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To: Chris Scruton (CEC)
From: Steve Wiel
Subject: **Cool Roof Colored Materials**: Monthly Progress Report for August 2003
CC: Hashem Akbari, Paul Berdahl, Andre Desjarlais, Bill Miller, Ronnen Levinson

A summary of the status of Tasks and Deliverables as of August 31, 2003 is presented in Attachment 1.

HIGHLIGHTS

- We set up exposure rack systems bearing painted-metal and clay-tile roofing samples at 7 California weathering farms.
- We prepared a draft paper summarizing our pigment characterization work to date.
- Planning continued for the forthcoming PAC meeting and industrial-partners meeting (September 11 and September 10, respectively).
- We posted our recent report reviewing roofing materials manufacturing methods on the project's website (<http://CoolColors.LBL.gov>).

Tasks

- 1.1 Attend Kick-Off Meeting
This Task is completed.
- 1.2 Describe Synergistic Projects
This Task is completed.
- 2.1 Establish the Project Advisory Committee (PAC)
This Task is completed.
- 2.2 Software Standardization
(No activity.)
- 2.3 PAC Meetings
Planning for the September 11, 2003 PAC meeting is underway. The project team will meet with the industrial partners on September 10, the afternoon before the PAC meeting.
- 2.4 Development of Cool Colored Coatings

2.4.1 Identify and Characterize Pigments with High Solar Reflectance

We have prepared a draft paper summarizing our pigment characterization work to date. The paper includes presentation and discussion of theory, model performance and spectral descriptions of the optical properties of 83 single-pigment paint films. This draft is being reviewed and revised, and we hope to finalize the paper (for purposes of journal submission) by October.

We have prepared 1:4 and 1:9 tints (mixtures with white) of all the acrylic-based paints received to date, and have nearly finished their optical measurements.

Next month we plan to (a) finish the tint measurements; (b) prepare mixtures of non-white paints; and (c) work with our industrial partners to begin producing samples of roofing products with bi-layer coatings.

A lamp failure caused downtime for the Lambda spectrometer in August; however, a replacement lamp was obtained and the spectrometer is again operational.

2.4.2 Develop a Computer Program for Optimal Design of Cool Coatings (No activity.)

2.4.3 Develop a Database of Cool-Colored Pigments

We developed a draft format for the database. This format will be presented and discussed in our next month meeting with our industrial partners and PAC members.

2.5 Development of Prototype Cool-Colored Roofing Materials

2.5.1 Review of Roofing Materials Manufacturing Methods

We edited the draft report and posted it on the web.

2.5.2 Design Innovative Methods for Application of Cool Coatings to Roofing Materials

We provided additional data on the efficacy of ultramarine blue as a cool pigment to some of our industrial partners. They, in turn, emphasized that the limited stability of this pigment is a major drawback, even in silica-coated versions of the pigment.

2.5.3 Accelerated Weathering Testing

(No activity.)

2.6 Field-Testing and Product Useful Life Testing

Exposure rack sets are set up and painted metal and clay tile samples are being exposed in seven of the sixteen climatic zones of California. Mike Evans will be ready to install cool roofs on the demonstration homes the first week of October 03.

2.6.1 Building Energy-Use Measurements at California Demonstration Sites

Mike Evans of Evans Construction, W. Miller of ORNL, Hanson Roof Tile and Custom-Bilt Metals made arrangements for setting up one concrete tile and two painted metal roofs on residential homes being built in Cavalli Hills, a new housing subdivision in Sacramento, CA. Tony Chiovare of Custom-Bilt Metals will supply Evans with the "Country Manor Shake" with and without cool roofing materials. Painted metal shakes will be installed on two A style homes (labeled in Fig. 1) during the first week of October.

Hanson Roof Tile will supply the low-profile Hacienda concrete tile (with standard color pigments) for the C style home located between the two A style homes under construction (Fig. 1). This roof will also be constructed during the first or second week of October. A concrete tile roof with cool-colored pigment will follow on a second C style

home to be built in line with the other A and C style homes (Fig. 1). The second C style home will not be started for a few months, which gives Ferro and Hanson more time to develop the cool-colored concrete tile.

