



Smithsonian Astrophysical Observatory

Director's Office

August 1, 2013

Ms. Mindy Sue Vogel
Minerals & Geology Program Manager
Coronado National Forest
300 W Congress St
Tucson, AZ 85701

Dear Ms. Vogel:

We remain concerned about the adverse consequences of light from the Rosemont Copper Mine (RCM) on our observatories on and near Mt. Hopkins. The US and State of Arizona governments have invested more than \$40 million in developing these state of the art observatories. We cannot be certain that the RCM will operate within the constraints of their proposed lighting plan.

We have previously suggested that sky brightness monitoring of the RCM and enforcement of negotiated light levels be included in the Environmental Impact Statement.

The Forest Service (FS) stated in the June 21, 2012, *Rosemont Copper Project Analysis Update*:

“Additional mitigation measures are being developed along with detailed monitoring plans to respond to effects of the project on important Forest resources.”

Neither the Forest Service nor RCM representatives have contacted us to discuss sky brightness monitoring. We stand ready to share our considerable experience with sky brightness monitoring.

As part of the monitoring process, we request RCM provide their plans for lighting construction including the “as-built” configuration as well as any modifications implemented over the life of the mine to verify that the light levels do not exceed those described in the current plan.

We request that the Forest Service continue to protect this superb resource for scientific discovery as the Forest Service agreed to do when the observatories were established.

Sincerely,

Dr. Charles Alcock
Director, Smithsonian Astrophysical Observatory
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DOCUMENT REVIEW COMMENT FORM—SMITHSONIAN ASTROPHYSICAL OBSERVATORY

Commenter	Chapter	Section	Page	Line	Comment/Change requested
Emilio Falco, J. Shaw	2 Alternatives, Including the Proposed Action		12	34-35	<p>Please clarify the statement:</p> <p>“The original lighting plan remains a part of the proposed action, whereas the updated lighting mitigation plan applies to all other action alternatives.”</p> <p>This sentence is ambiguous. The FEIS should clearly state that RCM must implement the Monrad Lighting Plan (2012) in any approved action.</p>
Emilio Falco	2 Alternatives, Including the Proposed Action		13	14,15	<p>Please clarify the statement:</p> <p>“Elevated hazard areas, such as the mine process area and pit, would mostly require high-pressure sodium lighting or solid-state LED lighting fixtures that would be aimed and shielded to minimize light pollution.”</p> <p>The Monrad plan (2012) does not include any HPS.</p>
J. Shaw, Emilio Falco	2 Alternatives, Including the Proposed Action	Table 12 Alternatives impact summary	104	Issue 11A.7 Qualitative assessment of economic effect on astronomy industry Column Proposed Action	<p>Delete:</p> <p>“Adverse impacts on dark skies could result in an impairment of observatories near the project area, which could result in a decrease in State revenues generated from astronomy, space, and planetary research and tourism. Although the increase in night sky illumination is not expected to be significant, the negative public perception of having a copper mine next to an observatory may impact observatory revenues.”</p> <p>Replace with:</p> <p>“Adverse impacts on dark skies would result in an impairment of observatories near the project area, which would result in a decrease in State revenues generated from astronomy, space, and planetary research and tourism. Slight increase in night sky illumination will impact faint object astronomy. In addition the negative public perception of having a copper mine next to an observatory has already impacted future observatory revenues, particularly diversion of future leading edge projects to other “darker” locations.”</p> <p>Rationale – consistent with text in the EIS Dark Skies and Socioeconomics section.</p> <p>“However, even with the revised lighting plan’s reduction of lighting impacts, mine lighting would have a long term, adverse impact on dark skies during the premining and active mining phases.” (EIS Ch 3 Dark Skies p15, lines 20-22)</p> <p>Currently, no light illuminates the sky from the proposed RCM site. The 6 million + lumens proposed under the Monrad (2012) plan degrades the pre-existing dark sky environment.</p>

