



July 29, 2026

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AALO-1-24-US-0001

U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
ATTN: Document Control Desk

Subject: Submittal of “ESP Methodology White Paper,” WP-AALO-2026-002, Revision A

Aalo Holdings, Inc. (Aalo) submits the enclosed report, ESP Methodology White Paper (WP-AALO-2026-002), Revision A, to the U.S. Nuclear Regulatory Commission (NRC) for review and comment. The white paper presents our proposed methodology for developing Early Site Permit (ESP) applications under Title 10 of the Code of Federal Regulations (10 CFR) Part 53, “Risk-Informed, Technology-Inclusive Regulatory Framework for Commercial Nuclear Plants.” The methodology applies to future Aalo commercial product deployments, including deployments of one or more Aalo Pods.

The methodology defines what an ESP applicant proposes to resolve at the ESP stage, what would be bounded by the Aalo Plant Parameter Envelope and project-specific Aalo Site Parameter Envelope, and what would be carried forward into a future follow-on application. Its principal objective is regulatory certainty. The principal elements include the configuration-controlled Plant Parameter Envelope and corresponding Site Parameter Envelope, a graded site-characterization approach with associated Site Safety Analysis Report and Environmental Report methodologies, an ESP-stage emergency-planning and emergency-planning-zone framework, and a carry-forward and deferred-analysis framework that distinguishes ESP-resolved matters from matters requiring later confirmation. We request NRC staff preapplication feedback on the Part 53 ESP methodology and on the regulatory positions, information-allocation concepts, and application-development artifacts identified in this white paper.

The enclosed report contains proprietary information. We request that Enclosure 3, which contains proprietary information, be withheld from public disclosure in accordance with 10 CFR 2.390(a)(4). An affidavit certifying the basis for the request to withhold Enclosure 3 from public disclosure is included as Enclosure 1. Proprietary materials have been redacted from the report provided in Enclosure 2; proprietary information is identified using [] .

This letter and the enclosures make no new or revised regulatory commitments.

If you have any questions regarding this submittal, please contact Colter Somerville at colter@aalo.com.

Thank you.

Sincerely,

Signed by:

CF87281184CC4B3...
Parthasarathy Chandran

Regulatory Affairs Manager

Enclosure 1: Aalo Holdings, Inc. Affidavit and Request for Withholding from Public Disclosure (10 CFR 2.390(a)(4))

Enclosure 2: Aalo Holdings, Inc. Report, ESP Methodology White Paper (WP-AALO-2026-002-NP), Revision A – Non-Proprietary (Public)

Enclosure 3: Aalo Holdings, Inc. Report, ESP Methodology White Paper (WP-AALO-2026-002-P), Revision A – Proprietary (Non-Public)

cc: Jorge Hernandez Munoz, NRC

James Delosreyes, NRC

Marjorie McLaughlin, NRC

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ENCLOSURE 1

Aalo Holdings, Inc.
Affidavit and Request for Withholding from Public Disclosure
(10 CFR 2.390(a)(4))



Enclosure 1: Affidavit Supporting Request for Withholding from Public Disclosure (10 CFR 2.390)

I, Parthasarathy Chandran, Regulatory Affairs Manager of Aalo Holdings, Inc. (Aalo) do hereby affirm and state:

1. I am authorized to execute this affidavit on behalf of Aalo. Furthermore, I am authorized to review information submitted to or discussed with the U.S. Nuclear Regulatory Commission (NRC) and to apply for the withholding of information from public disclosure. The purpose of this affidavit is to provide the information required by 10 CFR 2.390(b) in support of Aalo's request for proprietary treatment of technical information. This information is contained in Enclosure 3, Aalo's proprietary report titled "ESP Methodology White Paper (WP-AALO-2026-002-P), Revision A," which I am submitting to the NRC.
2. The information sought to be withheld, in its entirety, is contained in Enclosure 3, which accompanies this affidavit.
3. I am making this request for withholding, and executing this affidavit, as required by 10 CFR 2.390(b)(1).
4. I have knowledge of the criteria utilized by Aalo in the classification of information as sensitive, proprietary, and confidential.
5. The information contained in Enclosure 3 consists of proprietary technical methodology and associated parameter values, including plant and site parameter-envelope values, site-characterization and analysis methodologies, and related quantitative bases supporting Aalo's Early Site Permit methodology. This information is located at the bracketed and highlighted passages within Section 1.2 (Requested NRC Staff Feedback), Sections 3.6 and 3.7, and Sections 4.1 through 4.8 of the report, including Section 4.2, Plant Parameter Envelope Methodology, and Section 4.3, Site Parameter Envelope Methodology, which contain the most extensive proprietary content.
6. Pursuant to 10 CFR 2.390(b)(4), the following is furnished for consideration by the Commission in determining whether the information in Enclosure 3 should be withheld:
 - a. The information has been held in confidence by Aalo.
 - b. The information is of a type customarily held in confidence by Aalo and not customarily disclosed to the public. Aalo has a rational basis for determining the types of information that it customarily holds in confidence and utilizes a system to determine when and whether to hold certain types of information in confidence.
 - c. The information is being transmitted to the Commission in confidence, and, under the provisions of 10 CFR 2.390, it is received in confidence by the Commission.
 - d. This information is not available in public sources.
 - e. Aalo asserts that public disclosure of this non-public information is likely to cause substantial harm to the competitive position of Aalo, because it would enhance the ability of competitors to provide similar products and services by reducing their expenditure of resources using similar



methodology, parameter-envelope development, site-characterization and analysis methods, or licensing approaches.

I declare under penalty of perjury that the foregoing statements are true and correct. Executed this 29th day of July 2026.

