



SMART CONTRACT AUDIT

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PREPARED FOR:
ARCADEUM



INTRODUCTION

Auditing Company	 VITAL BLOCK SECURITY
Client Project	 ARCADEUM (Arcadeum's LP Token)
Methodology	Automated Analysis, Manual Code Review
Language	Solidity
License	MIT
Contract Address	0x875Ce69F87beB1d9B0c407597d4057Fa91D364A7
Compiler Version	v0.8.15+commit.e14f2714
Network	ARBITRUM CHAIN
Token Type	ERC20
Website	https://www.arcadeum.io
Telegram	https://t.me/arcadeum
Twitter	https://twitter.com/arcadeum_io
GitHub	https://github.com/arcadeum
Prelim Report Date	February 19, 2023
Final Report Date	February 20, 2023



Verify the authenticity of this report on our GitHub Repo: <https://www.github.com/vital-block>

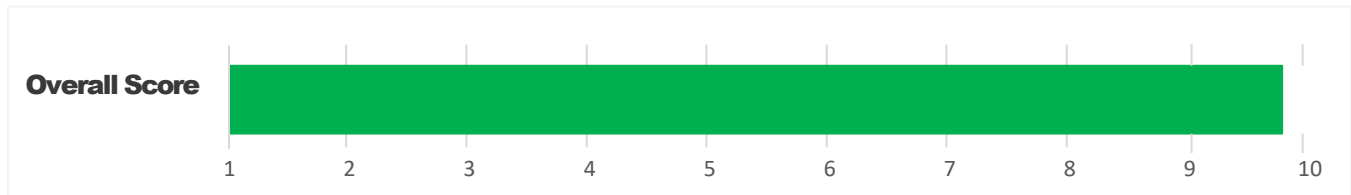


EXECUTIVE SUMMARY

Vital Block has performed the automated and manual analysis of the Sol code. The code was reviewed for common contract vulnerabilities and centralized exploits. Here's a quick audit summary:

Status	Critical ! 🔴	Major " 🟡	Medium # 🟡	Minor \$ 🟢	Unknown % 🟤
Open	0	0	0	2	0
Acknowledged	0	0	1	1	0
Resolved	0	0	0	0	0
Noteworthy OnlyOwner Privileges	Set Taxes and Ratios, Airdrop, Set Protection Settings, Set Reward Properties, Set Reflector Settings, Set Swap Settings, Set Pair and Router				

ARBITRUM Smart contract has achieved the following score: **98.5**



ⓘ Please note that smart contracts deployed on blockchains aren't resistant to exploits, vulnerabilities and/or hacks. Blockchain and cryptography assets utilize new and emerging technologies. These technologies present a high level of ongoing risks. For a detailed understanding of risk severity, source code vulnerability, and audit limitations, kindly review the audit report thoroughly.

ⓘ Please note that centralization privileges regardless of their inherited risk status - constitute an elevated impact on smart contract safety and security.



TABLE OF CONTENTS

TABLE OF CONTENTS	4
SCOPE OF WORK	5
AUDIT METHODOLOGY	6
RISK CATEGORIES	8
CENTRALIZED PRIVILEGES	9
AUTOMATED ANALYSIS	10
INHERITANCE GRAPH	15
MANUAL REVIEW	16
DISCLAIMERS	27
ABOUT VITALBLOCK	30



SCOPE OF WORK

Vital Block was consulted by ARCADEUM to conduct the smart contract audit of its .Sol source code. The audit scope of work is strictly limited to mentioned .SOL file only:

○ ARCADEUM.Sol

 External contracts and/or interfaces dependencies are not checked due to being out of scope.

Verify audited contract's contract address and deployed link below:

Public Contract.

0x875Ce69F87beB1d9B0c407597d4057Fa91D364A7

Contract Name	Arcadeum's LP Token
Token Symbol	ALP
Decimals	18
Total Supply	6.7993e-8



AUDIT METHODOLOGY

Smart contract audits are conducted using a set of standards and procedures. Mutual collaboration is essential to performing an effective smart contract audit. Here's a brief overview of Vital Block auditing process and methodology:

CONNECT

- The onboarding team gathers source codes, and specifications to make sure we understand the size, and scope of the smart contract audit.

AUDIT

- Automated analysis is performed to identify common contract vulnerabilities. We may use the following third-party frameworks and dependencies to perform the automated analysis:
 - Remix IDE Developer Tool
 - Open Zeppelin Code Analyzer
 - SWC Vulnerabilities Registry
 - DEX Dependencies, e.g., Pancakeswap, Uniswap
- Simulations are performed to identify centralized exploits causing contract and/or trade locks.
- A manual line-by-line analysis is performed to identify contract issues and centralized privileges.