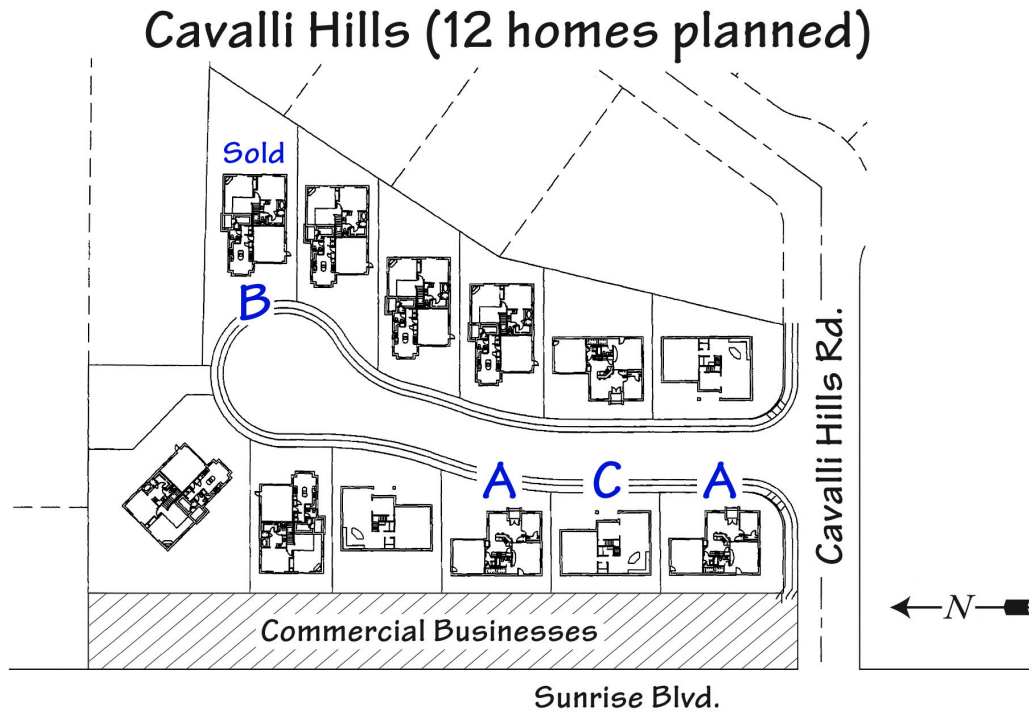


Figure 1. Plan view of the A, B and C style homes being built in Cavalli Hills subdivision, Sacramento, Ca.

Ferro and Hanson observed that adding the cool colored pigments to the sand, cement, and water mixture during the manufacturing process was not as successful as anticipated because the pigment blended into the mass of the cement and diluted the surface color. Ferro successfully developed a color match in a slurry coat application that Hanson has used in some of its concrete tiles. The slurry coat is applied while the concrete mix is still wet. Ken Loye of Ferro states the application puts the reflectance upwards of the 40% range.

W. Miller and J. Atchley visited the Cavalli Hills subdivision and reviewed setup of the instrumented oriented strand board (OSB) sandwich panels with Bill showing Mike Evans the proper placement of the panels in the demonstration homes. Mike had just received the instrumented roof deck panels made of 5/8-in OSB, which made our visit very timely.

2.6.2 Materials Testing at Weathering Farms in California

Shepherd Color Company sent a chemist from their technical service lab to Monierlife Tile's Rialto, CA plant to help expedite manufacture of the concrete tile samples. The results were not as successful as anticipated because the variegated colors were very difficult to match in the production process. Monierlife has shipped materials to Shepherd, and Shepherd plans to make all the samples at their facility. The Shepherd

Color Company will match cool-colors based on solid color standards that Monierlife Tile shall supply to produce the tiles.

Custom-Bilt, Steelscape, BASF, MCA, ELK, McArthur Farms and the California Irrigation Management Information System (CIMIS) sites located in Shasta and Imperial counties have received the painted metal and clay tile roof samples as well as the exposure rack systems. ORNL personnel will visit each site August 9 through 14 to check the setup of the exposure rack sets and to also install the sets at the CIMIS sites.

2.6.3 Steep-slope Assembly Testing at ORNL
(No activity)

2.6.4 Product Useful Life Testing
(No activity.)

2.7 Technology transfer and market plan

2.7.1 Technology Transfer
(No activity.)

2.7.2 Market Plan
(No activity.)

2.7.3 Title 24 Code Revisions
Levinson, Akbari, CEC, PG&E, Ely and Associates had several e-mail exchanges discussing and fine-tuning the details of proposed Title 24 code language for application of reflective low-sloped on non-residential buildings.

Management Issues

- None.

Attachment 1

Project Tasks and Schedules (Approved on May 16, 2002)

Task	Task Title and Deliverables	Plan Start Date	Actual Start Date	Plan Finish Date	Actual Finish Date	% Completion as of 08/31/2003
1	Preliminary Activities					
1.1	Attend Kick Off Meeting <i>Deliverables:</i> <ul style="list-style-type: none"> Written documentation of meeting agreements and all pertinent information (Completed) Initial schedule for the Project Advisory Committee meetings (Completed) Initial schedule for the Critical Project Reviews (Completed) 	5/16/02	5/16/02	6/1/02	6/10/02	100%
1.2	Describe Synergistic Projects <i>Deliverables:</i> <ul style="list-style-type: none"> A list of relevant on-going projects at LBNL and ORNL (Completed) 	5/1/02	2/1/02	5/1/02	5/1/02	100%
1.3	Identify Required Permits	N/A		N/A		
1.4	Obtain Required Permits	N/A		N/A		
1.5	Prepare Production Readiness Plan	N/A		N/A		
2	Technical Tasks					
2.1	Establish the project advisory committee <i>Deliverables:</i> <ul style="list-style-type: none"> Proposed Initial PAC Organization Membership List (Completed) Final Initial PAC Organization Membership List PAC Meeting Schedule (Completed) Letters of Acceptance 	6/1/02	5/17/02	9/1/02		100%
2.2	Software standardization <i>Deliverables:</i> <ul style="list-style-type: none"> When applicable, all reports will include additional file formats that will be necessary to transfer deliverables to the CEC When applicable, all reports will include lists of the computer platforms, operating systems and software required to review upcoming software deliverables 	N/A		N/A		

Project Tasks and Schedules (contd.)

