



Title: **10 CFR 51 Gap Analysis**  
Subject: **Radiant Document**  
Number: **DOC-0BDD**  
Revision: **0.1**  
Author: **Melinda Graham**  
Approved By: **Chanson Yang**  
Approval Date: **10/23/24**

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## REVISION LOG

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Rev.	Change Summary
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0.1	Initial issuance.
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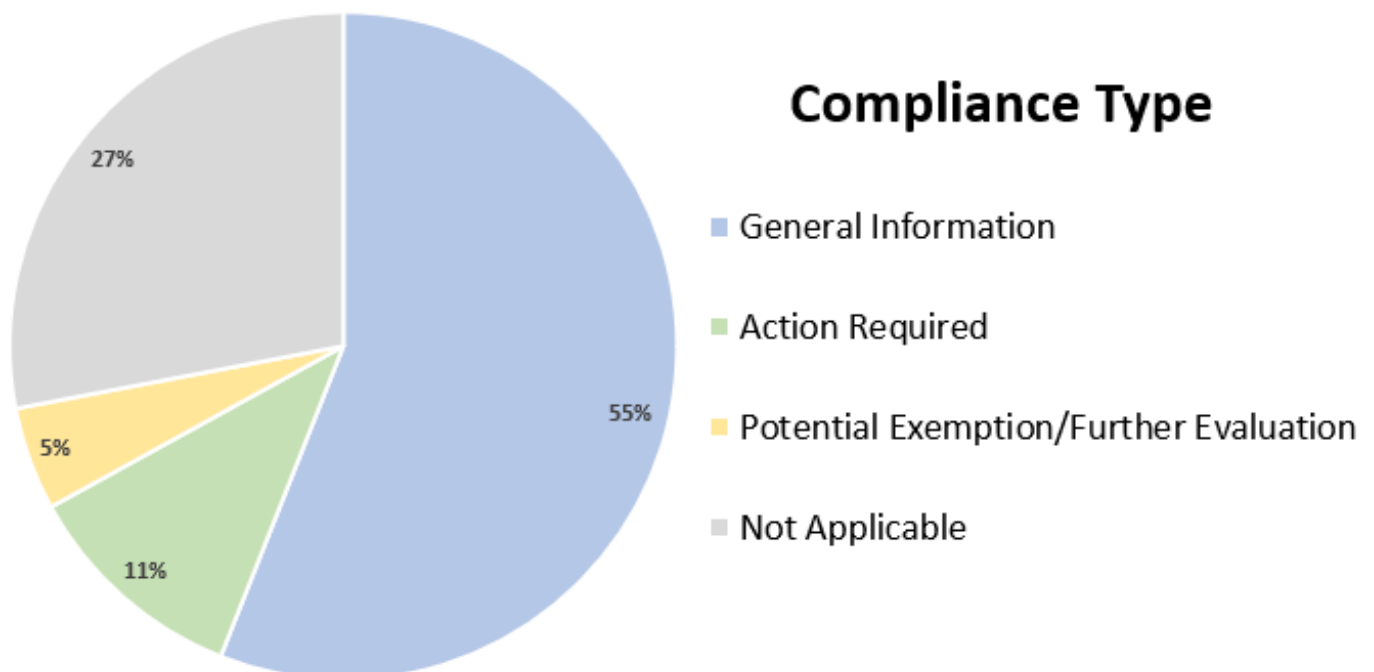
## 1 PURPOSE

This document is a gap analysis of 10 CFR 51, Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions against the specific requirements necessary to license both a manufacturing facility capable of online reactor testing and deployed microreactor units for the Kaleidos reactor design. The purpose of this gap analysis is to better understand and establish potential licensing gaps and/or items requiring further evaluation/discussion for the available licensing options. This gap analysis does not represent any specific commitment on Radiant's behalf regarding its licensing strategy; rather it is a document that will be used to inform the framework necessary to license the Kaleidos reactor.