Sincerely,

Signed by:

CE872914B4CC4B6
Parthasarathy Chandran
Regulatory Affairs Manager



ENCLOSURE 2

Aalo Holdings, Inc.
ESP Methodology White Paper
WP-AALO-2026-002-NP, Revision A
Non-Proprietary (Public)



WP-AALO-2026-002-NP

Effective Date: 07/28/26

Revision A

Approval CN: CN-AALO-2026-393

ESP Methodology White Paper

Report

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Revision History

Rev. #	Effective Date	By	Type ^a	Changes
A	See Cover Page	Thomas Braudt	N	Initial methodology.
a. N = new, M = Major change, Mc = Minor change				

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Acronyms

ANS	American Nuclear Society
BPI	Bounding Performance Indicator
CFR	Code of Federal Regulations
COL	combined license
CP	construction permit
EAB	exclusion area boundary
EPA	U.S. Environmental Protection Agency
EPZ	emergency planning zone
ESP	Early Site Permit
FEMA	Federal Emergency Management Agency
FOAK	first-of-a-kind
GEIS	Generic Environmental Impact Statement
IAEA	International Atomic Energy Agency
ITAAC	Inspections, Tests, Analyses, and Acceptance Criteria
LBE	Licensing-Basis Event
LPZ	low population zone
NEI	Nuclear Energy Institute
NOAA	National Oceanic and Atmospheric Administration
NOAK	nth-of-a-kind
NRC	U.S. Nuclear Regulatory Commission
NR GEIS	New Reactor GEIS (NUREG-2249)
PPE	Plant Parameter Envelope
PRA	Probabilistic Risk Assessment
SHI	Site Hazard Indicator
SPE	Site Parameter Envelope
SSAR	Site Safety Analysis Report
SSHAC	Senior Seismic Hazard Analysis Committee
SUNSI	Sensitive Unclassified Non-Safeguards Information

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TEDE	total effective dose equivalent
TIGER	Topologically Integrated Geographic Encoding and Referencing
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

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Definitions/Glossary

Aalo Plant Parameter Envelope (Aalo PPE): The configuration-controlled set of bounding plant-side design parameters, assumptions, and interface requirements used to support the 10 Code of Federal Regulations (CFR) Part 53, “Risk-Informed, Technology-Inclusive Regulatory Framework for Commercial Nuclear Plants,” (Part 53) Early Site Permit (ESP) review and later conformance determinations.

Aalo Site Parameter Envelope (Aalo SPE): Aalo’s Generic Environmental Impact Statement (GEIS)-aligned reusable site-side methodology for defining site characteristics, data sources, screening criteria, uncertainty treatment, escalation triggers, and dispositions, as applied to a project-specific site.

Follow-on application: A later 10 CFR Part 53 construction permit, operating license, or combined license application, as applicable to the licensing pathway selected for the deployment, that references, relies on, or confirms matters addressed in the ESP.

ESP permit basis: The site characteristics, design parameters, and terms and conditions specified in the ESP under 10 CFR 53.1158. Supporting assumptions, analyses, 10 CFR Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions,” environmental conclusions, and emergency-planning information are identified separately unless incorporated into an enforceable permit-basis element.

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1. Purpose and Requested NRC Staff Feedback

1.1 Purpose of White Paper

This white paper presents Aalo Atomicals' (Aalo) proposed methodology for developing Early Site Permit (ESP) applications under 10 Code of Federal Regulations (CFR) Part 53, "Risk-Informed, Technology-Inclusive Regulatory Framework for Commercial Nuclear Plants," (Part 53) for future Aalo commercial product deployments, including deployments of one or more Aalo Pods, and to support U.S. Nuclear Regulatory Commission (NRC) staff preapplication feedback on the regulatory logic, information allocation, permit-basis structure, and carry-forward framework for that methodology.

This white paper presents the generic Aalo ESP methodology. Aalo expects the first implementation of the methodology to be the initial project-specific ESP application. Future ESP applicants may apply the methodology where its applicability to the proposed site and deployment is demonstrated.

The methodology's primary objective is regulatory certainty. Specifically, the methodology is intended to define what an ESP applicant proposes to resolve at the ESP stage, what would be bounded by the Aalo Plant Parameter Envelope (Aalo PPE) and project-specific Aalo Site Parameter Envelope (Aalo SPE), what would be carried forward into a future follow-on application, what would be confirmed at that later licensing stage, and what would trigger additional review. Review efficiency is an expected benefit of that certainty, but it is not the primary basis for the proposed approach.

The proposed methodology is based on the following principal elements:

- A configuration-controlled Aalo PPE and corresponding Aalo SPE that establish the plant-side and site-side parameter framework for the requested ESP findings
- A graded site-characterization approach and associated Site Safety Analysis Report (SSAR) and Environmental Report methodologies that support the applicable Part 53 safety and 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," (Part 51) environmental reviews
- An ESP-stage emergency-planning and emergency-planning-zone (EPZ) framework that defines the proposed plant/site-interface basis and the matters to be confirmed in the follow-on application

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- A carry-forward and deferred-analysis framework that distinguishes ESP-resolved matters from matters requiring later confirmation or other regulatory resolution.

The methodology does not replace the final design-specific analyses and demonstrations required in the applicable follow-on application.

1.2 Requested NRC Staff Feedback

Aalo requests NRC staff preapplication feedback on the proposed Part 53 ESP methodology and on the regulatory positions, information-allocation concepts, and application-development artifacts identified in this white paper.

Aalo requests NRC staff feedback on (1) whether the proposed methodology is sufficiently defined to support ESP application development and (2) whether NRC staff identifies regulatory concerns, information gaps, or topics that should be addressed through follow-on technical meetings, separate white papers, topical reports, or application-specific analyses before or during ESP application development.

Specifically, Aalo requests NRC staff feedback on the following methodology-level questions:

Request 1 - Plant-side design-parameter basis and PPE/SPE permit-basis structure. Does NRC staff have feedback on whether a configuration-controlled Aalo PPE, supported in an ESP application by appropriate technical bases and quality-controlled configuration management and combined with a project-specific Aalo SPE, would provide an adequate framework for evaluating plant-side design parameters, site suitability, plant/site-interface assumptions, Part 53 site characteristics, design parameters, terms and conditions, emergency-planning interfaces and any proposed major features, and follow-on application conformance?