We may inspect below mentioned common contract vulnerabilities, and centralized exploits:

Centralized Exploits	<ul style="list-style-type: none">○ Token Supply Manipulation○ Access Control and Authorization○ Assets Manipulation○ Ownership Control○ Liquidity Access○ Stop and Pause Trading○ Ownable Library Verification
----------------------	---

Common Contract Vulnerabilities

- **Integer Overflow**
- **Lack of Arbitrary limits**
- **Incorrect Inheritance Order**
- **Typographical Errors**
- **Requirement Violation**
- **Gas Optimization**
- **Coding Style Violations**
- **Re-entrancy**
- **Third-Party Dependencies**
- **Potential Sandwich Attacks**
- **Irrelevant Codes**
- **Divide before multiply**
- **Conformance to Solidity Naming Guides**
- **Compiler Specific Warnings**
- **Language Specific Warnings**

REPORT

- **The auditing team provides a preliminary report specifying all the checks which have been performed and the findings thereof.**
- **The client's development team reviews the report and makes amendments to the codes.**
- **The auditing team provides the final comprehensive report with open and unresolved issues.**

PUBLISH






- **The client may use the audit report internally or disclose it publicly.**

 **It is important to note that there is no pass or fail in the audit, it is recommended to view the audit as an unbiased assessment of the safety of solidity codes.**



RISK CATEGORIES

Smart contracts are generally designed to hold, approve, and transfer tokens. This makes them very tempting attack targets. A successful external attack may allow the external attacker to directly exploit. A successful centralization-related exploit may allow the privileged role to directly exploit. All risks which are identified in the audit report are categorized here for the reader to review:

Risk Type	Definition
Critical ! 	These risks could be exploited easily and can lead to asset loss, data loss, asset, or data manipulation. They should be fixed right away.
Major " 	These risks are hard to exploit but very important to fix, they carry an elevated risk of smart contract manipulation, which can lead to high-risk severity.
Medium # 	These risks should be fixed, as they carry an inherent risk of future exploits, and hacks which may or may not impact the smart contract execution. Low-risk re-entrancy-related vulnerabilities should be fixed to deter exploits.
Minor \$ 	These risks do not pose a considerable risk to the contract or those who interact with it. They are code-style violations and deviations from standard practices. They should be highlighted and fixed nonetheless.
Unknown % 	These risks pose uncertain severity to the contract or those who interact with it. They should be fixed immediately to mitigate the risk uncertainty.

All statuses which are identified in the audit report are categorized here for the reader to review:

Status Type	Definition
Open	Risks are open.
Acknowledged	Risks are acknowledged, but not fixed.
Resolved	Risks are acknowledged and fixed.



CENTRALIZED PRIVILEGES

Centralization risk is the most common cause of cryptography asset loss. When a smart contract has a privileged role, the risk related to centralization is elevated.

There are some well-intended reasons have privileged roles, such as:

- **Privileged roles can be granted the power to `pause()` the contract in case of an external attack.**
- **Privileged roles can use functions like, `include()`, and `exclude()` to add or remove wallets from fees, swap checks, and transaction limits. This is useful to run a presale and to list on an exchange.**

Authorizing privileged roles to externally-owned-account (EOA) is dangerous. Lately, centralization-related losses are increasing in frequency and magnitude.

- **The client can lower centralization-related risks by implementing below mentioned practices:**
- **Privileged role's private key must be carefully secured to avoid any potential hack.**
- **Privileged role should be shared by multi-signature (multi-sig) wallets.**
- **Authorized privilege can be locked in a contract, user voting, or community DAO can be introduced to unlock the privilege.**
- **Renouncing the contract ownership, and privileged roles.**
- **Remove functions with elevated centralization risk.**

 **Understand the project's initial asset distribution. Assets in the liquidity pair should be locked. Assets outside the liquidity pair should be locked with a release schedule.**



AUTOMATED ANALYSIS

Symbol	Definition
	Function modifies state
	Function is payable
	Function is internal
	Function is private
	Function is important

```

| **Arcadeum's LP Token** | Interface |   || | |
|  | totalSupply | External |   |   | NO |
|  | decimals | External |   |   | NO |
|  | symbol | External |   |   | NO |
|  | name | External |   |   | NO |
|  | getOwner | External |   |   | NO |
|  | balanceOf | External |   |   | NO |
|  | transfer | External | "   |   | NO |
|  | allowance | External |   |   | NO |
|  | approve | External | "   |   | NO |
|  | transferFrom | External | "   |   | NO |
|||||
| **Staking** | Interface |   ||
|  | getPair | External |   |   | NO |
|  | createPair | External | "   |   | NO |
|||||
| **IERC20** | Interface |   ||
|  | factory | External |   |   | NO |
|  | getReserves | External |   |   | NO |
|  | sync | External | "   |   | NO |