## 2 EVALUATION CRITERIA

The following evaluation criteria was utilized to categorize the sections and subsections of 10 CFR 50 and 10 CFR 52:

- **Action Required:** Items that need to be proven/verified/accounted for in the design and/or license application.
- **General Information:** Items associated with regulatory action or process, or represents general information that requires no specific action on Radiant's part.
- **Not Applicable:** Items that do not apply by nature of subpart or section applicability.
- **Potential Exemption/Further Evaluation:** Items that require additional evaluation, analysis, discussion, or consideration with regards to the requirement integration into the Kaleidos regulatory framework. This item also indicates sections or subsections that may require an exemption in whole or part.



### 3 GENERAL SUMMARY

Radiant is actively working towards licensing a microreactor design to be manufactured, fueled, tested and then shipped to a remote site for operation and use. At the end of fuel life, the unit will be shipped back to the manufacturing facility for refuel. The unit will ship with fuel following testing at the manufacturing location, and will be ready for operation as soon as it reaches its intended destination. The licensing framework for the Kaleidos design needs to include accommodations to allow for the fuel load and testing at the manufacturing location, subsequent shipment and operation at designated sites, and return shipment of a unit containing spent fuel. Units may also be temporarily deployed to an operating site (i.e., relocated to a new or multiple new locations prior to end of fuel life). Units are anticipated to be deployed in either single units (standalone), or multiple units that would operate in parallel. At end of fuel life, it is possible that a replacement unit is deployed and placed into operation before the unit identified for refuel is removed.

10 CFR 51 was evaluated independent of operating license approach (utilizing 10 CFR 50 or 10 CFR 52 Subpart C).

There were no items currently identified within 10 CFR 51 that requires a specific exemption for licensing the Kaleidos manufacturing facility and/or reactor; this determination is subject to change and may be reflected in a revision to this document, or during submission of the eventual application. There were items identified for further evaluation that may warrant follow on meetings to establish a clear and reasonable path to licensing a Kaleidos reactor. Radiant is requesting discussion and feedback from the staff to ensure regulatory alignment as early as possible in the pre-application process.

### 4 GAP ANALYSIS 10 CFR 51: ENVIRONMENTAL PROTECTION REGULATIONS FOR DOMESTIC LICENSING AND RELATED REGULATORY FUNCTIONS

This subsection describes the portions of the NRC regulated NEPA action that would apply to the Kaleidos reactor design, including unit manufacture (Part 52 Subpart F), unit testing (Part 50 or Part 52 Subpart C), and unit deployment (Part 50 or Part 52 Subpart C).

#### 4.1 General Provisions

Part 51 General Provisions		Compliance Type	Compliance Rationale
50.1	Scope	General Information	
50.2	Subparts	General Information	
50.3	Resolution of conflict	General Information	
50.4	Definitions	Further Evaluation	Further evaluation is necessary to ensure the definition of construction applied to the Kaleidos reactor for the purposes of issuing a construction permit (CP)/operating license (OL) or combined operating license (COL) meets the intent of 10 CFR 51 and allows for the fueling and operational testing of the reactor unit at the manufacturing facility location. Site

Part 51 General Provisions		Compliance Type	Compliance Rationale
			preparation activities as described by 10 CFR 51.4 may be necessary, however occur prior to or following the necessary issuance of a CP/OL or COL.
50.5	Interpretations	General Information	
50.6	Specific exemptions	General Information	

## 4.2 Subpart A – National Environmental Policy Act – Regulations Implementing Section 102(2)

Part 50 Subpart A		Compliance Type	Compliance Rationale
51.10	Purpose and scope of subpart; application of regulations of Council on Environmental Quality	General Information	
51.11	Relationship to other subparts [Reserved]	Not Applicable	Reserved.
51.12	Application of subpart to ongoing environmental work	General Information	
51.13	Emergencies	General Information	
51.14	Definitions	General Information	
51.15	Time schedules	General Information	
51.16	Proprietary Information	General Information	
51.17	Information collection requirements; OMB approval	General Information	

## 4.3 Preliminary Procedures

Part 51 Preliminary Procedures		Compliance Type	Compliance Rationale
51.20	Criteria for and identification of licensing and regulatory actions requiring environmental impact statements	General Information	
(a)	Criteria for actions requiring an EIS	Further Evaluation	Regarding the sited units, further evaluation on the applicability of “significantly affecting the quality of the