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Request 5 - ESP-stage and follow-on application information allocation, carry-forward, finality, and out-of-envelope resolution. Does NRC staff have feedback on whether the proposed allocation of information between ESP-stage review and follow-on application confirmation, together with the proposed carry-forward framework, adequately distinguishes ESP-resolved matters from matters requiring later confirmation or other regulatory resolution, including conformance confirmation, updates, variance or amendment pathways, supplemental analysis, design or deployment constraints, site rejection, and other resolution pathways under the applicable matter-specific provisions of 10 CFR 53.1188 and the applicable follow-on application provisions?

Request 6 - ESP-stage emergency-planning framework. Does NRC staff have feedback on whether the proposed ESP-stage emergency-planning approach appropriately addresses the minimum obligation under 10 CFR 53.1146(b)—namely, identifying any physical characteristics unique to the site that could pose a significant impediment to the development of emergency plans, and describing the contacts and arrangements made with agencies having emergency-planning responsibilities—while deferring emergency-plan major features, EPZ sizing, and complete and integrated emergency plans to the follow-on application?

Request 7 - ESP-stage emergency-planning minimum: site impediment identification and agency contacts. Does NRC staff have feedback on whether Aalo's proposed ESP-stage emergency-planning approach appropriately satisfies the minimum obligation under 10 CFR 53.1146(b)—that is, (1) identifying any physical characteristics unique to the proposed site that could pose a significant impediment to the development of emergency plans, and (2) describing the contacts and arrangements made with local, state, federal, and tribal agencies having emergency-planning responsibilities, including each organization's name and location, the title or position of the persons contacted, and that organization's role in emergency planning? The ESP application does not seek approval of a plume exposure pathway EPZ or any emergency-plan

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major feature at the ESP stage; the determination of the exact size and configuration of the EPZ, the complete and integrated emergency plans, and any associated dose-versus-distance analyses are deferred to the follow-on application.

Aalo requests written NRC staff feedback following a public meeting, supplemented by focused technical meetings where needed. Aalo recognizes that any staff feedback on this white paper would be preapplication feedback and would not constitute approval of the white paper, a safety evaluation, a binding regulatory finding, or a final agency position on an application not yet submitted.

1.3 Scope and Finality of Requested Feedback

The feedback requested in Section 1.2 is methodology-level feedback. Aalo seeks NRC staff views on the structure, regulatory logic, information allocation, permit-basis concept, and follow-on application carry-forward framework described in this white paper. The requested feedback is not intended to seek approval of final application content, final technical analyses, or final licensing findings.

For purposes of this white paper, matters discussed as final plant design; final Aalo PPE values; final site-specific SPE values; final licensing-basis-event evaluation; final probabilistic risk assessment; final mechanistic source term; final radiological consequence analysis; final emergency-planning basis; final EPZ confirmation; final structures, systems, and components classification; final functional design criteria; final security-plan content; or final follow-on application content are discussed only to explain the proposed methodology, information interfaces, permit-basis structure, and future confirmation logic.

Where information is necessary to support a requested ESP finding, approved design parameter, site characteristic, term or condition, emergency-plan major feature, or environmental conclusion, the ESP application would provide that information. Information may be confirmed in a follow-on application only where the requested ESP-stage action does not depend on the deferred information. For each deferred item, the ESP application would identify the bounding ESP-stage basis, the information being deferred, the applicable acceptance criterion, the follow-on deliverable, how conformance will be demonstrated, and the regulatory treatment if the acceptance criterion is not satisfied.

For carry-forward purposes, this white paper distinguishes among: (1) Part 53 permit-basis elements including site characteristics, design parameters, and terms and conditions; (2) controlled assumptions and analyses supporting those elements; (3) approved emergency-plan major features or other emergency-planning information; and (4) Part 51 environmental

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conclusions supported by applicable plant and site parameters. Environmental conclusions are not characterized as ESP-approved permit-basis elements unless they are implemented through an approved site characteristic, design parameter, enforceable term or condition, or other controlled Part 53 element.

The applicable follow-on review standard depends on the matter involved. New and significant information is principally an environmental-review standard in this context and should not be used as a universal reopening criterion for safety, siting, emergency-planning, and environmental matters. The ESP application and associated traceability matrix should identify the matter-specific trigger under 10 CFR 53.1188 or the applicable follow-on application provision.

1.4 Intended Use of NRC Feedback

Aalo intends to use NRC staff feedback on this white paper to refine the Part 53 ESP methodology before preparation of the first Aalo ESP application and related supporting materials. Feedback would be used to confirm the structure and level of detail needed for future submittals, identify topics that may require additional preapplication engagement, and reduce uncertainty regarding the information needed to support ESP-stage findings and follow-on application confirmation. Future ESP applicants may propose to apply the methodology where they demonstrate its applicability to the candidate site and deployment configuration and conformance with the applicable Aalo PPE, project-specific SPE, approved parameters and conditions, emergency-planning bases, environmental assumptions, and referenced NRC approvals.

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2. Regulatory Context

2.1 Purpose of Regulatory Context

This section identifies the regulatory framework, interfacing requirements, and supporting guidance that inform Aalo's proposed 10 CFR Part 53 ESP methodology. The purpose of this section is not to restate the methodology described in Section 4. Rather, this section identifies the regulatory context Aalo proposes to develop future ESP applications, allocate information between the ESP stage and a future follow-on application, and support NRC staff preapplication feedback on the positions identified in Section 1.2.

Aalo's proposed methodology is anchored in the 10 CFR Part 53 ESP framework. Other regulatory provisions, guidance documents, and precedents are referenced where they inform environmental review, emergency planning, siting, hazard evaluation, graded characterization, plant/site parameter development, or follow-on application carry-forward. Unless expressly identified as controlling requirements, those references are used as supporting, corroborating, or illustrative sources.

2.2 Intended Licensing Action

Aalo intends to use this white paper to support preapplication alignment with NRC staff on Aalo's proposed methodology for preparing ESP applications under 10 CFR Part 53 for future Aalo commercial product deployments. The white paper is not an application and does not request NRC approval of final design, final site-specific information, final environmental analysis, final emergency-planning basis, final EPZ demonstration, final source-term information, or final safety findings. It presents the proposed methodology, regulatory logic, information allocation, and permit-basis structure that Aalo proposes for use in future Part 53 ESP applications.