```



|||||

```

| **IRouter01** | Interface |      |||
|  ↳ | factory | External ¶ |      !      |NO! |
|  ↳ | ETH | External ¶ |      !      |NO! |
|  ↳ | addLiquidityETH | External ¶ |      !      #s |NO! |
|  ↳ | addLiquidity | External ¶ | " !      ● |NO! |
|  ↳ | swapExactETHForTokens | External ¶ |      !      #s |NO! |
|  ↳ | getAmountsOut | External ¶ |      !      |NO! |
|  ↳ | getAmountsIn | External ¶ |      !      |NO! |

```

|||||

```

| **IRouter02** | Interface | IRouter01 |||
|  ↳ | swapExactTokensForETHSupportingFeeOnTransferTokens | External ¶ | " !      ● |NO! |
|  ↳ | swapExactETHForTokensSupportingFeeOnTransferTokens | External ¶ |      !      #s |NO! |
|  ↳ | swapExactTokensForTokensSupportingFeeOnTransferTokens | External ¶ | " !      ● |NO! |
|  ↳ | swapExactTokensForTokens | External ¶ | " !      ● |NO! |

```

|||||

```

| **Safemath** | Interface |      |||
|  ↳ | checkUser | External ¶ | " !      ● |NO! |
|  ↳ | setLaunch | External ¶ | " !      ● |NO! |
|  ↳ | setLpPair | External ¶ | " !      ● |NO! |
|  ↳ | Basic token | External ¶ | !      ● |NO! |
|  ↳ | removeSniper | External ¶ | !      ● |NO! |

```

|||||

```

| **ALP** | Interface |      |||
|  ↳ | setRewardsProperties | External ¶ | " !      ● |NO! |
|  ↳ | tally | External ¶ | !      ● |NO! |
|  ↳ | load | External ¶ |      !      #s |NO! |
|  ↳ | cashout | External ¶ | " !      ● |NO! |
|  ↳ | giveMeWelfarePlease | External ¶ | " !      ● |NO! |
|  ↳ | getTotalDistributed | External ¶ |      !      |NO! |
|  ↳ | getUserInfo | External ¶ |      !      |NO! |
|  ↳ | getUserRealizedRewards | External ¶ |      !      |NO! |






```

^L	getUserRealizedGains	External ^U	[!]	NO ^U
^L	getUserUnpaidEarnings	External ^U	[!]	NO ^U
^L	getCurrentReward	External ^U	[!]	NO ^U

Ownership

0xFc2ec93A918B44e30A163e7DAeB02f62595407F3 Is The Owner Of The Contract.

Summary

-  Owner is not able to change or set taxes (0% tax)
-  Owner is not able to set a max amount for buys/sells/transfer
-  Owner is not able to pause trades
-  Owner is not able to mint new tokens
-  Owner is not able to blacklist an arbitrary address

Risk Analysis



Contract Source Code Verified.

This token contract is open source. You can check the contract code for details. Unsourced token contracts are likely to have malicious functions to defraud their users of their assets.



No Proxy

There is no proxy in the contract. The proxy contract means contract owner can modify the function of the token and possibly effect the price.



No Anti Whale

There is no limit to the number of token transactions. The number of scam token transactions may be limited (honeypot risk).



No function to retrieve ownership

If this function exists, it is possible for the project owner to regain ownership even after relinquishing it



Owner cant change balance

The contract owner does not have the authority to modify the balance of tokens at other addresses.