Task	Task Title and Deliverables	Plan Start Date	Actual Start Date	Plan Finish Date	Actual Finish Date	% Completion as of 08/31/2003
2.3	<p>PAC meetings <i>Deliverables:</i></p> <ul style="list-style-type: none"> • Draft PAC meeting agenda(s) with back-up materials for agenda items • Final PAC meeting agenda(s) with back-up materials for agenda items • Schedule of Critical Project Reviews • Draft PAC Meeting Summaries • Final PAC Meeting Summaries 	9/1/02	6/1/02	6/1/05		33% (2/6)
2.4	Development of cool colored coatings					
2.4.1	<p>Identify and Characterize Pigments with High Solar Reflectance <i>Deliverables:</i></p> <ul style="list-style-type: none"> • Pigment Characterization Data Report 	6/1/02	6/1/02	12/1/04		~ 50%
2.4.2	<p>Develop a Computer Program for Optimal Design of Cool Coatings <i>Deliverables:</i></p> <ul style="list-style-type: none"> • Computer Program 	11/1/03		12/1/04		
2.4.3	<p>Develop a Database of Cool-Colored Pigments <i>Deliverables:</i></p> <ul style="list-style-type: none"> • Electronic-format Pigment Database 	6/1/03	7/1/03	6/1/05		< 5%
2.5	Development of prototype cool-colored roofing materials					
2.5.1	<p>Review of Roofing Materials Manufacturing Methods <i>Deliverables:</i></p> <ul style="list-style-type: none"> • Methods of Fabrication and Coloring Report 	6/1/02	6/1/02	6/1/03		~ 95%
2.5.2	<p>Design Innovative Methods for Application of Cool Coatings to Roofing Materials <i>Deliverables:</i></p> <ul style="list-style-type: none"> • Summary Coating Report • Prototype Performance Report 	6/1/02	6/1/02	12/1/04		< 10%
2.5.3	<p>Accelerated Weathering Testing <i>Deliverables:</i></p> <ul style="list-style-type: none"> • Accelerated Weathering Testing Report 	11/1/02	10/1/02	6/1/05		< 5%

Project Tasks and Schedules (contd.)

Task	Task Title	Plan Start Date	Actual Start Date	Plan Finish Date	Actual Finish Date	% Completion as of 08/31/2003
2.6	Field-testing and product useful life testing					
2.6.1	Building Energy-Use Measurements at California Demonstration Sites <i>Deliverables:</i> <ul style="list-style-type: none"> • Demonstration Site Test Plan • Test Site Report 	6/1/02	9/1/02	10/1/05		26%
2.6.2	Materials Testing at Weathering Farms in California <i>Deliverables:</i> <ul style="list-style-type: none"> • Weathering Studies Report 	6/1/02	10/1/02	10/1/05		27%
2.6.3	Step-slope Assembly Testing at ORNL <i>Deliverables:</i> <ul style="list-style-type: none"> • Whole-Building Energy Model Validation Presentation at the Pacific Coast Builders Conference • Step Slope Assembly Test Report 	6/1/02	10/1/02	10/1/05		14%
2.6.4	Product Useful Life Testing <i>Deliverables:</i> <ul style="list-style-type: none"> • Solar Reflectance Test Report 	5/1/04		6/1/05		
2.7	Technology transfer and market plan					
2.7.1	Technology Transfer <i>Deliverables:</i> <ul style="list-style-type: none"> • Publication of results in industry magazines and refereed journal articles • Participation in buildings products exhibition, such as the PCBC Brochure summarizing research results and characterizing the benefits of cool colored roofing materials 	6/1/03	6/1/02	6/1/05		~ 5%
2.7.2	Market Plan <i>Deliverables:</i> <ul style="list-style-type: none"> • Market Plan(s) 	5/1/05		6/1/05		
2.7.3	Title 24 Code Revisions <i>Deliverables:</i> <ul style="list-style-type: none"> • Document coordination with Cool Roofs Rating Council in monthly progress reports • Title 24 Database 	6/1/02	5/16/02	6/1/05		~ 5%

Project Tasks and Schedules (contd.)

Task	Task Title	Plan Start Date	Actual Start Date	Plan Finish Date	Actual Finish Date	% Completion as of 08/31/2003
VII	Critical Project Review(s) <i>Deliverables:</i> <ul style="list-style-type: none"> Minutes of the CPR meeting 					
XII (C)	Monthly Progress Reports <i>Deliverables:</i> <ul style="list-style-type: none"> Monthly Progress Reports 	6/1/02	6/1/02	6/1/05		42% (15/36)
XII (D)	Final Report <i>Deliverables:</i> <ul style="list-style-type: none"> Final Report Outline Final Report 	3/1/05		10/1/05		
	Final Meeting <i>Deliverables:</i> <ul style="list-style-type: none"> Minutes of the CPR meeting 	10/15/05		10/31/05		