For purposes of this white paper, "follow-on application" is used as a pathway-neutral term. The term refers to the later licensing action that would incorporate, rely on, or confirm matters addressed in the ESP, as applicable to the licensing pathway selected for the deployment by the applicable applicant. This white paper does not resolve whether a future follow-on action would proceed through a construction permit / operating license pathway, combined license pathway, or another pathway available under Part 53.

Under the proposed approach, the ESP would specify approved site characteristics, design parameters, and terms and conditions for later reference or conformance confirmation. The

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Part 51 environmental review would separately document environmental findings and conclusions, supported, as appropriate, by controlled plant and site parameters and any related ESP conditions.

For the purposes of emergency planning, an ESP application under this methodology would not seek approval for complete and integrated emergency plans or emergency-plan major features, such as the exact size and configuration of the EPZ. Instead, the ESP will satisfy the minimum statutory requirements by evaluating the site to identify any unique physical characteristics that could pose a significant impediment to the development of emergency plans and will identify measures to mitigate those impediments.

Additionally, the ESP will include a description of preliminary contacts and arrangements made with applicable federal, state, local, and tribal governmental agencies with emergency planning responsibilities. The determination of the exact size and configuration of the EPZ, along with the detailed mechanistic source term, probabilistic risk assessment, and complete emergency plans, are fully deferred and will be submitted for NRC review and approval in the follow-on application.

2.3 Aalo Deployment Model Context



Figure 1. Aalo Pod conceptual co-location with a hyperscale data center.

Aalo's ESP methodology supports deployment of the Aalo commercial product through a standardized Aalo Pod deployment model. For purposes of this white paper, the Aalo commercial

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product is described at a level sufficient to explain the regulatory methodology, plant/site parameter structure, and follow-on confirmation logic. Detailed design information, final parameter values, final aggregate source-term information, final safety analyses, and the determination of the exact size and configuration of the EPZ are fully deferred to the follow-on application.

The current reference commercial deployment concept includes multiple pods at a site. The maximum deployment configuration, site caps, and cumulative-impact treatments defined in the Aalo PPE are used strictly to evaluate overall site suitability and bound environmental impacts. For emergency planning, the ESP scope is limited to identifying any unique physical characteristics of the site that could pose significant impediments to the development of emergency plans and describing preliminary contacts and arrangements with applicable agencies. Section 3.2 provides the fuller controlled product description used to support this methodology.

2.4 Primary Regulatory Framework

Aalo proposes to anchor the ESP methodology in the 10 CFR Part 53 ESP framework. The principal provisions relevant to this methodology include the following:

- 10 CFR 53.1140 through 53.1188, which establish the ESP requirements and procedures
- 10 CFR 53.500 through 53.540, which establish siting requirements
- 10 CFR 53.1146, which identifies ESP technical-information requirements
- 10 CFR 53.1158, which addresses issuance findings and specification of site characteristics, design parameters, and terms and conditions
- 10 CFR 53.1164, which addresses ESP duration, continuation in timely follow-on proceedings, and subsuming of a referenced ESP into a construction permit (CP) or combined license (COL)
- 10 CFR 53.1188, which addresses ESP finality, updates, hearings, variances, and amendments
- 10 CFR 53.1124, which addresses the relationship to CP, operating license, and COL applications
- 10 CFR 53.1318, which addresses construction permit treatment of referenced approvals
- 10 CFR 53.1425, which addresses combined license treatment of referenced approvals.
- Aalo's graded approach to site characterization is similar to the approach in the proposed guidance of NUREG-2271, "Guidelines for Preparing and Reviewing Applications Under 10 CFR Part 57," which is referenced as a non-binding, corroborating source and not as a regulatory basis.

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10 CFR Part 53, therefore, provides the regulatory spine for the methodology described in this white paper. This framework establishes the ESP instrument, site-suitability and siting requirements, and ESP terms and conditions, while deferring the final demonstration of technology-inclusive safety requirements and mature risk analyses to the follow-on application confirmation process.

2.5 Interfacing Regulations and Requirements

Although Part 53 provides the proposed licensing pathway, Aalo’s ESP methodology interfaces with other NRC regulations and regulatory programs. The white paper distinguishes controlling Part 53 requirements from Part 51 environmental-review requirements and from supporting guidance or methods used to demonstrate conformance with the requested ESP findings.

- 10 CFR Part 51, including the Environmental Report and National Environmental Policy Act review requirements applicable to ESP applications
- NUREG-2249, as a tool for identifying and supporting generic environmental conclusions and Category 1 / Category 2 environmental issue treatment under the Part 51 environmental review
- 10 CFR Part 100, “Reactor Site Criteria,” and associated NRC siting guidance, as applicable supporting siting or hazard-evaluation guidance under the Part 53 ESP framework
- 10 CFR Part 20, as the radiation-protection and effluent-related standard relevant to normal operations, releases, and environmental interfaces
- 10 CFR 53.1146(b), implemented using 10 CFR 50.160, “Emergency Preparedness for Small Modular Reactors, Non-light-water Reactors, and Non-power Production or Utilization Facilities,” for Aalo’s proposed performance-based emergency-planning path, with Appendix E to 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” and 10 CFR 50.47(b) addressed to the extent applicable to major features or complete emergency plans under the Part 53 framework
- 10 CFR 53.1109(g)(2), to the extent emergency-planning information or approval is sought for a Part 53 ESP
- 10 CFR Part 73 only to the extent site characteristics, security-plan developability, proximity hazards, or physical-security interfaces are within the requested ESP scope; final security-plan content is outside the scope of this white paper
- Applicable NRC regulatory guides, consensus standards, and endorsed industry guidance used to support siting, site characterization, emergency planning, environmental review, or external-hazard evaluation.

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2.6 Advanced Reactor Policy and Guidance Context

Aalo’s methodology is risk-informed, performance-based, and technology-inclusive, implemented under the 10 CFR Part 53 framework.

