U. S. DEPARTMENT OF ENERGY, OFFICE OF SCIENCE INTEGRATED SUPPORT CENTER—CHICAGO OFFICE

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) ENVIRONMENTAL EVALUATION NOTIFICATION FORM

To be completed by "Applicant," i.e., organization with responsibilities for a "Federal action" involving application to DOE for a permit, license, exemption or allocation, or other similar actions. For assistance with this Form, refer to "Instructions for Preparing ISC-CH F-560, Environmental Evaluation Notification Form."

Solic	itatio	Award No. (if applicable): DE-SC0019929
Orga	nizat	n Name: Catalytic and Redox Solutions LLC
Prop	osed	Action Title: Low-Temperature Chemical Looping Reforming Catalysts for Small-Footprint GTL
Total	DOE	Funding/Total Funding: \$200,000 DOE/Total
l.	<u>Proj</u>	ct Description: (Use explanation pages if additional space is required)
	A.	Proposed Project/Action (if applicable, delineate Federally funded/Non-Federally funded portions)
		Mixed metal redox catalyst will be synthesized at the RI (NC State University). The catalyst may be contain heavy metals. The catalyst precursors may include toxic chemicals including nitrate salts and heavy metal oxide.
		The catalyst will be tested for the conversion of methane to CO and Hydrogen at the RI.
1000		-200 H
	В.	Yes No Nould the project proceed without Federal funding? ☐ ✓ f "yes," use explanation page.
11.	Des	ription of Affected Environment: (Use explanation pages if additional space is required)
		Catalyst synthesis: Creation of up to 10 kg of mixed metal oxide catalyst that may contain heavy metals. All solid samples will be disposed of in compliance with NC State's existing permits. The emission of up to 100 g of NOx may result from synthesis procedures. This emission is in line with NC State's existing permits.

Catalyst Testing: Emission of up to 10 kg of methane, CO, and H2. This is consistent with the Universities existing permits. Generation of up to 1 L of hydrocarbon contaminated water, which will be collected stored and disposed of as hazardous waste in a manor consistent with the Universities

existing permits.

		DOE NEPA Tracking N	umber			
311.	Pre	liminary Questions:				
	A.	Is the DOE-funded work routinely administrative or entirely advisory or a "paper study?"	Yes	No ✓		
		If "Yes", ensure that the description in Section I reflects this and go directly to Section	V			
	В.	Is there any potential whatsoever for: (Provide an explanation for each "Yes" response)				
		1. Work to be performed outdoors?		V		
		 Major modification of a building interior? Threat of violation of applicable statutory, regulatory, or permit requirements for 	님			
		environment, safety, and health?		\checkmark		
		4. Siting, construction or major expansion of waste treatment, storage, or disposal facilities?	_			
		5. Disturbance to hazardous substances, pollutants, or contaminants preexisting in the environment?		\checkmark		
		6. The presence of any environmentally-sensitive resources?		√		
		7. Any potential whatsoever for high consequence impacts to human health or the environment?				
		8. The work being connected to another existing/proposed activity that could		V		
		potentially create a significant impact? 9. Nearby past, present, and/or reasonably foreseeable future actions such that collective	ely□	V		
		significant impacts could result?		V		
		 Scientific or public controversy, uncertainty over potential impacts, or conflicts regarding resource usage? 		_		
		If "No" to ALL Section III.B. questions, go directly to Section V.				
		I No to ALL obtain the queen, go and any				
IV.	Po	tential Environmental Effects: (Provide an explanation for each "Yes" response)				
		Environmentally Sensitive Resources: Could the proposed action potentially result in change	s and/or			
	Α.	disturbances to any of the following resources?				
		Threatened/Endangered Species and/or Critical Habitats	Yes	No		
		 Other Protected Species (e.g., Burros, Migratory Birds, Pollinators) 				
		 Sensitive Environments (e.g., Tundra/Coral Reefs/Rain Forests) 		H		
		Cultural or Historic Resources	H	H		
		5. Important Farmland	H	Ħ		
		Non-Attainment Areas for Ambient Air Quality Standards Class I Air Quality Control Region	П	Ħ		
		 Class I Air Quality Control Region Special Sources of Groundwater (e.g. Sole Source Aquifer) 				
		9. Navigable Air Space				
		10 Coastal Zones		Ц		
		 Areas with Special National Designation (e.g. National Forests, Parks, Trails) 		Ш		
		12. Floodplains and/or Wetlands				
	В.	Regulated Substances/Activities: Would the proposed action involve any of the following reg	ulated Ite	ems or		
		activities?				
		13. Natural Resource Damage Assessments				
		14. Invasive Species or Exotic Organisms	H	\vdash		
		15. Noxious Weeds	H	H		
		16. Clearing or Excavation greater than one acre or Removal of Trees Governed by	Ц			
		Local Requirement 17. Dredge or Fill (under Clean Water Act, Section 404, greater than one acre)				

