ABENGOA SOLAR INC
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Mr. Thomas Barnett
Inland Energy, Inc.
3501 Jamboree Road
Newport Beach, CA 92660

Dear Mr. Barnett:

At the CEC Workshop held on December 11, 2007 in Victorville, Mr. Jim Adams of the CEC raised some issues relating to photographs describing what was categorized as "glare" from the parabolic trough mirror array at the CSP generating plant(s) at Kramer Junction. As the former COO of KJC Operating Company, the company that owned and operated those SEGS for more than 14 years, I was requested to provide some further clarification to the comments I made at the Workshop. My comments follow, referencing the photos that are attached designated: **Photo A:** *"Back" of KJ Solar Field – Ground Level*; **Photo B**: *Ground Level Shot of KJ Array*, and; **Photo C**: *Aerial Shot of KJ Array*.

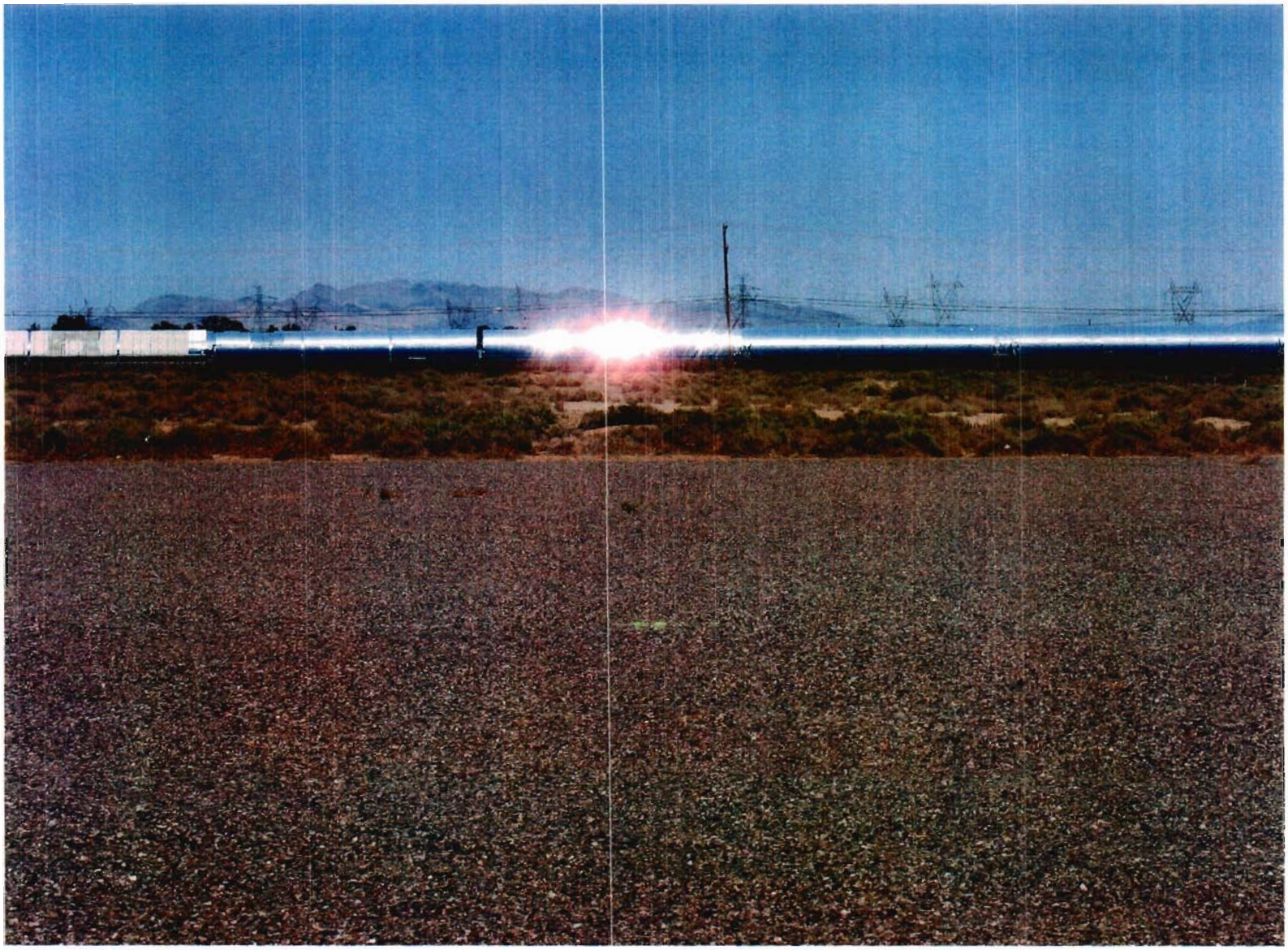
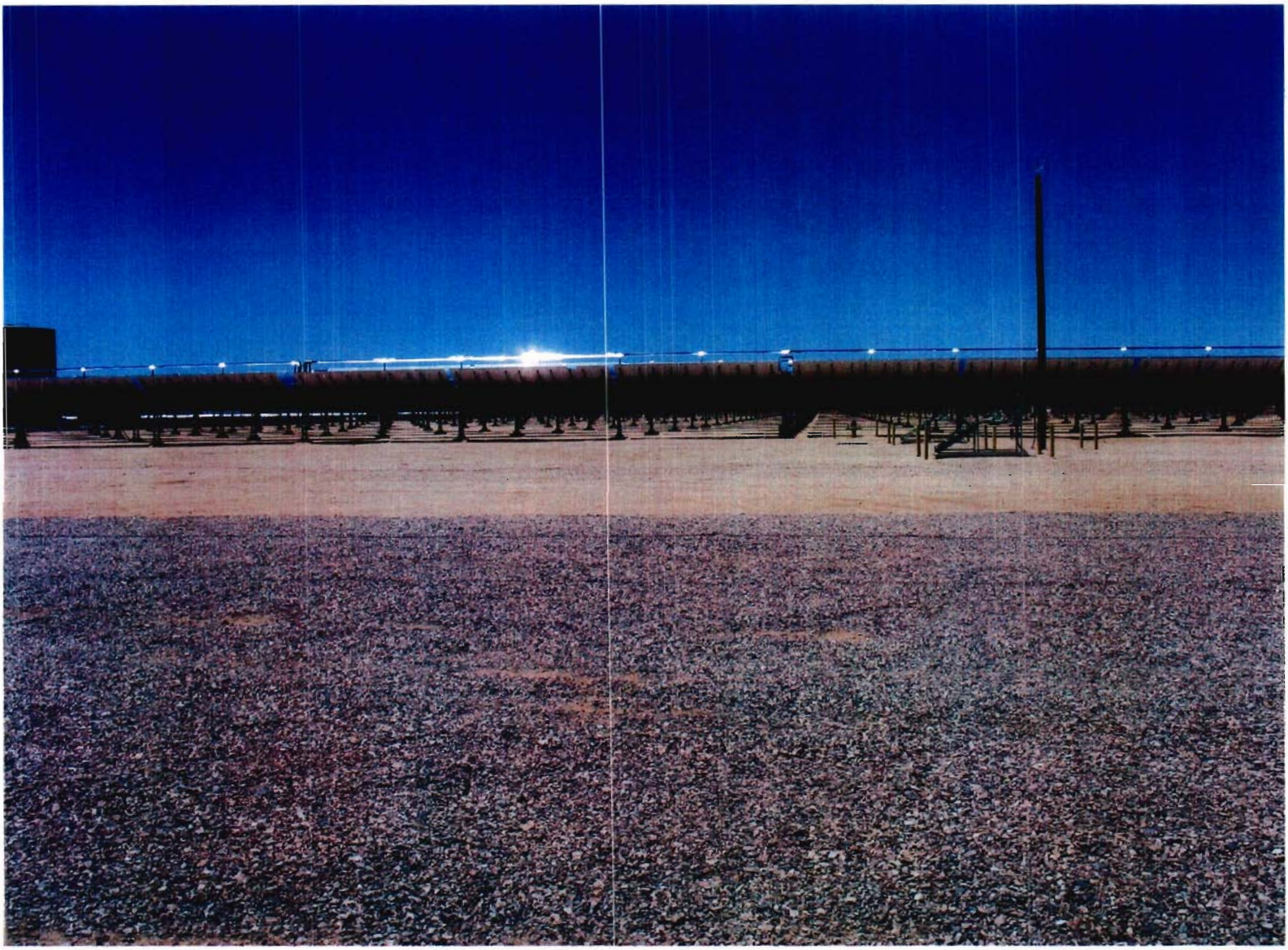
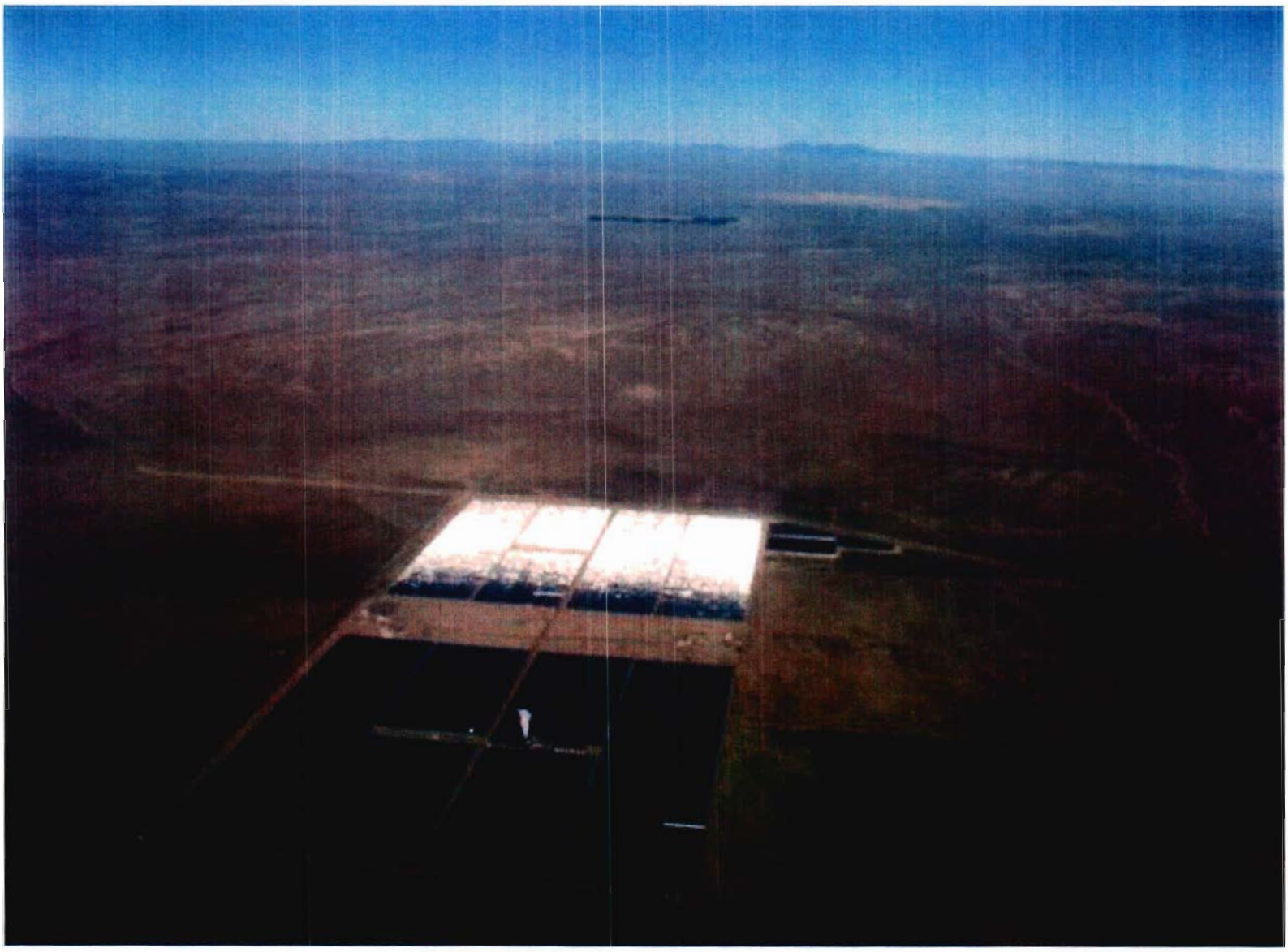
Photo A shows the back of several rows of mirrors in the left hand portion of the shot – the backs of the mirrors are not reflective. The reflections visible in the middle of the photo are from mirrors that are generally facing the photographer (I.e., the fronts). These reflections are from the glass-encased metal receiver tubes containing the heat transfer fluid (Receiver tubes) and <u>not</u> the mirrored surfaces themselves. As such the reflections are greatly diminished in intensity from those that would be associated with a reflection of the sun in a mirror. These reflections are similar to the reflections one would observe from a body of water with waves on it – if the viewer is in the right spot, incident rays from the sun will reflect directly off the curved glass surface of the receiver tube where the vertex of the incidental and reflected rays hits the tiny spot that is momentarily exactly perpendicular to the viewer's eye. In the photo, the three apparent areas of glare bursts or concentrations are the result of the metal receiver tube joint assemblies creating additional reflective surfaces which augment the glare. Again, in this case, no direct reflection of the sun from a mirror is involved.