Aalo may use Nuclear Energy Institute (NEI) 10-01, “Industry Guideline for Developing a Plant Parameter Envelope in Support of an Early Site Permit,” as a historical reference point for developing the Aalo PPE. Aalo adapts that experience to its standardized reactor and Pod deployment model. This differs from the traditional site-centric PPE use case because Aalo proposes to use a controlled product envelope to support one or more candidate sites, rather than preserving flexibility for an unspecified future plant design.

While this PPE establishes bounding values for site suitability and environmental reviews, it does not provide generic technical-basis approval for the reactor design itself. A future standard-design approval, design certification, manufacturing license, or topical report may provide a separate vehicle for generic technical-basis approval of the reactor design. This white paper does not request such approval.

To implement a graded site-characterization methodology across all external hazards (including seismic, meteorological, hydrological, and geotechnical) while minimizing site-specific field investigations, Aalo’s approach is similar to the approach in the proposed guidance of NUREG-2271, Appendix F, which is referenced as a non-binding, corroborating source and not as a regulatory basis. By demonstrating that the Aalo commercial product qualifies using the project-level Bounding Performance Indicator determined under the graded site-characterization methodology in Section 4.4, which is informed by the performance-based emergency-planning criteria in 10 CFR 53.1109(g)(2) and 10 CFR 50.160 and the associated dose-versus-distance evaluation for the maximum deployment configuration bounded by the ESP.

Aalo will use authoritative, publicly available national and regional hazard datasets to establish bounding external hazard levels. In the absence of detailed site-specific empirical data, the methodology explicitly adopts conservative, default site conditions and bounding generic parameters to ensure the proposed design envelopes the site characteristics with sufficient margin.

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2.7 Environmental Review Context

Aalo intends the Environmental Report for a Part 53 ESP application to satisfy the applicable Part 51 requirements and to use the final NUREG-2249 NR GEIS and the associated Part 51 framework as environmental-review tools. The Environmental Report would identify which Category 1 conclusions may be relied upon and which issues require project-specific analysis.

Under this approach, the ESP applicant would map the Aalo PPE and project-specific SPE to the applicable NUREG-2249 plant and site parameters. Where the plant parameters, site characteristics, and environmental assumptions remain within the assumptions supporting generic conclusions, the Environmental Report would identify the basis for relying on those conclusions. Where an issue is Category 2, out-of-envelope, affected by new and significant information, or otherwise site-specific, the Environmental Report would provide supplemental analysis.

A controlled Part 53 parameter or condition is distinct from the Part 51 environmental conclusion it supports. For example, Aalo's bounding accident dose consequence requirement (e.g., projected public dose remaining below 1 rem total effective dose equivalent [TEDE] over 96 hours within the site boundary) would be specified as a Part 53 design parameter and working assumption within the PPE. This parameter supports site suitability and establishes the bounding envelope for environmental reviews, with associated terms and conditions and, where appropriate, Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC).

While this dose requirement is intended to ultimately justify a site-boundary EPZ under 10 CFR 50.33(g)(2), the formal 10 CFR 50.160 EPZ sizing analysis is deferred to the follow-on application. Meanwhile, the associated conclusion concerning accidental radiological environmental effects remains a separate Part 51 environmental finding.

Aalo uses NUREG-2249 as part of the Part 51 environmental-review strategy, not as the safety or site-suitability basis for the Part 53 ESP. The safety and site-suitability basis remain anchored in 10 CFR Part 53, supported by the Aalo PPE; project-specific SPE, SSAR, graded site-characterization methodology; and applicable siting/external-hazard guidance.

2.8 NRC Preapplication Context

Aalo intends to use this white paper as part of an iterative preapplication engagement strategy with NRC staff. The white paper presents Aalo's proposed 10 CFR Part 53 ESP methodology before preparation of the first ESP application, identifies the proposed information allocation between

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ESP-stage findings and follow-on application confirmation, and supports focused NRC staff feedback on the methodology before Aalo finalizes application-development plans and its formal Regulatory Engagement Plan (REP).

The requested NRC staff feedback is consolidated in Section 1.2. This section provides regulatory context for those requests. Section 4 provides the supporting methodology. Later sections identify how the methodology would be translated into application artifacts without creating additional feedback-request lists.

Aalo expects additional engagement may be warranted on topics such as the Part 53 ESP application structure, PPE/SPE methodology, the graded site-characterization approach, Part 51 Environmental Report strategy, minimum emergency planning scope, and ESP follow-on licensing carry-forward logic. The scope, sequencing, and format of that engagement would be determined based on NRC staff feedback, application-development needs, and Aalo licensing priorities.

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3. Background and Applicant Position

3.1 Purpose of Section

This section provides the background and applicant position that support Aalo's proposed ESP methodology. Section 2 identifies the regulatory context for the methodology, and Section 4 describes the methodology in detail. This section explains why Aalo's standardized commercial product, repeatable deployment model, and 10 CFR Part 53 licensing strategy, support use of a PPE, SPE, graded site-characterization approach, and follow-on application carry-forward framework.

The purpose of this section is not to provide a complete technical design description of the Aalo commercial product. Detailed design information, final design parameters, final source-term information, final licensing-basis-event evaluation, final probabilistic risk assessment, final mechanistic source term, and final radiological consequence analysis are fully deferred to the follow-on application-stage documents, alongside the complete emergency plan and the 10 CFR 50.160 EPZ sizing determination. This section instead provides the background needed to understand how bounding PPE assumptions are utilized in the proposed ESP-stage methodology to evaluate site suitability in the absence of a finalized design.

As noted in Section 2.8, this section provides context only and does not create additional feedback requests; the requested NRC staff feedback is consolidated in Section 1.2.

3.2 Aalo Commercial Product Overview

Aalo is developing a standardized commercial reactor product intended for repeatable deployment across candidate sites. The commercial product is based on the Aalo-1 reactor module and the Aalo Pod deployment configuration. The Aalo-1 module is a sodium-cooled, thermal-spectrum reactor module with a nominal thermal power of 30 MWt and nominal electrical output of 10 MWe. The Aalo Pod is the aggregated commercial deployment unit consisting of five Aalo-1 reactor modules and associated shared systems, producing a nominal 50 MWe configuration.