Part 51 Preliminary Procedures	Compliance Type	Compliance Rationale
		<p>human environment” to the Kaleidos design is warranted. Kaleidos has negligible interface with the surrounding environment, requires minimal site preparation, and has a small radionuclide inventory (similar to that of a research and test reactor).</p> <p>This section does not apply to the manufacturing facility license application, however would apply for operational testing of fueled units at the factory location.</p>
(b) Actions requiring an EIS		
(1) Issuance of LWA or construction permit for nuclear power reactor	Further Evaluation	<p>Regarding the sited units, further evaluation is required to determine an appropriate envelope for which efficient and effective siting evaluations can occur. Based on 10 CFR 51.20(a), an exemption to this requirement requesting an Environmental Assessment (EA) be performed in lieu of an EIS may be justified based on the minimal environmental insult from the Kaleidos design.</p> <p>This section does not apply to the manufacturing facility license application, however would apply for operational testing of fueled units at the factory location.</p>
(2) Issuance of operating license for nuclear power reactor	Further Evaluation	<p>Regarding the sited units, further evaluation is required to determine an appropriate envelope for which efficient and effective siting evaluations can occur. Based on 10 CFR 51.20(a), an exemption to this requirement requesting that an EA be performed in lieu of an EIS may be justified based on the minimal environmental insult from the Kaleidos design.</p> <p>This section does not apply to the manufacturing facility license application, however would apply for operational testing of fueled units at the factory location.</p>
(3) Issuance of license for enrichment	Not Applicable	This section applies to a uranium enrichment facility only.

Part 51 Preliminary Procedures		Compliance Type	Compliance Rationale
(4)	Conversion of provisional operating license	General Information	This section would apply if Radiant were issued a provisional operating license. Refer to item (b)(1) and (b)(2) above.
(5)	Reserved	Not Applicable	Reserved
(6)	Reserved	Not Applicable	Reserved
(7)	Issuance of SNM possession for fuel	Not Applicable	This section applies to SNM processing, fuel fabrication, scrap recovery, or the conversion of uranium hexafluoride only.
(8)	Issuance of source material possession for milling	Not Applicable	This section applies to source material for uranium milling or production of uranium hexafluoride only.
(9)	Issuance of ISFSI license	Action Required	Radiant will submit a 10 CFR 72 license application for an independent spent fuel storage location. Storage of spent fuel will be limited to fuel removed from the Kaleidos reactor unit at end of fuel life.
(10)	Issuance of license for uranium enrichment facility	Not Applicable	This section applies to uranium enrichment facilities only.
(11)	Issuance of license renewal for radioactive waste	Not Applicable	Radiant will not be pursuing a 10 CFR 61 license for land disposal of radioactive waste.
(12)	Issuance of amendment for Part 61	Not Applicable	Radiant will not be pursuing a license for disposal of high-level radioactive waste.
(13)	Issuance of construction authorization for Part 60 or 63	Not Applicable	Radiant will not be constructing or licensing a high-level radioactive waste repository.
(14)	Any other action deemed by Commission	General Information	
51.21	Criteria for and identification of licensing and regulatory actions requiring environmental assessments	General Information	
51.22	Criterion for categorical exclusion; identification of licensing and regulatory action eligible for categorical exclusion or otherwise not requiring environmental review	Further Evaluation	Further evaluation is necessary to determine if a categorical exclusion could be utilized during the licensing process to streamline application processing for acceptable siting locations. Additional discussion is necessary to establish a bounding envelope and specific criteria with which a categorical exclusion could be utilized.



