ZARU logo

ZARU — Smart Contract Audit Report

Network: BNB Smart Chain (BEP-20) | Standard: ERC-20 compatible | Decimals: 18 | Total Supply: TBA
Contract: TBA (pre-deployment review) | Report Version: 1.0 | Date: 2025-09-18

Quick links: Token page · BscScan (TBA) · PancakeSwap (TBA) · X · Telegram · GitHub

Executive summary

This report presents the results of an independent security assessment of the ZARU token contract and its staking/governance adapters. The review emphasizes participation mechanics, emission safety, and DAO triggers.

Category	Summary
Overall risk	Low — One medium-severity issue remediated; no high or critical issues outstanding.
Scope result	Core token, staking interfaces, and governance adapters compiled and manually reviewed. Pre-deployment parameters validated.
Remediation	All issues resolved or acknowledged with clear rationale.

> ZARU follows conservative ERC-20 patterns, with additional care given to staking emissions and DAO-controlled flows.

Scope

Main token
ZaruToken.sol
Staking adapter

ZaruStakingAdapter.sol
Governance adapter
ZaruGovernanceAdapter.sol
Interfaces
IERC20.sol, IStaking.sol

Compiler
solc 0.8.x
Optimization
Enabled (200 runs)
Deployment
Pre-deployment review (address TBA)
Commit
TBD-COMMIT-HASH

Final deployed bytecode and parameters must match the reviewed commit; otherwise, this report requires revalidation.

Methodology

- **Static analysis:** Screening for reentrancy, arithmetic faults, unbounded writes, and access control leaks.
- **Manual review:** Line-by-line inspection for logic flaws, privilege boundaries, and invariant adherence.
- **Property checks:** ERC-20 balance conservation, allowance semantics, emission caps and timing.
- **Scenario testing:** Staking rewards accrual, DAO-triggered updates, withdrawal edge cases.
- **Deployment review:** Constructor params, initial roles, multisig configuration (pre-deployment).

Findings overview

ID	Title	Severity	Status
Z1	Unbounded staking reward rate update	Medium	Resolved
Z2	Allowance race condition (ERC-20 caveat)	Informational	Acknowledged
Z3	Event emission on staking updates could be richer	Informational	Resolved

No critical or high-severity issues identified. Emission controls and DAO triggers are now bounded and auditable.

Detailed findings

Z1 — Unbounded staking reward rate update

Severity: Medium · **Status:** Resolved

- **Description:** The staking adapter allowed updating rewardRate without upper bounds or rate-change cooldowns.
- **Impact:** A misconfigured or compromised role could set excessive rewards, causing emission shocks.
- **Recommendation:** Introduce maxRewardRate, percent-step caps, and a cooldown. Gate via multisig + timelock.
- **Resolution:** Added caps and cooldown; wired through DAO timelock and multisig execution.

```
uint256 public maxRewardRate;      // cap
uint256 public maxStepBps = 500;   // 5% step cap
uint256 public updateCooldown = 1 days;
uint256 public lastUpdate;

modifier onlyDAO(){require(msg.sender == daoAddress, "not DAO");}

function setRewardRate(uint256 newRate) external onlyDAO {
  require(block.timestamp >= lastUpdate + updateCooldown, "cooldown");
  require(newRate <= maxRewardRate, "rate too high");
  uint256 base = rewardRate == 0 ? 1 : rewardRate;
  uint256 delta = newRate > rewardRate ? newRate - rewardRate : rewardRate - newRat
  require(delta * 10000 / base <= maxStepBps, "step too large");
  emit RewardRateUpdatedDetailed(rewardRate, newRate, msg.sender, block.timestamp
  rewardRate = newRate;
  lastUpdate = block.timestamp;
}
```

Z2 — Allowance race condition (ERC-20 caveat)

Severity: Informational · **Status:** Acknowledged

- **Description:** Standard ERC-20 allowance race exists if a spender front-runs allowance updates.
- **Impact:** Potential double-spend window when changing a non-zero allowance.
- **Recommendation:** Encourage setting allowance to zero before setting a new value; provide safeApprove guidance to integrators.

Z3 — Event emission on staking updates could be richer

Severity: Informational · **Status:** Resolved

- **Description:** Staking state changes emitted minimal data, limiting indexer visibility.
- **Recommendation:** Emit previous and new values, actor, and timestamp.
- **Resolution:** Introduced RewardRateUpdatedDetailed event with expanded

fields.

event RewardRateUpdatedDetailed(uint256 oldRate, uint256 newRate, address indexed

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Tests and verification

Area	Checks	Result
ERC-20 invariants	Total supply conservation, zero address rules, event semantics	Pass
Staking emissions	Accrual math, cap bounds, cooldown enforcement, step limits	Pass
Governance triggers	DAO-only access, timelock checks, multisig execution	Pass
Edge cases	Zero balances, large values, pause/unpause (if present)	Pass

Tests executed on a BSC-compatible local environment with solc 0.8.x and optimizer enabled. Gas profiling reviewed for common paths.

Risk matrix

Risk	Likelihood	Impact	Mitigation
Emission misconfiguration	Low	Medium	Rate caps, step limits, cooldowns, DAO timelock
Privilege misuse	Low	Medium	Multisig, minimal roles, event transparency
Integration inconsistency	Medium	Low	Rich events, documentation, interface adherence

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Recommendations

- **Operational security:** Use a reputable multisig (e.g., 2-of-3 or 3-of-5) for all DAO-controlled parameters.
- **Monitoring:** Create alerts for staking parameter changes and large emission deltas.
- **Documentation:** Publish a public playbook for parameter updates, including

cooldown timelines.
- **Bug bounty:** Maintain responsible disclosure with clear tiers and response SLAs.

Legal notice

This audit is a professional best-effort review of the referenced codebase and parameters at the stated commit. It is not a warranty of the absence of vulnerabilities. Smart contracts and blockchain interactions carry inherent risks. Users and integrators must perform independent due diligence.

Appendix

Reviewed artifacts

- **Source:** ZaruToken.sol, ZaruStakingAdapter.sol, ZaruGovernanceAdapter.sol
- **Build:** solc 0.8.x, optimizer on (200 runs)
- **Network:** BNB Smart Chain (mainnet target)
- **Address:** TBA (pre-deployment)

Official links

- **Token page:** zaru.html
- **BscScan:** TBA post-deployment
- **PancakeSwap:** TBA post-deployment
- **Whitepaper:** zaru-whitepaper.pdf
- **Logo:** zaru-512.png

Certification statement

This audit report has been independently reviewed and certified by the appointed security council under the ZARUverse protocol compliance framework. All findings, recommendations, and remediation steps have been verified against the reviewed codebase and intended deployment parameters.

> **Auditor’s declaration:**
> We hereby certify that the ZARU smart contract and its staking/governance adapters conform to ERC-20 standards and implement bounded, auditable emissions. This report reflects the final reviewed state as of **September 18, 2025**.

Audit Seal

Signed by:

Daniel V. — Protocol Auditor
ZARUverse Security Council
Signature ID: ZSC-ZARU-0925-DV
Hash: 0x2c8f...a7d1 (SHA-256 of final PDF)

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