The Aalo commercial product uses liquid sodium coolant, graphite moderation, UO₂ fuel, a steam Rankine power conversion cycle, air-cooled condensers, passive decay heat removal features, and a functional containment strategy. These characteristics inform the plant-side parameters, bounding assumptions, site-interface requirements, environmental assumptions, bounding accident dose limits, and follow-on confirmation items addressed through the Aalo PPE/SPE methodology.

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Aalo's current reference commercial deployment concept includes multiple Pods at a site. The maximum deployment configuration and scaling rules will be controlled by the Aalo PPE. The PPE will identify which parameters scale linearly, which are cumulative for environmental and site-impact purposes, which are capped by design or site-interface limits (e.g., maximum bounding dose or total thermal output), and which do not scale materially with the number of Pods.

For purposes of this white paper, references to the Aalo commercial product are intended to support the ESP methodology and should not be read as final application-stage design approvals. Final design details would be confirmed, as applicable, in the follow-on application and supporting analyses.

3.3 Aalo Pod Deployment Concept

Aalo's proposed approach starts from a standardized product and a controlled set of plant-side assumptions, then evaluates whether a candidate site remains compatible with those assumptions and with the requested ESP findings. This differs from a traditional site-centric ESP model in which a specific site is approved while preserving flexibility for a range of future, unspecified plant designs.

Under this approach, the Aalo PPE defines the plant-centric envelope relevant to ESP-stage review. This is paired with an SPE that aligns with the NRC's NUREG-2249 NR GEIS. The SPE defines the corresponding site-side characteristics, data sources, screening criteria, and site-interface assumptions used to determine whether a candidate site is compatible with the Aalo PPE. Together, the Aalo PPE and GEIS-aligned SPE provide the plant-and-site parameter basis for the proposed 10 CFR Part 53 ESP licensing approach.

This structure is intended to support repeatable application development while preserving site-specific review where it is needed. Candidate sites would be evaluated against the Aalo PPE/SPE framework. Where a site characteristic, environmental issue, or hazard remains within the applicable envelope, the ESP application would identify the basis for relying on the bounded analysis or proposed permit-basis condition. Where a matter is outside the envelope, affected by limited margin, affected by uncertainty, or otherwise not suitable for generic treatment, the ESP application would provide supplemental analysis, define a follow-on confirmation item, identify a design or deployment constraint, or use another resolution pathway appropriate to the issue.

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3.4 Problem Statement

Aalo's planned deployment model requires an ESP methodology that can support regulatory certainty without unnecessary repetition of bounded analyses across substantially similar deployments. A site-by-site approach may require repeated treatment of matters that are controlled by the standardized plant design, bounded by the Aalo PPE, or appropriately addressed through a common site-characterization methodology. At the same time, the methodology must preserve site-specific review for hazards, environmental issues, significant impediments to emergency planning, and other matters that depend on candidate-site conditions.

Existing siting and environmental-review guidance was primarily developed from experience with large light-water-reactor facilities. Aalo proposes to demonstrate how to implement the applicable requirements for its standardized, lower-consequence product using the 10 CFR Part 53 licensing framework, while maintaining the applicable safety, environmental, and statutory minimum emergency-planning requirements.

The proposed methodology sorts matters into three categories: those resolved or bounded at the ESP stage, those requiring site-specific analysis in the ESP application, and those confirmed in a follow-on application. This lets the ESP application focus on site suitability, environmental review, the identification of physical impediments to emergency planning, bounding design parameters, permit-basis conditions, and carry-forward logic, while preserving later confirmation of final design-specific information and the complete emergency plan.

3.5 Applicant Position

Under Aalo's methodology, the 10 CFR Part 53 ESP application for the Aalo commercial product is structured around a controlled Aalo PPE and a corresponding NUREG-2249 NR GEIS-aligned SPE. The Aalo PPE would identify the plant-side assumptions and bounding parameters relevant to ESP-stage review. The GEIS-aligned SPE would identify the site-side characteristics and assumptions used to evaluate whether a candidate site remains compatible with the Aalo PPE and the requested ESP findings.

Under Aalo's methodology, the level of site-characterization effort is commensurate with the safety and environmental significance of the issue being evaluated. Where existing qualified data, public datasets, prior site investigations, operating experience, or other reliable information provide an adequate basis for an ESP-stage conclusion, Aalo relies on those sources. Where margin is limited, uncertainty is

Aalo's methodology does not reduce the applicable safety, environmental, or statutory minimum emergency-planning requirements. It defines a structured method for determining what information is needed at the ESP stage, what information may be confirmed later, and what circumstances would require supplemental analysis, a design or deployment constraint, a variance, an amendment, a departure review, site rejection, or another applicable resolution pathway.

3.6 Relationship to the First Implementation

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4. Proposed ESP Approach

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4.2 Plant Parameter Envelope Methodology

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### 4.3 Site Parameter Envelope Methodology

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### Screening Dispositions

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### 4.4 Graded Site Characterization

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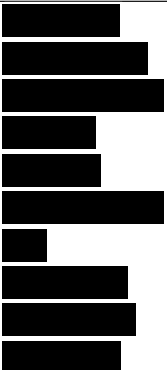
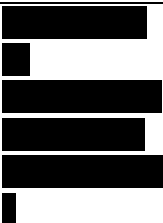
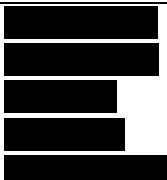
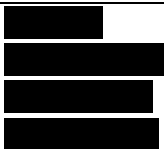
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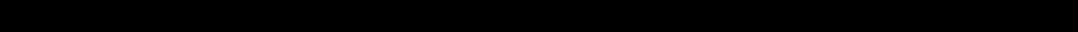
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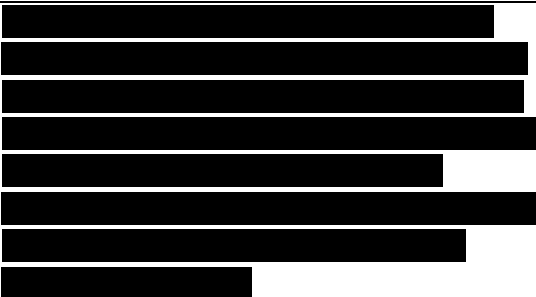
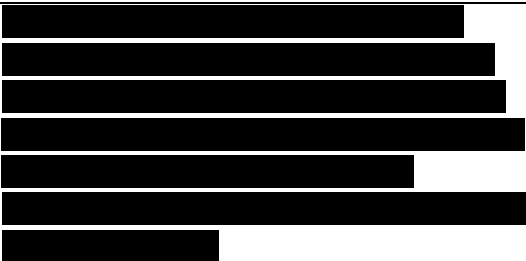
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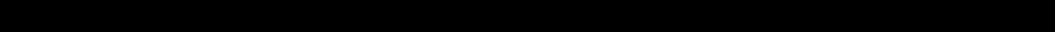
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## 4.6 Environmental Report Methodology