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	В.		ated Substances/Activities: Would the proposed action involve any of the following regulated Iter	ns or
		activitie	es? (continued) Yes	No
		18.	Noise (in excess of regulations)	
		19.	Asbestos Removal	H
		20.	Polychlorinated biphenyls (PCBs)	Ħ
		20.	Import, Manufacture, or Processing of Toxic Substances	Ħ
		22.	Chemical Storage/Use	Ħ
		23.	Pesticide Use	H
		24.	Hazardous, Toxic, or Criteria Pollutant Air Emissions	Ħ
		2 4 . 25.	Liquid Effluents	Ħ
		26.	Spill Prevention/Surface Water Protection	Ħ
		27.	Underground Injection	Ħ
		28.	Hazardous Waste	Ħ
		29.	Underground Storage Tanks	
		30.	Radioactive or Radioactive Mixed Waste	
		31.	Radiation Exposure	
		32.	Nanoscale Materials	Ī
		33.	Genetically Engineered Microorganisms/Plants or Synthetic Biology	
		34.	Ozone Depleting Substances	
		35.	Greenhouse Gas Generation/Sustainability	
		36.	Off-Road Vehicles	
		37.	Biosafety Level 3-4 Laboratory	
		38.	Research on Human Subjects or other Vertebrate Animals	
		39.	Facility footprint exceeds 5,000 Square Feet	
	C.	Other I	Relevant Information: Would the proposed action involve the following?	
			Yes	No
		40.	Disproportionate Nearby Presence of Minority and/or Low Income Populations	Н
		41.	Existing, Modified, or New Federal/State Permits	H
		42.	Involvement of Another Federal Agency (e.g. license/permit, funding, approval)	H
		43.	Action in a State with NEPA-type law	
		44.	Expansion of Public Utilities/Services	H
		45.	Depletion of a Non-Renewable Resources	H
		46.	Subject to an Existing Institutional Work Planning and Control Process	H
		47.	Other Pertinent Information Which Could Impact Human Health or the Environment	
			2002 BN	
V.	App	olicant ce	ertification that to the best of their knowledge all information provided on this form is accurate:	
			Yes	No
	Doc	e thie di	disclosure contain: classified, sensitive business, or other exempt information that DOE	$\overline{\mathbf{V}}$
	MOI	ild not h	be obligated to disclose pursuant to the Freedom of Information Act.	
	WOL			
	A.	Organi	nization Official (Name and Title): Qingying Zha, Controller	
	Λ.	Organi		
		Signat	ture:	
		Olginat		
		e-mail:	kelly.zha@catredox.com Phone: 919-757-9108	
			M. N. al. Objet Tachnelogy Officer	
	B.	Option	nal Secondary Approval (Name and Title): Luke IVI. Neal, Chief Technology Officer	
		0:	ture: Luk M New Date:7/17/2019	
		Signat	ture	
		e-mail	l: redox@catredox.com Phone: 309-868-2234	
		G-Mall.		

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Remainder to be completed by DOE

VI. DOE Concurrence/Recommendation/Determination:				
	A.	DOE Project Director/Program Manager or Contract/Grant Management Specialist:	Yes	No
		Has the Applicant completed this Form correctly? Does an existing generic categorical exclusion apply? If yes, indicate:		
		Name and Title: Christine Grady Contract Specialist		
		Signature: Christin Mady Date: 7/17/19	}	
	В.	DOE NEPA Team Review (if requested):	Vac	No
		Is the class of action identified in the DOE NEPA Regulations (Appendices A-D to Subpart D (10 CFR § 1021))? If yes, specify the class(es) of action: 33.6	*	<u> </u>
		Name and Title:		
		Signature: Date:		
	C.	DOE Counsel (if requested):		
		Name and Title Reter Sig Doch		
		Signature: Date: 7/18/2	2019	
	D.	DOE NEPA Compliance Officer:		
		preceding pages are a record of documentation required under DOE Final NEPA Regulatio I.410.	n, 10 CFR <u>§</u>	
,	M	Action may be categorically excluded from further NEPA review. I have determined the action meets the requirements for Categorical Exclusion referenced above.	nat the propose	eď
		Action requires approval by Head of the Field Organization. Recommend preparation Environmental Assessment.	of an	
		Action requires approval by Head of the Field Organization or a Secretarial Officer. R preparation of an Environmental Impact Statement.		
		comments/limitations if any: The attacked disclosure from Carolina State University is incorporated in disclosure from Catalytic and Redox Solutions determination applies to the entire proposed	North to this LLC, 7 action	rhe
		NEPA Compliance Officer: Name: Peter Siebach		
		Signature: Date: 7/	18/2019	·
		X-		

