Exhibit A
Comparison of Oil Produced From Shale GHG to Oil Produced from Conventional Methods

General Conclusions[1]

1. "Without mitigation or technology improvements, full-fuel-cycle carbon dioxide (CO2) emissions from oil shale derived liquid fuels are likely to be 25 to 75% higher than those from conventional liquid fuels, depending on the details of the process used."

2. "The emissions of CO2 from oil shale derived fuels come from three stages: retorting of shale, upgrading and refining of raw shale oil, and combustion of the finished transportation fuels. Emissions from these stages represent approximately 25-40%, 5-15%, and 50-65% of total fuel-cycle emissions, respectively."

3. "The most uncertain source of emissions is the retorting stage, due to variation in emissions with shale quality and retorting technology used."

4. "Carbon dioxide is directly emitted in all three primary stages of producing and consuming fuels from oil shale. First are emissions resulting from the retorting of oil shales to generate unrefined hydrocarbons (HCs), including crude shale oil and HC gases. Second are emissions from the upgrading and refining of crude shale oil to refined fuels (e.g., gasoline or diesel). Third, direct emissions result from combustion of the refined fuel by the consumer. Additionally, there are minor indirect emissions from the consumption of materials such as steel or cement used in oil shale extraction."

5. "Emissions from oil shale **retorting** process can be divided into three components: CO2 emitted due to the thermal energy requirements of retorting, CO2 emitted from other energy uses associated with retorting, and CO2 emitted from the shale itself."

6. "Thus, a large oil shale industry in western Colorado would be a major global emitter."

7. "The primary opportunity for reducing CO2 emissions from oil shale retorting lies in the substitution of low- or zero-carbon energy sources for high carbon sources. Using the carbon intensities from Table 3, this clearly means avoiding the use of coal and shale char for process heat and encouraging usage of natural gas or co-produced HC gases. Substitution of natural gas for coal or char will nearly halve the carbon burden of retorting."

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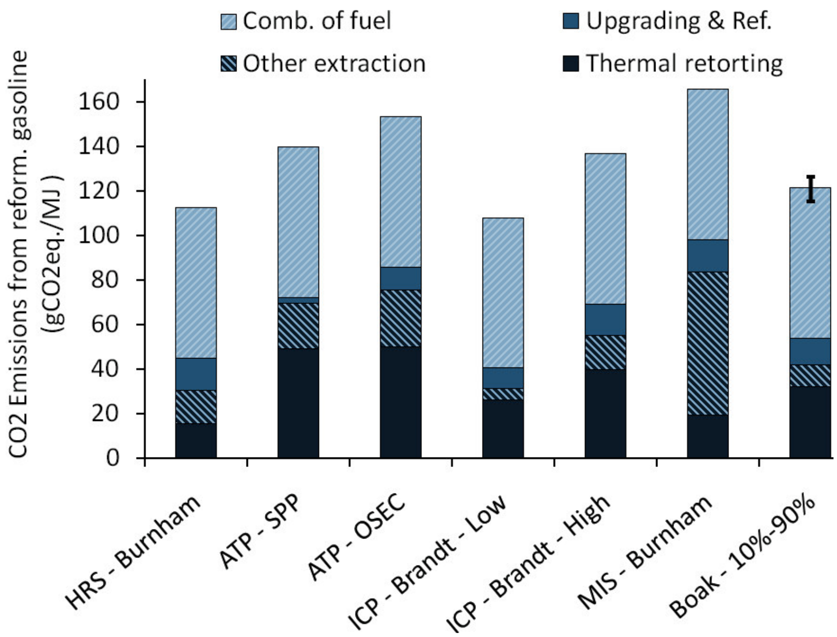
[1] Adam Brandt, Jeremy Boak, Alan Burnham, "Carbon Dioxide Emissions from Oil Shale Derived Liquid Fuels" (in press)



8. "For example, in Boak's industry-scale model described above, if all power were generated from the newest high efficiency gas turbines, it could reduce the emissions from the values presented here, perhaps by 10-15 percent. Even more radical reductions could be achieved through the use of near-zero GHG sources such as off-peak wind power, nuclear power or solar power for retorting heat requirements. Replacing the retorting heat source with a near-zero-carbon energy source would bring emissions from oil shale-derived fuels quite near to those from conventional oil production, as the CO2 generation from mineral and kerogen reactions is less than 10% of the total."

Shell In Situ[2]

1. "In the absence of capturing CO_2 generated from electricity produced to fuel the process, well-to-pump GHG emissions are in the range of 30.6-37.1 grams of carbon equivalent per megajoule of liquid fuel produced. These full-fuel-cycle emissions are 21%-47% larger than those from conventionally produced petroleum-based fuels."

2. "Note that if electricity were generated from low carbon sources (such as renewables or fossil fuels with carbon capture), then emissions from oil shale would be approximately equal to those from conventional oil."

3. "Emissions from final fuel combustion are equal in all cases, because the fuels that are produced from oil shale are equivalent to those from conventional petroleum."

NOTE: Brandt's analysis assumes the bulk of the energy input comes from electricity.