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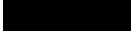
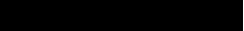
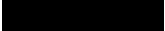
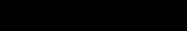
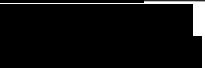
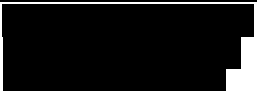
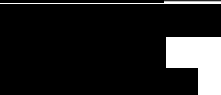
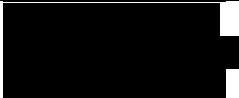
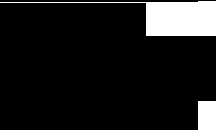
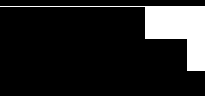
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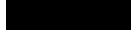
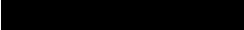
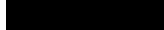
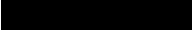
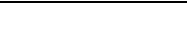
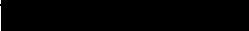
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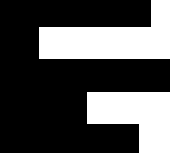
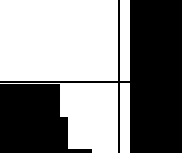
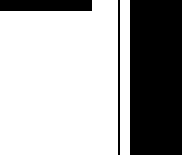
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## 5. Methodology Implementation in ESP Application Development

### 5.1 Purpose of Section

This section describes how the methodology described in Section 4 would be implemented in ESP application development. The purpose of this section is not to restate the Aalo PPE, Aalo SPE, graded site-characterization, SSAR, Environmental Report, emergency-planning, EPZ, or carry-forward methodologies. Those methodologies are described in Section 4. This section instead identifies the application-development structure, traceability tools, role allocation, and first-implementation approach that would support use of the methodology in an ESP application.

Personnel performing quality assurance functions would maintain the authority and organizational freedom to identify and resolve quality concerns independent of cost and schedule pressures. Data collection, literature review, and field testing used as application inputs would be controlled under a quality-assurance program consistent with 10 CFR Part 50, Appendix B, so that inputs are documented, traceable, and reproducible.

As noted in Section 2.8, this section provides implementation context only and does not create additional feedback requests; the requested NRC staff feedback is consolidated in Section 1.2.

### 5.2 First Implementation

Aalo expects the first implementation of the methodology described in this white paper to be the initial project-specific ESP application. That first application would serve as the first project-specific application of the Aalo PPE/SPE framework, graded site-characterization methodology, Environmental Report strategy, emergency-planning and EPZ methodology, and ESP follow-on application carry-forward framework. As this FOAK application, it would establish the project-specific basis for applying the methodology; subsequent applications may reuse the methodology for other sites and deployment configurations that conform to the applicable Aalo PPE, project-specific SPE, and approved bases, as described in Section 5.7.

That first application would not define the methodology solely for that site. Rather, it would apply the methodology to the site-specific information, environmental setting, emergency-planning interfaces, external-hazard profile, land-use assumptions, infrastructure interfaces, and deployment configuration relevant to that application. Future ESP applicants may propose to apply the same methodology where candidate-site conditions, deployment configuration, plant

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parameters, environmental assumptions, emergency-planning bases, and ESP terms and conditions remain within the applicable Aalo PPE/SPE framework or are otherwise addressed through an appropriate resolution pathway.

That first application would also provide an opportunity to demonstrate how the methodology supports early identification of matters proposed to be resolved or bounded at the ESP stage, matters requiring ESP-stage site-specific analysis, and matters proposed for follow-on application confirmation.

### 5.3 Implementation Responsibilities

Implementation of the methodology will distinguish between the responsibilities of Aalo, the ESP applicant, the follow-on applicant, and the licensee. The white paper does not assume that Aalo will be the applicant or licensee for every deployment.

- Aalo develops and controls the generic product methodology, Aalo PPE, product assumptions, below-1-rem design objective, and supporting generic technical bases
- The ESP applicant prepares and submits the site-specific ESP application, SSAR, Environmental Report, emergency-planning information, project-specific SPE, and requested major features or permit conditions
- The follow-on applicant demonstrates that the final design, LBE evaluation, PRA, mechanistic source term, deployment configuration, and other analyses conform to the ESP-approved basis or are otherwise addressed through an applicable regulatory pathway
- The licensee implements and maintains the approved emergency plan, operational programs, and other post-issuance obligations.

### 5.4 Integrated Regulatory Traceability Matrix

Aalo expects the methodology to be implemented through an integrated regulatory traceability matrix, supported by separate technical appendices where needed. This matrix would consolidate information that might otherwise appear in separate PPE/SPE conformance, deferred-analysis, permit-basis/carry-forward, emergency-planning, and GEIS applicability matrices.

The integrated matrix would be maintained in two views. View 1: The external Regulatory Conformance Matrix submitted to the NRC would be limited to the columns needed for regulatory review: the parameter, its bounding PPE or SPE value, the requested ESP-stage treatment, the required follow-on (COL-stage) action, and the applicable regulatory basis. View 2: A separate internal project-management matrix would track the supporting administrative fields, such as data

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source and quality assurance status, characterization tier and uncertainty treatment, deferred-information items, acceptance criteria, follow-on deliverables, change pathways, and the responsible entity for completing each item.

