 10:15 Coffee Break
- 10:30 Air Barrier in Cold and Arctic Climates - Panel Discussion.  
Alexander Zhivov (ERDC) - moderator.  
Mr. Emmett Leffel (Alaska Thermal Imaging)  
Mr. William Rose (UIUC)  
Prof. Eva Moller (DTU, Denmark)
- 11:45 Technical Tour of Geothermal tri-generation plant at CHSR - Mr. Bernie Karl
- 13:00 Working Lunch
- 13:30 Energy generation, storage, and delivery strategies. Panel Discussion.  
Dr. Alexander Zhivov (ERDC) - moderator  
Mr. Lon Fiedler (TKDA)  
Mr. Oddgeir Gudmundsson (Danfoss, Denmark)  
Mr. Jen Peter Sandemand (MOD, Denmark)  
Mr. Kurt Knitter (UAF Combined Heat & Power Plant)  
Mr. Nick Janssen (Doyon Utilities)  
Dr. George Roe. Estimating Alaska Community Heat and Power Requirements

- 15:00 Energy efficiency and renewable energy strategies – Panel Discussion..  
Dr. Stephen Doig (Dartmouth University) - moderator  
Dr. Jeremy Kasper (ACEP/UAF) –  
Dr. Viktoria Gisladdottir (ERDC-CRREL)  
Mr. John Zarling (Arctic Engineering)  
Mr. Whit Hicks  
Mr. Dan Sambor (Stanford University)  
Mr. Bernie Karl (CHSR)
- 16:30 Thermal energy resilience studies at Fort Greely and Fort Wainwright. Panel Discussion. Moderator: Dr. Alexander Zhivov (ERDC) (moderator),  
Mr. Jonathan Goebel (ERDC)  
Mr. Dayne Broderson (UAF)  
Mr. William Rose (UIUC),  
Dr. Richard Liesen (CERL)  
Mr. William Chedister (Fort Wainwright) –
- 17:45 Summary of the Forum and Follow-up requests.
- 18:15 Departure for Fairbanks

### **Friday, January 24 Permafrost Tunnel Tour**

- 8:30 Depart Hampton Inn for the CRREL permafrost tunnel. CRREL will provide transportation for those who are not planning to rent a car (up to 12 people). For rental car drivers see attached directions.
- 9:00 CRREL permafrost tunnel tour. Please wear appropriate gear for the tour: warm clothes and boots. The temperatures are forecasted to be around 0°F, there is a heated visitor cabin but most of the time we will be outside or in the tunnel. Please be prepared to get dusty, we are in the process of expanding the tunnel and all the walkways were removed.
- 11:00 Depart the CRREL permafrost tunnel for the Hampton Inn.

## **Information about CRREL Permafrost Tunnel.**

***What is the Permafrost Tunnel?*** Situated on a 16 acre parcel in Fox, Alaska near the confluence of Goldstream and Glenn Creeks, the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) permafrost tunnel is a 350 meter long research facility dug into a large block of discontinuous permafrost. The Tunnel has been used for more than 50 years to study permafrost, geology, cryospheric science, microbial life in extreme environments, permafrost biogeochemistry, and mining and construction techniques specific to permafrost environments. The tunnel intersects a wide range of permafrost features including ice wedges, segregated ice, thermokarst cave ice, frozen silts, gravels, and organic material. It also provides an unprecedented continuous hundred-meter exposure of permafrost extending in time from the present to about 45,000 years in the past, with unusually complete sequences of paleo-environments (including mega fauna bones) preserved intact. The permafrost in the tunnel represents syngenetic, ice rich, high organic carbon soils. The facilities at the Permafrost Tunnel consist of the old (north) portal and tunnel, the new (south) portal and tunnel, the visitor cabin, the safety building, three storage units and refrigeration units. A road heading above the tunnel provides access to modern surface vegetation and permafrost.

***Why was the Permafrost Tunnel constructed?*** Excavated from 1963 – 1969 into an escarpment left over from the area's historic gold mining past, the permafrost tunnel was originally constructed to evaluate underground excavation techniques for military and mining applications. During the excavation process the tunnel's usefulness as a natural laboratory for natural science and engineering study became clear. In 2011, 2013, and 2018 additional excavation provided 150 meters of additional access to permafrost in the area. Future plans call for another 200 meters of tunnel expansion.

***Why is the Permafrost Tunnel important?*** The permafrost tunnel is unique, like no other permafrost research facility in the world. The 1963 tunnel project jump-started a U.S. and international effort to better understand permafrost that has lasted more than 5 decades. The site provides a unique opportunity for research, outreach and education where thousands of people visit the facility annually to learn about permafrost and see features first hand. U.S. Presidents, Congressmen, Cabinet Members, Ambassadors, State and Federal agency heads, numerous researchers and thousands of teachers, students and administrators have studied and learned about permafrost first-hand in the tunnel.

***What have we learned in the Permafrost Tunnel?*** Over 70 technical papers have been based on research conducted within the Permafrost Tunnel and the surrounding property. These topics include placer mining techniques in permafrost, civil engineering, and geotechnical aspects of permafrost, geocryology, geology, paleontology, paleoclimatology, biogeochemistry, biology-including life in extreme environments, and Mars studies.

***Why expand the Permafrost Tunnel?*** Expansion of the permafrost tunnel, initiated in 2011, is essential to support vital research limited by the existing tunnel configuration. Expansion of the permafrost tunnel will result in a 3-dimensional test bed for use in advancing capabilities in geophysical and remote sensing standoff detection, predictions of thaw degradation based on similar historic warm periods evident in the tunnel, and improved engineering to account for the

changing future state of permafrost. The additional permafrost exposed by new excavations will provide access to more ice features, bones, vegetation, and soils which will allow for a more holistic view of the formation history and potential future state of permafrost in interior Alaska.

***What is the status of the Permafrost Tunnel expansion?*** A new tunnel entrance was excavated approximately 60 meters to the south of the existing entrance in 2011. Additional excavation in 2013 resulted in a total new tunnel length of 60 meters. A new log cabin Visitor Center was completed in 2014 with major upgrades to the interpretive displays and the content is continually updated. A cross cut connecting the two tunnel adits was completed in 2018. Future tunnel upgrades include another cross cut connecting the rear of the two tunnel adits, a new entry portal, and a new refrigeration system. These proposed actions will lower utility costs in out years and enhance safety aspects of the facility. Long term goals address the need to facilitate the performance of high level multi-agency research programs and bring the permafrost test bed towards a self-sustaining independent research facility.

### **Directions to the Permafrost Tunnel: 2100 New Steese Highway, Fox, Alaska**

Driving from the Main Gate of Fort Wainwright (University Ave, and New Steese Hwy):

- 1) Take the Steese Hwy North past the Johansen Expressway
- 2) Proceed north on the Steese Expressway; the tunnel is roughly 10 miles north of Fairbanks.
- 3) Travel past the Trans-Alaska Pipeline viewing site on your right.
- 4) Travel past the Goldstream Road intersection on the left.
- 5) Proceed ~ 0.8 miles past Goldstream Road and turn right at the 5th drive. There is a white 'Permafrost Tunnel' sign
- 6) Proceed 300 feet and turn left and enter the chain link fence, proceed to the log cabin visitor center. If you end up at Fox, you've gone too far. Your tour guide will meet you there.