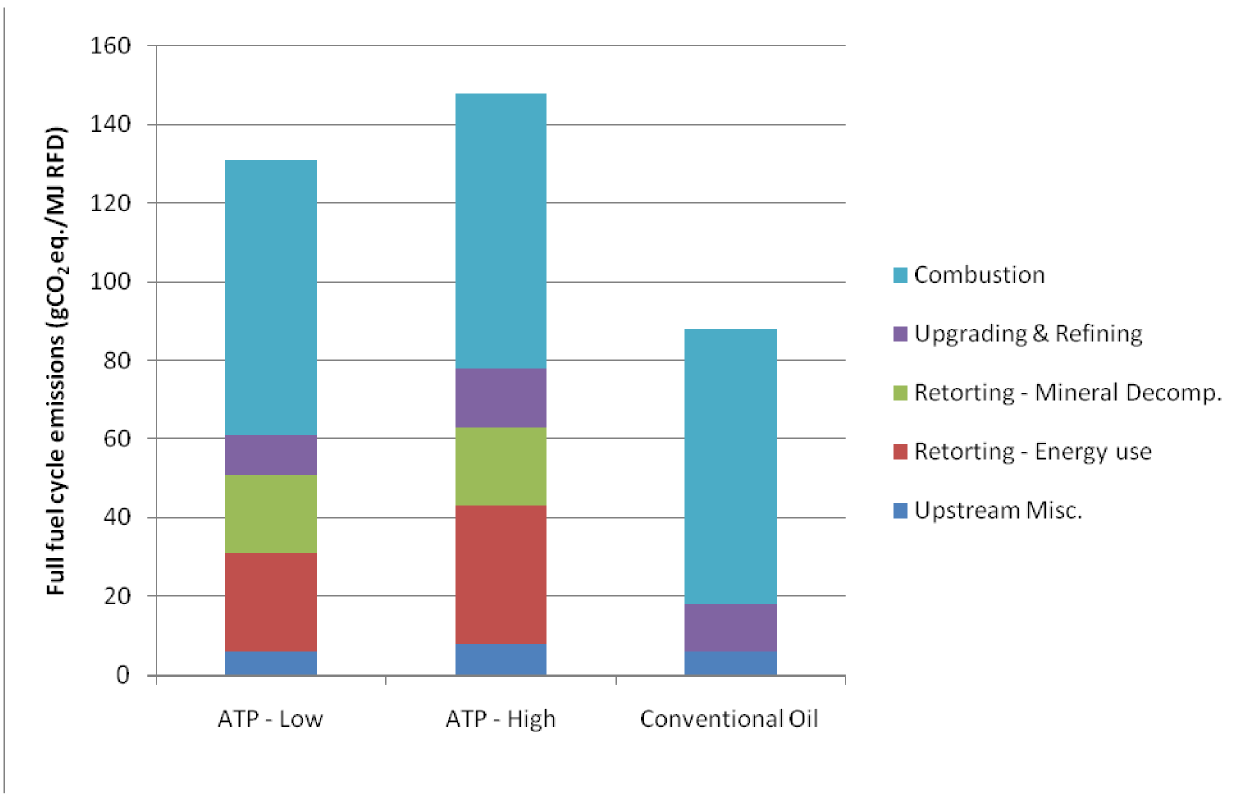
[2] Adam Brandt, (2008) "Converting Oil Shale to Liquid Fuels: Energy Inputs and Greenhouse Gas Emissions of the Shell in Situ Conversion Process", *Environ. Sci. Technol. Environmental Science & Technology* 42(19) 7489-7495. DOI: 10.1021/es800531f

Retort with Alberta Taciuk Processor (ATP)[3]

1. "The ATP process is designed to provide most of the process energy from the shale char and produced HC gas, minimizing purchased energy inputs. In one case of actual operation, the vast majority (86%) of the process heat required by the retort was provided by the oil shale itself, minimizing the need for external input energy from natural gas."

2. "Without mitigation, fuels produced from Green River oil shale using the ATP process have emissions significantly higher than those from conventionally produced petroleum. Emissions from low and high cases are 1.5-1.75 times those from conventional oil production on a full-fuel-cycle basis."

3. "If we produce, refine, and combust fuel equal to 10% of 2005 US gasoline consumption ($3.3x10^8$ bbl/y, or $1.8x101^8$ J) from oil shale using the ATP instead of conventional oil, full-fuel-cycle emissions could increase from about 42.5 million t of carbon (C as CO2) to 65-74 million t of carbon. This is a rough increase of 20 to 30 million t. To put these figures in perspective, emissions from all sectors in the state of Colorado equaled 24 million t of carbon in 2001. Thus, replacing 10% of U.S. gasoline with shale-derived fuels produced using large-scale ATP projects would result in additional emissions commensurate with the total emissions from the state of Colorado."



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[3]Brandt, A.R. (2009). **Converting oil shale to liquid fuels with the Alberta Taciuk Processor: Energy inputs and greenhouse gas emissions**. *Energy & Fuels*. DOI: 10.1021/ef900678d