Part 51 Preliminary Procedures		Compliance Type	Compliance Rationale
51.23	Environmental impacts of continued storage of spent nuclear fuel beyond the licensed life for operation of a reactor	General Information	NOTE: It is assumed that spent fuel will be stored past the licensed life of the Kaleidos reactor unit (~20yrs); this GEIS requires further evaluation to establish applicability to the spent fuel storage location for Kaleidos.
51.25	Determination to prepare environmental impact statement or environmental assessment; eligibility for categorical exclusion.	General Information	NOTE: These determinations should have fleetwide applicability and are not constrained to a single Kaleidos unit.
51.26	Requirement to publish notice of intent and conduct scoping process.	Action Required	NOTE: This was identified for action only because Radiant may take part in a public meeting for environmental action if the NRC staff director determines that a public scoping meeting is necessary.
51.27	Notice of intent.	General Information	
51.28	Scoping—participants.	Action Required	NOTE: This was identified for action only because Radiant will be notified and may take part in a public scoping meeting to discuss environmental action.
51.29	Scoping-environmental impact statement and supplement to environmental impact statement.	General Information	
51.30	Environmental assessment.	General Information	
51.31	Determinations based on environmental assessment.	Action Required	NOTE: This section was identified for action in the event an EA (for a Part 52 Subpart F license or if a license exemption is requested for Part 50/52 Subpart C licensing) is subject to public review and participation is required/requested of Radiant. Otherwise, this section provides general information related to the determination of an EA.
51.32	Finding of no significant impact.	General Information	
51.33	Draft finding of no significant impact; distribution.	General Information	
51.34	Preparation of finding of no significant impact.	General Information	
51.35	Requirement to publish finding of no significant impact; limitation on Commission action.	General Information	

#### 4.4 Environmental Reports and Information – Requirements Applicable to Applicants and Petitioners for Rulemaking

Part 51 Environmental Reports		Compliance Type	Compliance Rationale
51.40	Consultation with NRC staff.	General Information	
51.41	Requirement to submit environmental information.	General Information	
51.45	Environmental report.	Action Required	NOTE: Limited portions of this section are applicable to a Part 52 Subpart F manufacturing license. This section is almost wholly applicable to licensing associated with Part 50 or Part 52.
51.49	Environmental report—limited work authorization.	Not Applicable	At this point in time, Radiant does not plan to pursue a Limited Work Authorization (LWA) due to the timeframe required for a LWA to be reviewed and approved.
51.50	Environmental report-construction permit, early site permit, or combined license stage.	Action Required	NOTE: This section would apply for the operational testing portion of the manufacturing facility and the deployed units, unless otherwise excluded (e.g., CATEX, FONSI). Additionally for the deployed units, a manufacturing license ER can be incorporated by reference (demonstrating that site characteristics fall within those defined by the manufacturing ER).
51.51	Uranium fuel cycle environmental data—Table S-3.	Not Applicable	This section applies to a uranium fuel cycle facility only.
51.52	Environmental effects of transportation of fuel and waste—Table S-4.	Not Applicable	This section applies to light water reactors only.
51.53	Postconstruction environmental reports.	Action Required	
51.54	Environmental report—manufacturing license.	Action Required	
51.55	Environmental report-standard design certification.	Not Applicable	At this point in time, Radiant does not plan to pursue a Standard Design Certification.
51.58	Environmental report-number of copies; distribution.	General Information	

Part 51 Environmental Reports		Compliance Type	Compliance Rationale
51.60	Environmental report—materials licenses.	Action Required	
51.61	Environmental report—independent spent fuel storage installation (ISFSI) or monitored retrievable storage installation (MRS) license.	Action Required	
51.62	Environmental report—land disposal of radioactive waste licensed under 10 CFR part 61.	Action Required	NOTE: This item requires action only if Radiant pursues land disposal of radioactive waste licensed under Part 61.
51.66	Environmental report—number of copies; distribution.	General Information	
51.67	Environmental information concerning geologic repositories.	Not Applicable	This section is applicable to geologic repositories only.
51.68	Environmental report—rulemaking.	Not Applicable	Radiant is not considered a petitioner for rulemaking requesting an amendment to the listed Parts.