Commenter	Chapter	Section	Page	Line	Comment/Change requested
Emilio Falco	3. Affected Environment and Environmental Consequences	Dark Skies	1	14-17	<p>Delete:</p> <p>“The Kitt Peak National Observatory and the Smithsonian Institution’s Fred Lawrence Whipple Observatory are world-class astronomy research facilities located on the Coronado National Forest that rely on the area’s naturally dark, unpolluted night skies for optical and infrared astronomy research.”</p> <p>Replace with:</p> <p>“The Smithsonian Institution’s Fred Lawrence Whipple Observatory is a world-class astronomy research facility located on the Coronado National Forest and relies on the area’s naturally dark, unpolluted night skies for optical and infrared astronomy research.”</p> <p>Rationale - Kitt Peak National Observatory is not within the Coronado National Forest.</p>
J. Shaw	3. Affected Environment and Environmental Consequences	Dark Skies	7	8	<p>Add to Relevant Laws, Regulations, Policies, and Plans - <i>Federal</i>:</p> <p>Interagency Agreement for Land Use and Occupancy, U.S. Forest Service, Department of Agriculture & Smithsonian Astrophysical Observatory, Smithsonian Institution – dated 1 Jun 1978</p>
Emilio Falco	3. Affected Environment and Environmental Consequences	Dark Skies	8	1-2	<p>Please clarify:</p> <p>Pima County asserts that ARS 11-251 implies that RCM must comply with the OLC. If accurate, the FEIS should state that RCM must comply with the OLC.</p>

Commenter	Chapter	Section	Page	Line	Comment/Change requested
Emilio Falco	3. Affected Environment and Environmental Consequences	Astronomy and Dark Skies	14	27-31	<p>Delete:</p> <p>“While the Pima County Outdoor Lighting Code currently keeps light pollution at levels that do not adversely affect astronomy research, the trend toward increasing urban and industrial development and mineral resource exploration, development, and extraction would adversely impact night skies in terms of the nighttime light levels required for astronomy research.</p> <p>Replace with:</p> <p>“Although the Pima County Outdoor Lighting Code currently keeps light pollution at levels that minimize adverse effects to astronomy research, the trend toward increasing urban and industrial development and mineral resource exploration, development, and extraction would adversely impact night skies in terms of the nighttime light levels required for astronomy research.”</p> <p>Rationale – any light level impacts astronomy.</p>
Emilio Falco	3. Affected Environment and Environmental Consequences	Astronomy and Dark Skies	15	2	<p>Add:</p> <p>“Dark Skies mitigation and monitoring plan is described in Appendix B.”</p>

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J. Shaw, Emilio Falco	3. Socioeconomic and Environmental Justice	Table 205 Summary of Effects	9	Issue 11A.7 Qualitative assessment of economic effect on astronomy industry Column Proposed Action	<p>Delete:</p> <p>“Adverse impacts on dark skies could result in an impairment of observatories near the project area, which could result in a decrease in State revenues generated from astronomy, space, and planetary research and tourism. Although the increase in night sky illumination is not expected to be significant, the negative public perception of having a copper mine next to an observatory may impact observatory revenues.”</p> <p>Replace with:</p> <p>“Adverse impacts on dark skies would result in an impairment of observatories near the project area, which would result in a decrease in State revenues generated from astronomy, space, and planetary research and tourism. Slight increase in night sky illumination will impact faint object astronomy. In addition the negative public perception of having a copper mine next to an observatory has already impacted future observatory revenues, particularly diversion of future leading edge projects to other “darker” locations.”</p> <p>Rationale – consistent with text in the EIS Dark Skies and Socioeconomics section.</p> <p>“However, even with the revised lighting plan’s reduction of lighting impacts, mine lighting would have a long term, adverse impact on dark skies during the premining and active mining phases.” (EIS Ch 3 Dark Skies p15, lines 20-22)</p> <p>Currently, no light illuminates the sky from the proposed RCM site. The 6 million + lumens proposed under the Monrad (2012) plan degrades the pre-existing dark sky environment.</p>