DOE NEPA	Tracking Number
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Solicitation/	Award No. (if applicable):	DE-SC0019929		
Organizatio	n Name: North Carolina S	State University		
Proposed A	action Title: Low-Temper	rature Chemical Looping Reforming Catalysts for Small-Footprint G	ΓL	
Total DOE	Funding/Total Funding: \$1	16,001		
I. <u>Proje</u>	ct Description: (Use explai	nation pages if additional space is required)		
Α.]	Proposed Project/Action (if	applicable, delineate Federally funded/Non-Federally funded portion	<u>15)</u>	
	Mixed metal redox cata The catalyst precursors metal oxide.	alyst will be synthesized. The catalyst may be contain he s may include toxic chemicals including nitrate salts and	avy me heavy	atals
	The catalyst will be tes	ted for the conversion of methane to CO and Hydrogen.		
			Yes	No
В.	Would the project proceed v	without Federal funding?		V
	ff "yes," use explanation	page.		

II. Description of Affected Environment: (Use explanation pages if additional space is required)

Catalyst synthesis: Creation of up to 10 kg of mixed metal oxide catalyst that may contain heavy metals. All solid samples will be disposed of in compliance with NC State's existing permits. The emission of up to 100 g of NOx may result from synthesis procedures. This emission is in line with NC State's existing permits.

Catalyst Testing: Emission of up to 10 kg of methane, CO, and H2. This is consistent with the Universities existing permits. Generation of up to 1 L of hydrocarbon contaminated water, which will be collected stored and disposed of as hazardous waste in a manor consistent with the Universities existing permits.

		DOE NEPA Tracking Number				
111.	Pre	liminar	y Questions:			
	A.	Is the DOE-funded work routinely administrative or entirely advisory or a "paper study?"			No ✓	
		If "Yes", ensure that the description in Section I reflects this and go directly to Section				
	B.	Is there any potential whatsoever for: (Provide an explanation for each "Yes" response)				
		1,	Work to be performed outdoors?			
		 Major modification of a building interior? Threat of violation of applicable statutory, regulatory, or permit requirements for 				
			environment, safety, and health?	_		
		4.	Siting, construction or major expansion of waste treatment, storage, or disposal facilities?	L	Ø	
		5.	Disturbance to hazardous substances, pollutants, or contaminants preexisting in the environment?		✓	
		6.	The presence of any environmentally-sensitive resources?		V	
		7.	Any potential whatsoever for high consequence impacts to human health or the environment?		V	
		8.	The work being connected to another existing/proposed activity that could		V	
		9.	potentially create a significant impact? Nearby past, present, and/or reasonably foreseeable future actions such that collective	/ely□	√	
		significant impacts could result? 10. Scientific or public controversy, uncertainty over potential impacts, or conflicts regarding				
	resource usage?					
		H "No	o" to ALL Section III.B. questions, go directly to Section V.			
IV.	Pot	ential E	Environmental Effects: (Provide an explanation for each "Yes" response)			
	A.	Envir	onmentally Sensitive Resources: Could the proposed action potentially result in change	es and/or		
	7 1.	distur	bances to any of the following resources?			
		4	Threatened/Endengared Species and/as Critical Habitats	Yes	No	
		1. 2.	Threatened/Endangered Species and/or Critical Habitats Other Protected Species (e.g., Burros, Migratory Birds, Pollinators)	H		
		2. 3.	Sensitive Environments (e.g., Tundra/Coral Reefs/Rain Forests)	Ħ	岗	
		4.	Cultural or Historic Resources	Ħ	7	
		5.	Important Farmland	Ħ	V	
		6.	Non-Attainment Areas for Ambient Air Quality Standards	Ħ	7	
		7.	Class I Air Quality Control Region	Ħ	1	
		8.	Special Sources of Groundwater (e.g. Sole Source Aquifer)	Ħ	V	
		9.	Navigable Air Space	Ħ		
		10.	Coastal Zones	Ħ	7	
		11.	Areas with Special National Designation (e.g. National Forests, Parks, Trails)	Ħ	V	
		12.	Floodplains and/or Wetlands	_		
	В.	Regu	lated Substances/Activities: Would the proposed action involve any of the following reg	ulated Ite	ms or	
		activi	ties?			
		13.	Natural Resource Damage Assessments		\checkmark	
		14.	Invasive Species or Exotic Organisms		$\overline{\mathcal{L}}$	
		15,	Noxious Weeds		V V	
		16.	Clearing or Excavation greater than one acre or Removal of Trees Governed by		V	
		17,	Local Requirement Dredge or Fill (under Clean Water Act, Section 404, greater than one acre)		\checkmark	

