

STATEMENT OF CONSIDERATIONS

REQUEST BY RADIAN INTERNATIONAL LLC FOR AN ADVANCE WAIVER OF DOMESTIC AND FOREIGN INVENTION RIGHTS UNDER DOE COOPERATIVE AGREEMENT NO. DE-FC26-99FT40725; W(A)-99-020, CH-1019

The Petitioner, Radian International LLC (Radian), was awarded this cooperative agreement for the performance of work entitled, "Hybrid Sulfur Recovery Process for Natural Gas Upgrading". Under the cooperative agreement, Radian is to demonstrate a new and innovative process for upgrading low-quality, sour natural gas to pipeline quality. The effort will target the removal of hydrogen sulfide from on-shore and offshore low quality natural gas and associated gas reservoirs, including coal beds and landfill locations. More specifically, as discussed in the Statement of Work for this Cooperative Agreement, Radian, along with the Gas Research Institute (GRI), TDA Research, Inc., and Walk Haydel will develop the proposed hybrid process for sour gas upgrading. The proposed technology will combine an upstream catalytic oxidation reactor with the CrystaSulfSM process, a nonaqueous liquid redox process currently under development by Radian and GRI (CrystaSulfSM is a service mark of GRI). The upstream catalytic reactor will convert 1/3 of the H₂S in the inlet sour gas to SO₂, to support a "liquid Claus" reaction in the CrystaSulf process. The hybrid process is expected to reduce hydrogen sulfide concentrations in the natural gas feed stream to pipeline specifications, maximize hydrocarbon recovery, lower costs compared to existing technologies, and operate within environmental regulations. This waiver is only for any inventions made by Radian under this cooperative agreement.

The total estimated cost of the cooperative agreement is about \$1,287,210, with the DOE share being \$699,845. Cost sharing of the project for Radian is \$587,365, or about 45%. It is anticipated that the length of this subcontract will be from October 1, 1999 until March 31, 2001.

In its response to questions 4 and 5 of the attached waiver petition, Radian has shown significant technical competence in developing and evaluating liquid redox sulfur recovery technologies since the 1980's. Observation of problems associated with aqueous slurry-based processes led Radian and the Gas Research Institute to begin development of a non-aqueous process. The state of the art is currently being demonstrated by Radian through the CrystaSulfSM process, and a pilot unit is currently in operation in Denver City, Texas. Radian and GRI have presented numerous technical papers on liquid redox processes, a representative

sampling of which is attached to the waiver petition. Radian and GRI also hold a number of U.S. and foreign patents and have applied for additional patents related to non-aqueous liquid redox sulfur recovery processes. Table 1 of the waiver petition lists these patents and applications. To enhance the commercialization of the proposed technology, Radian will obtain an exclusive license from GRI in the CrystaSulfSM process. Additionally, Radian and GRI are negotiating to establish a Gas Processing Alliance for marketing the CrystaSulf process and other gas treating technologies to domestic and foreign gas exploration and production companies. Radian, along with GRI, has also been investing significant resources toward its goal of marketing this technology: specifically, closing a commercial sale for a CrystaSulfSM process by March 2000. Its investment expenditures have been steadily increasing to meet this stated goal, and is evidenced in part by Radian's attached sales brochure to the waiver petition.

From its response to question 9, Radian indicates that there will be a positive effect on competition and market concentration by grant of the waiver. Radian defines the market as the area of sulfur recovery from sub-quality natural gas in quantities of 0.2 to 25 LT/day. This market is currently being served by firms that offer aqueous-iron liquid redox processes, a technology that has been commercially available for about ten years. Although there are no commercial installations of the CrystaSulfSM process or related technologies such as the hybrid process to be pilot tested under the cooperative agreement, Radian believes that it will not be placed in an advantageous market position because the older, competing technologies are well entrenched. Additionally, Radian asserts that grant of the waiver would strengthen its ability to offer new technology that it expects will lower the costs required to upgrade sulfur-containing natural gas to pipeline standards. That is, offering a new process commercially will encourage competition for sulfur recovery plants installed on new and existing gas processing plants. Any lowering of costs associated with sulfur recovery that can be established with the new process will make more sub-quality natural gas cost effective to produce and held to reduce U.S. dependence on imported fuels.

The subject cooperative agreement will be modified to add the Patent Rights--Waiver clause in conformance with 10 CFR 784.12. This waiver clause will also include a paragraph entitled U.S. Competitiveness, in which Radian agrees to substantial U. S. manufacture of subject inventions (attached hereto). Additionally, Radian agrees not to transfer subject inventions to any other entity unless that other entity agrees to these same requirements. The

petitioner has further agreed to modification of the data clause of the subject cooperative agreement (48 C.F.R. 952.227-14) by adding paragraph (k), Alternative VI, concerning contractor licensing of data.

Considering the foregoing, it is believed that granting the waiver will provide the Petitioner with the necessary incentive to invest resources in the commercialization of the results of the agreement in a fashion which will make the agreement's benefits available to the public in the shortest practicable time. In addition, it would appear that grant of the above requested waiver would not result in an adverse effect on competition nor result in excessive market concentration. Therefore, in view of the objectives and considerations set forth in 10 CFR 784, all of which have been considered, it is recommended that the requested waiver, as set forth above, be granted.



Mark P. Dvorscak
Assistant Chief Counsel
Office of Intellectual Property Law

Date Jan 28, 2000

Based on the foregoing Statement of Considerations and the representations in the attached waiver petition, it is determined that the United States and the general public will best be served by a waiver of rights and consent to assignment of the scope described above, and therefore the waiver is granted. This waiver shall not apply to any modification or extension of this agreement, where through such modification or extension, the purpose, scope, or cost of the agreement is substantially altered.

CONCURRENCE:

Ralph Avellanet, FE-32
Program Manager, Downstream Gas Processing
Office of Natural Gas and Petroleum Technology

Date _____

APPROVAL:

Paul A. Gottlieb
Assistant General Counsel
for Technology Transfer and
Intellectual Property

Date _____

(t) U. S. COMPETITIVENESS The Contractor agrees that any products embodying any waived invention or produced through the use of any waived invention will be manufactured substantially in the United States unless the Contractor can show to the satisfaction of the DOE that it is not commercially feasible to do so. In the event the DOE agrees to foreign manufacture, there will be a requirement that the Government's support of the technology be recognized in some appropriate manner, e.g., recoupment of the Government's investment, etc. The Contractor agrees that it will not license, assign or otherwise transfer any waived invention to any entity unless that entity agrees to these same requirements. Should the Contractor or other such entity receiving rights in the invention undergo a change in ownership amounting to a controlling interest, then the waiver, assignment, license, or other transfer of rights in the waived invention is suspended until approved in writing by the DOE.