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J. Shaw	3. Socioeconomic and Environmental Justice	Astronomy and Dark Skies	60	15-21	<p>Delete:</p> <p>“According to the “Dark Skies” analysis, there could be adverse impacts to dark sky visibility at the Whipple and Jarnac Observatories as a result of light pollution and dust emissions emanating from the mine. The equipment’s ability to locate and track fainter targets, which are often the ones of greatest interest for astronomical research, diminishes with increasing light levels. New and more sensitive instruments and longer exposures (which increase operating costs), can be required to maintain effective observations. Adverse impacts to these world-class astronomy research facilities could have long-term, adverse impacts on the economic contributions of the astronomy, planetary, and space sciences.”</p> <p>Replace with:</p> <p>“According to the “Dark Skies” analysis, there would be adverse impacts to dark sky visibility at the Whipple and Jarnac Observatories as a result of light pollution and dust emissions emanating from the mine. The equipment’s ability to locate and track fainter targets, which are often the ones of greatest interest for astronomical research, diminishes with increasing light levels. New and more sensitive instruments and longer exposures (which increase operating costs), will be required to maintain effective observations. Adverse impacts to these world-class astronomy research facilities would have long-term, adverse impacts on the economic contributions of the astronomy, planetary, and space sciences.”</p> <p>Rationale – consistent with text in the EIS Dark Skies and Socioeconomics section.</p> <p>“However, even with the revised lighting plan’s reduction of lighting impacts, mine lighting would have a long term, adverse impact on dark skies during the premining and active mining phases.” (EIS Ch 3 Dark Skies p15, lines 20-22). Currently, no light illuminates the sky from the proposed RCM site. The 6 million + lumens proposed under the Monrad plan (2012) degrades the pre-existing dark sky environment.</p>
J. Shaw	3. Socioeconomic and Environmental Justice	Astronomy and Dark Skies	61	16-17	<p>Delete: “The increases in illumination under the revised lighting plan generally do not appear to be very significant from observatory’s perspective, though”</p> <p>Rationale – The SAO position is that any increased illumination is detrimental to science operations</p>
J. Shaw	3. Socioeconomic and Environmental Justice	Astronomy and Dark Skies	61	36	<p>Delete: “These risks cannot be reliably quantified.”</p> <p>Rationale – None of the next series of \$700M+ “Giant” observatories are planned for the Arizona area. This should be sufficient anecdotal evidence to note impacts of concerns regarding deteriorating lighting conditions.</p>

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Dan Brocius	Appendix B	Mitigation and Monitoring – Forest Service	3	20	<p>Please clarify:</p> <p>The FEIS says “Rosemont Copper has publicly agreed to consider or implement the mitigation and monitoring items under this heading. These may include contractual and financial agreements over which the Forest Service and other agencies have no jurisdiction.”</p> <p>Is RCM bound by the MPO to act as asserted in the RCM Light Pollution Mitigation Recommendation Report (Monrad 2012) and as described in pages 43-44 of Appendix B?</p>
Dan Brocius	Appendix B	Mitigation and Monitoring – Forest Service	3	20	<p>Comment:</p> <p>The RCM Light Pollution Mitigation Recommendation Report (Monrad 2012) says, “However, as part of its commitment to best possible environmental practices, Rosemont Copper Company (Rosemont) will voluntarily employ an advanced light pollution mitigation plan. (page 2) As for monitoring, however, it says only, “Measurements may be made in the future to determine the impact of the Project, its compliance with established goals and mitigation methods, and to identify other newly introduced sources of light pollution in the Tucson region and their relative impacts. (p. 3).</p> <p>The FEIS should state that RCM will perform a monitoring program as described in pages 43-44 of Appendix B.</p>
Emilio Falco	Appendix B	Mitigation and Monitoring – Forest Service	3	20	<p>Comment:</p> <p>The FEIS should state that, were Augusta Resources to sell RCM, the new owner would be held to the Monrad lighting plan, with the same conditions as in the current FEIS.</p>