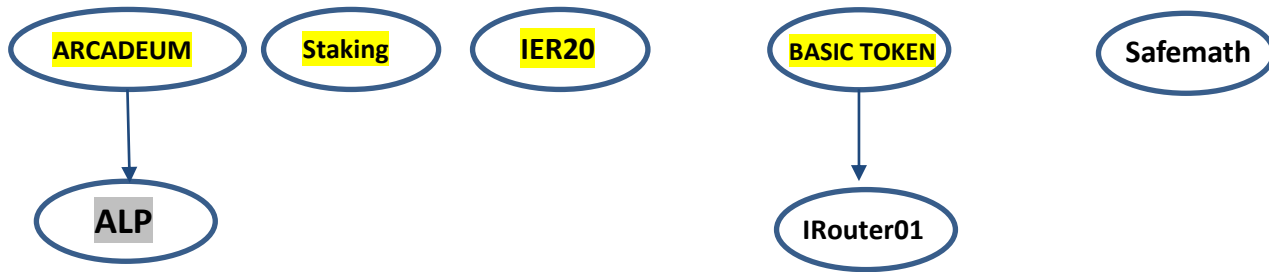


No trading cooldown

The token contract has no trading cooldown function. If there is a trading cooldown function, the user will not be able to sell the token within a certain time or block after buying.



INHERITANCE GRAPH



Identifier	Definition	Severity
CEN-12	Centralization privileges of Arcadeum's LP Token	Medium # 🟡

Vulnerability 0 : No important security issue detected.

Threat level: Low

```

32  /**
33   * @dev Throws if called by any account other than the owner.
34   */
35  modifier onlyOwner() {
36    _checkOwner();
37    _;
38  }
39
40  /**
41   * @dev Returns the address of the current owner.
42   */
43  function owner() public view virtual returns (address) {
44    return _owner;
45  }
46
47  /**
48   * @dev Throws if the sender is not the owner.
49   */
50  function _checkOwner() internal view virtual {
51    require(owner() == _msgSender(), "Ownable: caller is not the owner");
52  }
53
54  /**
55   * @dev Leaves the contract without owner. It will not be possible to call
  
```

Vulnerability Scan

REENTRANCY

Scanning Line:

```
function transferOwnership(address newOwner) public  
virtual onlyOwner {  
    require(newOwner != address(0), "Ownable:  
new owner is the zero address");  
    _transferOwnership(newOwner);  
}  
  
/**  
 * @dev Transfers ownership of the contract to a  
new account (`newOwner`).  
 * Internal function without access restriction.  
 */  
function _transferOwnership(address newOwner)  
internal virtual {  
    address oldOwner = _owner;  
    _owner = newOwner;  
    emit OwnershipTransferred(oldOwner,  
newOwner);
```

Recommen- dation:

The contract may contain additional issuance functions, which could maybe generate a large number of tokens, resulting in significant fluctuations in token prices. **It is recommended to confirm with the project team whether it complies with the token issuance instructions.**

MANUAL REVIEW

Arcadeum's LP Token: ALP (Arcadeum's LP Token) is a single-asset liquidity pool that entitles liquidity providers to a cut of the house proportional to their deposit. USDT is the pool's base asset, but zap deposits routed through Uniswap are supported via Arcadeum's web interface, with no additional fees. As the pool increases and decreases in underlying USDT, depositors assume linear risk/reward. For example, if a user deposits \$100K, bringing the pool to \$1M: If the pool climbs to \$1.1M, the user's position will be worth \$110K, for a PnL of \$10k. (assuming no other deposits/withdrawals) If the pool dips to \$900K, the user's position will be worth \$90K, for a PnL of -\$10k. (assuming no other deposits/withdrawals)