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	B. Regulated Substances/Activities. Would the proposed action involve any of the following regulated items of						ris ui
		activitie	s? (continued)			V	NI-
						Yes	No
		18.	Noise (in excess of regulations)			H	N.
		19.	Asbestos Removal				
		20.	Polychlorinated biphenyls (PCBs)			Ц	$\overline{\mathbf{A}}$
		21.	Import, Manufacture, or Processing of Toxic Substances				$\overline{\mathbf{Z}}$
		22.	Chemical, Storage/Use			✓	
		23.	Pesticide Use				\checkmark
		24.	Hazardous, Toxic, or Criteria Pollutant Air Emissions				V
		25.	Liquid Effluents			1	
		26.	Spill Prevention/Surface Water Protection				\checkmark
		27.	Underground Injection				
7.		28.	Hazardous Waste			V	
		29.	Underground Storage Tanks				团
		30.	Radioactive or Radioactive Mixed Waste			Ħ	[Z]
		31.	Radiation Exposure			Ħ	团
		32.	Nanoscale Materials			Ħ	
			Genetically Engineered Microorganisms/Plants or Synthetic	- Riology		Ħ	岃
		33.		5 Diology		Ħ	Ħ
		34.	Ozone Depleting Substances			H	যবাবাবাবাবাবাবা
		35.	Greenhouse Gas Generation/Sustainability			H	H
		36.	Off-Road Vehicles			H	K
		37.	Biosafety Level 3-4 Laboratory			님	¥.
		38.	Research on Human Subjects or other Vertebrate Animals				
		39.	Facility footprint exceeds 5,000 Square Feet				$\overline{\mathbf{A}}$
	C.	Other F	Relevant Information: Would the proposed action involve the	e followir	ig?	Vaa	No
		4.0	The state of the state of the state and for the state of	laaansa E) an ulations	Yes	No
		40.	Disproportionate Nearby Presence of Minority and/or Low	income r	opulations	님	
		41.	Existing, Modified, or New Federal/State Permits	u . e		H	_
		42.	Involvement of Another Federal Agency (e.g. license/perm	it, tunain	g, approvar)	H	띩
		43.	Action in a State with NEPA-type law			=	띩
		44.	Expansion of Public Utilities/Services			\vdash	M.
		45.	Depletion of a Non-Renewable Resources			님	띩
		46.	Subject to an Existing Institutional Work Planning and Con-	trol Proce	ess	Ц	
		47.	Other Pertinent Information Which Could Impact Human H	ealth or t	he Environment		\checkmark
	Ann	licant ce	rtification that to the best of their knowledge all information p	provided	on this form is accu	rate:	
	· ipp	nount or					No
						Yes	No ☑
	Doe	es this di	sclosure contain: classified, sensitive business, or other exe	empt into	rmation that DOE		V
	WOL	uld not b	e obligated to disclose pursuant to the Freedom of Information	on Act.			
			zation Official (Name and Title): David Rainer, Assoc. Vic	e Chanc	ellor of Env. Health	1 & Publ	ic Safety
	Α.	Organi	zation Official (Nameland) itie):				
			1 11)tc.	Deter	7/12/2019	a	
		Signat					
		ili	sps@ncsu.edu	Phone:	919-515-244	4	
		e-maii:		i none.			
	В.	Option	al Secondary Approval (Name and Title)				
		Signat	Ire:	Date:			
				Dhana			
		e-mail:		Phone:			