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J. Shaw	Appendix B	FS-DS-01 – Implementation of an outdoor lighting plan that would reduce potential impacts from artificial night lighting	43	Description	Add: Rosemont Copper and the Forest Service will review effectiveness of the lighting mitigation measures on at least an annual basis throughout the operational lifetime of the mine.
Emilio Falco, J. Shaw	Appendix B	FS-DS-01 – Implementation of an outdoor lighting plan that would reduce potential impacts from artificial night lighting	44		<p>The FEIS should state that outdoor light monitoring will be conducted by RCM, with the help and oversight from cooperating agencies including SAO.</p> <p>The FEIS should specify mechanisms to report Rosemont Mine light levels above measured above baseline sky brightness levels, and to ensure elimination or mitigation of any violations. The FEIS should indicate that the FS will handle such violations in the same manner as violations of permit violations of environmental requirements such as those for water and air quality.</p> <p>An appropriate threshold is 10% above the baseline RCM operational lighting installation sky brightness measurements. Sustained levels exceeding this threshold will be reported to the FS to pursue appropriate corrective measures.</p>

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Emilio Falco, J. Shaw	Appendix B	FS-DS-01 – Implemen tation of an outdoor lighting plan that would reduce potential impacts from artificial night lighting	44		<p>The FEIS should indicate that the light fixtures will be inspected prior to mounting for compliance with the Monrad lighting plan and to establish the “as built” baseline.</p> <p>The FEIS should specifically the identify the responsible organizations, such as Monrad Engineering, who will inspect the light fixtures to verify the as-installed RCM lighting follows the Monrad (2012) lighting plan in terms of fixtures, their orientations, and lumen outputs.</p> <p>Annual light fixtures inspections should be performed, to verify the Monrad plan is followed during RCM operations.</p>

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J. Shaw, Emilio Falco	Appendix B	FS-DS-01 – Implementation of an outdoor lighting plan that would reduce potential impacts from artificial night lighting	44	Monitoring/Reporting Action	<p>Delete:</p> <p>“Effectiveness: Baseline data monitoring would occur at a frequency to be determined that represents periods of maximum outside night light use during the active mining phase. Monitoring would duplicate the baseline monitoring that is described in the Monrad et al. (2012) “Rosemont Copper Project Light Pollution Mitigation Recommendation Report,” dated June 18, 2012, pages 23–24 (which would be incorporated into the final MPO), and the “20 Year Monitoring Plan: Light at Night – Measurements at Rosemont Copper Project,” dated May 20, 2012. Includes mobile aerial, mobile ground-based and static ground-based measurements. If additional shielding could be placed to further reduce lighting effects without adverse impacts to safety and unreasonable operational expectations, Rosemont Copper would implement that additional shielding in a manner consistent with safe mining.”</p> <p>Replace with addition:</p> <p>“Effectiveness: Baseline data monitoring would start before RCM construction to establish levels prior to RCM operations. On-going monitoring would occur continually during the active mining phase. Monitoring would duplicate the baseline monitoring that is described in the Monrad et al. (2012) “Rosemont Copper Project Light Pollution Mitigation Recommendation Report,” dated June 18, 2012, pages 23–24 (which would be incorporated into the final MPO), and the “20 Year Monitoring Plan: Light at Night – Measurements at Rosemont Copper Project,” dated May 20, 2012. Includes mobile aerial, mobile ground-based and static ground-based measurements.</p> <p>In addition, there will be a permanent fixed monitoring site on Mt Hopkins along with several permanent fixed ground sites around the mine. Spectroscopy will also be collected using the FLWO 1.5M telescope. Monitoring for these sites will be described in an SAO monitoring plan.</p> <p>If additional shielding could be placed to further reduce lighting effects without adverse impacts to safety and unreasonable operational expectations, Rosemont Copper would implement that additional shielding in a manner consistent with safe mining. As part of the monitoring process, RCM will provide the FS and SAO their plans for lighting construction including the “as-built” configuration as well as any modifications implemented over the life of the mine to verify that the light levels do not exceed those described in the Monrad plan.</p>