## 4.5 Environmental Impact Statements

Part 51 Environmental Impact Statements		Compliance Type	Compliance Rationale
51.70	Draft environmental impact statement—general.	Not Applicable	This section is applicable to staff action only.
51.71	Draft environmental impact statement—contents.	General Information	
51.72	Supplement to draft environmental impact statement.	General Information	
51.73	Request for comments on draft environmental impact statement.	General Information	
51.74	Distribution of draft environmental impact statement and supplement to draft environmental impact statement; news releases.	General Information	
51.75	Draft environmental impact statement—construction permit, early site permit, or combined license.	General Information	
51.76	Draft environmental impact statement—limited work authorization.	Not Applicable	At this point in time, Radiant does not plan to pursue a Limited Work Authorization

Part 51 Environmental Impact Statements		Compliance Type	Compliance Rationale
			(LWA) due to the timeframe required for a LWA to be reviewed and approved.
51.77	Distribution of draft environmental impact statement.	General Information	
51.80	Draft environmental impact statement—materials license.	General Information	
51.81	Distribution of draft environmental impact statement.	General Information	
51.85	Draft environmental impact statement—rulemaking.	Not Applicable	
51.86	Distribution of draft environmental impact statement.	Not Applicable	
51.88	Proposals for legislation.	General Information	
51.90	Final environmental impact statement—general.	General Information	
51.91	Final environmental impact statement—contents.	General Information	
51.92	Supplement to the final environmental impact statement.	General Information	
51.93	Distribution of final environmental impact statement and supplement to final environmental impact statement; news releases.	General Information	
51.94	Requirement to consider final environmental impact statement.	General Information	
51.95	Postconstruction environmental impact statements.	General Information	
51.97	Final environmental impact statement—materials license.	General Information	
51.99	[Reserved]	Not Applicable	Reserved.

## 4.6 NEPA Procedure and Administrative Action

Part 51 NEPA Procedure		Compliance Type	Compliance Rationale
51.100	Timing of Commission action.	General Information	
51.101	Limitations on actions.	General Information	
51.102	Requirement to provide a record of decision; preparation.	General Information	
51.103	Record of decision—general.	General Information	
51.104	NRC proceeding using public hearings; consideration of environmental impact statement.	Not Applicable	This section only applies to public hearings and has no specific applicability unless a hearing is granted.
51.105	Public hearings in proceedings for issuance of construction permits or early site permits; limited work authorizations.	Not Applicable	This section only applies to public hearings and has no specific applicability unless a hearing is granted.
51.105a	Public hearings in proceedings for issuance of manufacturing licenses.	Not Applicable	This section only applies to public hearings and has no specific applicability unless a hearing is granted.
51.106	Public hearings in proceedings for issuance of operating licenses.	Not Applicable	This section only applies to public hearings and has no specific applicability unless a hearing is granted.
51.107	Public hearings in proceedings for issuance of combined licenses; limited work authorizations.	Not Applicable	This section only applies to public hearings and has no specific applicability unless a hearing is granted.
51.108	Public hearings on Commission findings that inspections, tests, analyses, and acceptance criteria of combined licenses are met	Not Applicable	This section only applies to public hearings and has no specific applicability unless a hearing is granted.
51.109	Public hearings in proceedings for issuance of materials license with respect to a geologic repository.	Not Applicable	This section only applies to public hearings and has no specific applicability unless a hearing is granted.
51.110	[Reserved]	Not Applicable	Reserved.
51.116	Notice of intent.	General Information	
51.117	Draft environmental impact statement—notice of availability.	General Information	
51.118	Final environmental impact statement—notice of availability.	General Information	
51.119	Publication of finding of no significant impact; distribution.	General Information	

<b>Part 51 NEPA Procedure</b>		<b>Compliance Type</b>	<b>Compliance Rationale</b>
51.120	Availability of environmental documents for public inspection.	General Information	
51.121	Status of NEPA actions.	General Information	
51.122	List of interested organizations and groups.	General Information	
51.123	Charges for environmental documents; distribution to public; distribution to governmental agencies.	Not Applicable	This section is applicable to staff action only.
51.124	Commission duty to comment.	Not Applicable	This section is applicable to staff action only.
51.125	Responsible official.	Not Applicable	This section is applicable to staff action only.
Appendix A	Format for Presentation of Material in Environmental Impact Statements	General Information	
Appendix B	Environmental Effect of Renewing the Operating License of a Nuclear Power Plant	Not Applicable	This section only applies to licensees submitting for license renewal.