This phenomenon is further demonstrated in Photo B: If you look to the left hand side of the photo (where the building provides a backdrop), you can see that the position of the mirror is nearly straight up (i.e., such as might be expected at mid-day when tracking the sun) – this is indicated by the fact that the receiver tube is plainly visible above the edges of the mirrors. Then, if you look to the

source of the reflected light in the photo, it is easy to see that it results entirely from the receiver tube and does not involve the mirrors at all.

With regard to the glare shown in Photo C, this phenomenon is what we refer to as Columnar Illumination (CI); it too is related to reflections from the receiver tube and not reflections of direct incident rays of the sun. The glass envelope covering the receiver tube glows as direct incident and reflected rays of sunlight strike it and are diffused and refracted by the numerous curved glass and metal surfaces of the tube apparatus; this glowing tube acts somewhat like the filament in a car headlight, and a portion of the glowing light strikes the mirrored surface of the parabolic mirror and is reflected back out into space, like an elongated headlight. Since the mirrors are in long rows, an elongated rectangle of light generated from the glowing receiver tube is produced in columns so that if (and only if) the observer passes through one of the columns (i.e., if the mirrors are pointed at the observer – the sun would therefore be more or less directly behind the viewer), it will be visible. If the observer passes overhead in a parallel direction, the illumination will remain visible for the length of the row; if the direction of the observer is perpendicular to the alignment of mirrors, the rows will illuminate one by one as they are traversed. As with a group of side by side headlights, the light from more than one row of mirrors at a time can be seen from a given vantage point, but the intensity will diminish the further the row is from the one that the observer is directly in the path of. Again, this light is <u>not</u> from direct reflection of the sun, but from the greatly diminished reflected light from the illuminated receiver tube.

In summary, just as the CEC representative observed himself when flying over the Kramer Junction facility, the glare is not a distraction to pilots; this fact has been verified over the nearly 20 years the Kramer Junction and Harper Lake facilities have been in operation. As mentioned above – I ran the Kramer SEGS facility, maintained long-term relationships with Edwards Air Force Base command and public relations personnel and the crop dusting service who maintains and air strip adjacent to the Kramer site, and I would have been the first to know if there were any complaints or problems.

Best regards,

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