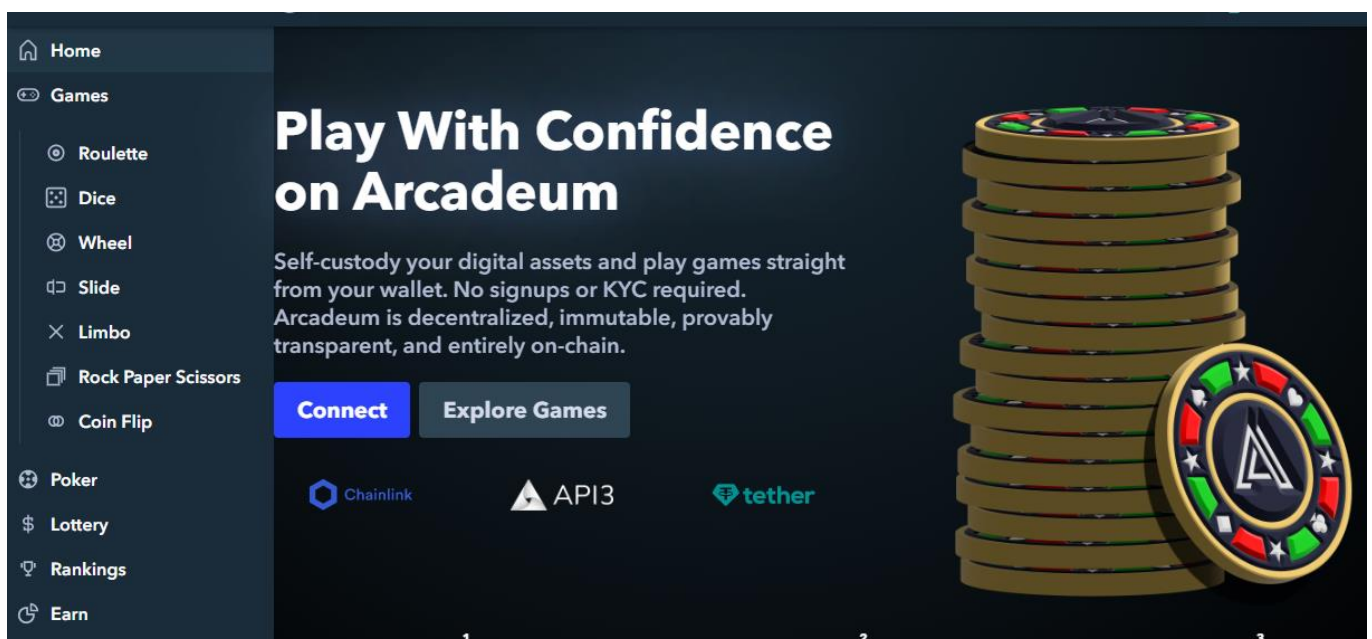
ARBISHIELD: ARCADEUM


Ticker: ALP

Chain/Standard: Arbitrum Network



Outstanding Features of ARCADEUM Launching On Arbitrum Network



Identifier	Definition	Severity
CEN-02	Initial asset distribution	Minor 

All of the initially minted assets are sent to the contract deployer when deploying the contract. This can be an issue as the deployer and/or contract owner can distribute tokens without consulting the community.

```
function owner() public view virtual returns (address) {
    return _owner;
}

/**
 * @dev Throws if the sender is not the owner.
 */
function _checkOwner() internal view virtual {
    require(owner() == _msgSender(), "Ownable: caller is not the owner");
}
```

RECOMMENDATION

Project stakeholders should be consulted during the initial asset distribution process.



RECOMMENDATION


Deployer and/or contract owner private keys are secured carefully.

Please refer to PAGE-09 CENTRALIZED PRIVILEGES for a detailed understanding.

ALLEVIATION

Arcadeum's LP Token project team understands the centralization risk. Some functions are provided privileged access to ensure a good runtime behavior in the project



Identifier	Definition	Severity
COD-10	Third Party Dependencies	Minor 

A smart contract is interacting with third-party protocols e.g., Uniswap, Pancakeswap router, cashier contract,

And protections contract. The scope of the audit treats third-party entities as black boxes and assumes their functional correctness. However, in the real world, third parties can be compromised and exploited. Moreover, upgrades in third parties can create severe impacts, e.g., increased transactional fees, deprecation of previous routers, etc.

RECOMMENDATION

Inspect and validate third party dependencies regularly, and mitigate severe impacts whenever necessary.



DISCLAIMERS

Vital Block Security provides the easy-to-understand audit of Solidity, Move, and Raw source codes (commonly known as smart contracts).

The smart contract for this particular audit was analyzed for common contract vulnerabilities, and centralization exploits. This audit report makes no statements or warranties on the security of the code. This audit report does not provide any warranty or guarantee regarding the absolute bug-free nature of the smart contract analyzed, nor do they provide any indication of the client's business, business model, or legal compliance. This audit report does not extend to the compiler layer, any other areas beyond the programming language, or other programming aspects that could present security risks. Cryptographic tokens are emergent technologies, they carry high levels of technical risks and uncertainty. You agree that your access and/or use, including but not limited to any services, reports, and materials, will be at your sole risk on an as-is, where-is, and as-available basis. This audit report could include false positives, false negatives, and other unpredictable results.

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ABOUT VITAL BLOCK

Vital Block provides intelligent blockchain Security Solutions. We provide solidity and Raw Code Review, testing, and auditing services. We have Partnered with 15+ Crypto Launchpads, audited 50+ smart contracts, and analyzed 200,000+ code lines. We have worked on major public blockchains e.g., Ethereum, Binance, Cronos, Doge, Polygon, Avalanche, Metis, Fantom, Bitcoin Cash, Aptos, Oasis, etc.

Vital Block is Dedicated to Making Defi & Web3 A Safer Place. We are Powered by Security engineers, developers, UI experts, and blockchain enthusiasts. Our team currently consists of 5 core members, and 4+ casual contributors.

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