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J. Shaw	Appendix B	FS-DS-01 – Implementation of an outdoor lighting plan that would reduce potential impacts from artificial night lighting	44	Performance Criteria	Delete sentence: “Effectiveness monitoring would demonstrate that all site lighting lumen emissions is 15 percent or less of the amount allowed by the Pima County Outdoor Lighting Code lumen per acre table for Zone 1a” Rationale: incorrect quote from report. Percentage is not mentioned on referenced page.
J. Shaw	Appendix B	FS-DS-01 – Implementation of an outdoor lighting plan that would reduce potential impacts from artificial night lighting	44	Performance Criteria	Delete: “Effectiveness: Monitoring would provide for review and comparison of lighting emissions of the Rosemont Copper Mine and other new developments. Effectiveness monitoring would demonstrate that all site lighting lumen emissions is 15 percent or less of the amount allowed by the Pima County Outdoor Lighting Code lumen per acre table for Zone 1a (Monrad et al. (2012) “Rosemont Copper Project Light Pollution Mitigation Recommendation Report,” dated June 18, 2012, page 5). The intent is to fully comply with the Pima County Outdoor Lighting Code; however, deviations may be required to comply with Mine Safety and Health Administration (MSHA) regulations.” Replace with: “Effectiveness: Monitoring would provide for review and comparison of lighting emissions of the Rosemont Copper Mine and other new developments. Effectiveness monitoring would demonstrate that all site lighting lumen emissions is less than the amount allowed by the Pima County Outdoor Lighting Code lumen per acre table for Zone 1a (Monrad et al. (2012) “Rosemont Copper Project Light Pollution Mitigation Recommendation Report,” dated June 18, 2012). The intent is to fully comply with the Pima County Outdoor Lighting Code. If deviations are required to comply with Mine Safety and Health Administration (MSHA) regulations, then the lighting plan will be balanced to reduce a similar amount of illumination in non-critical use areas.” Rationale: Minimizes adverse lighting impact if modifications are required to the Monrad Plan for safety reasons.

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J. Shaw	Appendix B	FS-DS-01 – Implemen tation of an outdoor lighting plan that would reduce potential impacts from artificial night lighting	44	Timing	<p>Delete:</p> <p>“Annual or semiannual monitoring (in accordance with the “20 Year Monitoring Plan: Light at Night – Measurements at Rosemont Copper Project,” dated May 20, 2012). Monitoring localized and regional quantitative trends in sky-brightness changes due to on-site lighting systems to establish current sources and allow for comparison of Rosemont Copper Mine and all other new developments would determine whether predictions of lumens are accurate; would include direct measurement of sky brightness using over flights and land-based measurements. Monitoring every 5 years during later years of operations phase (in accordance with the “20 Year Monitoring Plan: Light at Night – Measurements at Rosemont Copper Project,” dated May 20, 2012). Review of the efficacy of light mitigation measures would occur following construction of the mine.”</p> <p>Replace with:</p> <p>Continual monitoring (in accordance with the “20 Year Monitoring Plan: Light at Night – Measurements at Rosemont Copper Project,” dated May 20, 2012). Monitoring localized and regional quantitative trends in sky-brightness changes due to on-site lighting systems to establish current sources and allow for comparison of Rosemont Copper Mine and all other new developments would determine whether predictions of lumens are accurate; would include direct measurement of sky brightness using over flights and land-based measurements.”</p> <p>Rationale: Monitoring should continually occur to ensure mitigation measures remain effective taking into account any facility modifications or maintenance over time.</p>