The matrix should clearly distinguish the underlying controlled Part 53 element from the environmental conclusion supported by that element. For the emergency-planning example, the ESP-stage obligation under 10 CFR 53.1146(b) is limited to identifying any physical characteristics unique to the site that could pose a significant impediment to the development of emergency plans and describing the contacts and arrangements made with agencies having emergency-planning responsibilities; no plume exposure pathway EPZ or other emergency-plan major feature is approved at the ESP stage. The below-1-rem dose objective and the determination of the EPZ size and configuration are developed in the follow-on application. The related conclusion concerning the environmental effects of accidental radiological releases remains a Part 51 environmental conclusion.

## 5.5 Identification of Requested ESP-Stage Regulatory Treatment

For each major methodology output, the ESP application will identify the specific regulatory treatment being requested. For each item, the application will state whether the ESP applicant is seeking:

- An ESP safety or site-suitability finding
- Specification as an approved site characteristic
- Specification as an approved design parameter
- Inclusion as an ESP term or condition
- Approval as an emergency-plan major feature
- Reliance on a Part 51 environmental conclusion
- Bounding treatment with follow-on conformance confirmation
- Complete deferral to the follow-on application.

This classification is intended to make clear whether a technical subject is being presented as information supporting the ESP review, a proposed permit-basis element, an environmental-review conclusion, a follow-on confirmation item, or a matter outside the requested ESP-stage action.

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## 5.6 Relationship to ESP Application Content

The methodology would be implemented through the ESP application's safety, environmental, emergency-planning, and terms-and-conditions content. The ESP application would identify the matters proposed to be resolved or bounded at the ESP stage, the basis for those proposed findings, and the permit-basis elements proposed for carry-forward into a future follow-on application.

For site-safety matters, the ESP application would identify the site characteristics, external hazards, site-boundary assumptions, population and land-use information, nearby hazards, and other information needed to support the requested ESP findings. Where the graded site-characterization methodology supports use of existing qualified information or public data, the application would identify the data source, applicability, uncertainty, margin, and basis for the proposed level of characterization.

Where additional analysis or investigation is necessary to support a requested ESP finding, approval, permit-basis element, emergency-plan major feature, or environmental conclusion, the ESP application will provide that information. Where information may permissibly be confirmed in the follow-on application without undermining the requested ESP-stage action, the application will identify the deferred item, bounding ESP-stage basis, applicable acceptance criterion, required follow-on deliverable, and regulatory treatment if the criterion is not satisfied.

For environmental matters, the ESP application would use the Environmental Report to identify the extent to which generic environmental conclusions may apply and the extent to which site-specific analysis is needed. Where the ESP applicant relies on a GEIS conclusion or other generic environmental basis, the Environmental Report would identify the relevant assumptions and the basis for concluding that the proposed deployment remains within those assumptions. Where an issue is Category 2, out-of-envelope, affected by new and significant information, cumulative, or otherwise site-specific, the Environmental Report would provide supplemental analysis.

For emergency-planning matters, the ESP application will satisfy the minimum obligation under 10 CFR 53.1146(b) by (1) identifying any physical characteristics unique to the site that could pose a significant impediment to the development of emergency plans, and (2) describing the contacts and arrangements made with local, State, Federal, and Tribal agencies having emergency-planning responsibilities, including each organization's name and location, the title or position of the persons contacted, and that organization's role in emergency planning. The ESP application does not seek approval of a plume exposure pathway EPZ or of any emergency-plan major feature, and

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no emergency-planning certifications are required at the ESP stage. BPI = 4 remains Aalo's internal consequence-grading designation and is not a requested NRC finding.

To support identification of significant impediments to emergency-plan development, the ESP application will provide the site-specific information appropriate to that screening, such as population distribution and any site-specific physical or geographic constraints, together with the description of agency contacts and arrangements. The dose-versus-distance evaluation, the EPZ size and configuration, the complete and integrated emergency plans, and the final PRA, LBE evaluation, mechanistic source term, radiological consequence analysis, and detailed design are developed in the follow-on application.

## 5.7 Future Use of the Methodology

Future ESP applicants may propose to apply the methodology where they demonstrate its applicability to the candidate site and deployment configuration and conformance with the applicable Aalo PPE, project-specific SPE, approved parameters and conditions, emergency-planning bases, environmental assumptions, and referenced NRC approvals.

NRC staff feedback on this white paper would not itself establish an approved generic methodology or authorize future applicants to rely on the methodology without further demonstration. The ability to reuse the methodology would be stronger if generic technical bases were later incorporated into an NRC-approved topical report, standard design approval, design certification, manufacturing license, or other referenced approval. Until then, future applicants may propose to apply the methodology rather than rely on it without further support.

This approach is intended to support repeatable ESP application development while preserving the site-specific review needed for candidate-site characteristics, environmental issues, significant physical impediments to emergency planning, out-of-envelope conditions, and final design-specific confirmation.

## 5.8 Section Summary

Section 4 describes the proposed methodology. Section 5 describes how that methodology would be translated into ESP application-development artifacts and reviewable application content. Under this approach, the ESP application would identify the applicable Aalo PPE/SPE parameters, site-specific evaluations, environmental-review basis, emergency-planning basis, permit-basis elements, follow-on confirmation items, regulatory treatment requested for each item, responsible entity, and resolution pathways needed to support NRC review.

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This implementation structure is intended to provide traceability from the methodology described in this white paper to the content of a future ESP application, while avoiding unnecessary duplication of analyses that are bounded, resolved, or otherwise controlled by the ESP-approved basis.

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## 6. Requested NRC Engagement

Aalo requests written NRC staff feedback on the methodology-level questions identified in Section 1.2 following a public meeting, supplemented by focused technical meetings where needed. Based on that feedback, Aalo may submit additional technical materials, white papers, or topical reports. The sequencing, schedule, and any external commitments associated with those activities will be managed through the Regulatory Engagement Plan, cover correspondence, or future submittals.

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