May 2023

Network BSC

Address 0x81E1291fcbc7f13557d38D710A776eb090b38669

Audited by © cyberscope

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## 

## Review

| **Contract Name** | zkPiggyAI |
| --- | --- |
| **Compiler Version** | v0.8.7+commit.e28d00a7 |
| **Optimization** | 200 runs |
| **Explorer** | <https://bscscan.com/address/0x81e1291fcbc7f13557d38d710a776eb090b38669> |
| **Address** | 0x81e1291fcbc7f13557d38d710a776eb090b38669 |
| **Network** | BSC |
| **Symbol** | zkPAI |
| **Decimals** | 18 |
| **Total Supply** | 1,000,000,000 |

### Audit Updates

| **Initial Audit** | 10 May 2023 |
| --- | --- |

### Source Files

| **Filename** | SHA256 |
| --- | --- |
| **zkPiggyAI.sol** | 794de7a56b5aff117f7ab5299625f3be0b6e4a98478486abcc88611bab0965eb |

## Findings Breakdown

| Findings Breakdown | | ⬤ | Critical | 0 | | --- | --- | --- | | ⬤ | Medium | 0 | | ⬤ | Minor / Informative | 6 | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |

| **Severity** | | **Unresolved** | **Acknowledged** | **Resolved** | **Other** |
| --- | --- | --- | --- | --- | --- |
| ⬤ | Critical | 0 | 0 | 0 | 0 |
| ⬤ | Medium | 0 | 0 | 0 | 0 |
| ⬤ | Minor / Informative | 6 | 0 | 0 | 0 |

## Analysis

|  | ⬤ | Critical | ⬤ | Medium | ⬤ | Minor / Informative | ⬤ | Pass |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |

| **Severity** | **Code** | **Description** | **Status** |
| --- | --- | --- | --- |
| ⬤ | ST | Stops Transactions | Unresolved |
| ⬤ | OCTD | Transfers Contract's Tokens | Passed |
| ⬤ | OTUT | Transfers User's Tokens | Passed |
| ⬤ | ELFM | Exceeds Fees Limit | Passed |
| ⬤ | ULTW | Transfers Liquidity to Team Wallet | Passed |
| ⬤ | MT | Mints Tokens | Passed |
| ⬤ | BT | Burns Tokens | Passed |
| ⬤ | BC | Blacklists Addresses | Passed |

### 

### ST - Stops Transactions

| **Criticality** | Minor / Informative |
| --- | --- |
| **Location** | zkPiggyAI.sol#L147 |
| **Status** | Unresolved |

#### Description

The contract owner has the authority to stop the transactions for all users. The owner may take advantage of it by calling the pauseContract function.

| function pauseContract() public onlyOwner{  \_pause();  } |
| --- |

#### Recommendation

The team should carefully manage the private keys of the owner’s account. We strongly recommend a powerful security mechanism that will prevent a single user from accessing the contract admin functions. Some suggestions are:

* Introduce a time-locker mechanism with a reasonable delay.
* Introduce a multi-sign wallet so that many addresses will confirm the action.
* Introduce a governance model where users will vote about the actions.
* Renouncing the ownership will eliminate the threats but it is non-reversible.

## Diagnostics

|  |  |  | ⬤ | Critical | ⬤ | Medium | ⬤ | Minor / Informative |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |

| **Severity** | **Code** | **Description** | **Status** |
| --- | --- | --- | --- |
| ⬤ | RSML | Redundant SafeMath Library | Unresolved |
| ⬤ | L04 | Conformance to Solidity Naming Conventions | Unresolved |
| ⬤ | L06 | Missing Events Access Control | Unresolved |
| ⬤ | L09 | Dead Code Elimination | Unresolved |
| ⬤ | L16 | Validate Variable Setters | Unresolved |

### 

### RSML - Redundant SafeMath Library

| **Criticality** | Minor / Informative |
| --- | --- |
| **Location** | zkPiggyAI.sol |
| **Status** | Unresolved |

#### Description

SafeMath is a popular Solidity library that provides a set of functions for performing common arithmetic operations in a way that is resistant to integer overflows and underflows.

Starting with Solidity versions that are greater than or equal to 0.8.0, the arithmetic operations revert to underflow and overflow. As a result, the native functionality of the Solidity operations replaces the SafeMath library. Hence, the usage of the SafeMath library adds complexity, and overhead and increases gas consumption unnecessarily.

| library SafeMath {...} |
| --- |

#### Recommendation

The team is advised to remove the SafeMath library. Since the version of the contract is greater than 0.8.0 then the pure Solidity arithmetic operations produce the same result.

If the previous functionality is required, then the contract could exploit the unchecked { ... } statement.

Read more about the breaking change at <https://docs.soliditylang.org/en/v0.8.16/080-breaking-changes.html#solidity-v0-8-0-breaking-changes>.

### 

### L04 - Conformance to Solidity Naming Conventions

| **Criticality** | Minor / Informative |
| --- | --- |
| **Location** | zkPiggyAI.sol#L52,179 |
| **Status** | Unresolved |

#### Description

The Solidity style guide is a set of guidelines for writing clean and consistent Solidity code. Adhering to a style guide can help improve the readability and maintainability of the Solidity code, making it easier for others to understand and work with.

The followings are a few key points from the Solidity style guide:

1. Use camelCase for function and variable names, with the first letter in lowercase (e.g., myVariable, updateCounter).
2. Use PascalCase for contract, struct, and enum names, with the first letter in uppercase (e.g., MyContract, UserStruct, ErrorEnum).
3. Use uppercase for constant variables and enums (e.g., MAX\_VALUE, ERROR\_CODE).
4. Use indentation to improve readability and structure.
5. Use spaces between operators and after commas.
6. Use comments to explain the purpose and behavior of the code.
7. Keep lines short (around 120 characters) to improve readability.

| contract zkPiggyAI is IBEP20 {  using SafeMath for uint256;  modifier onlyOwner() {  require(msg.sender==owner, "Only Call by Owner");  \_;  ...  return \_symbol;  }  function decimals() public view returns (uint8) {  return \_decimals;  }  }  ... |
| --- |

#### Recommendation

By following the Solidity naming convention guidelines, the codebase increased the readability, maintainability, and makes it easier to work with.  
Find more information on the Solidity documentation [https://docs.soliditylang.org/en/v0.8.17/style-guide.html#naming-convention](https://docs.soliditylang.org/en/v0.8.17/style-guide.html#naming-conventions).

### 

### L06 - Missing Events Access Control

| **Criticality** | Minor / Informative |
| --- | --- |
| **Location** | zkPiggyAI.sol#L180 |
| **Status** | Unresolved |

#### Description

Events are a way to record and log information about changes or actions that occur within a contract. They are often used to notify external parties or clients about events that have occurred within the contract, such as the transfer of tokens or the completion of a task. There are functions that have no event emitted, so it is difficult to track off-chain changes.

| owner=\_newonwer |
| --- |

#### Recommendation

To avoid this issue, it's important to carefully design and implement the events in a contract, and to ensure that all required events are included. It's also a good idea to test the contract to ensure that all events are being properly triggered and logged.

By including all required events in the contract and thoroughly testing the contract's functionality, the contract ensures that it performs as intended and does not have any missing events that could cause issues.

### 

### L09 - Dead Code Elimination

| **Criticality** | Minor / Informative |
| --- | --- |
| **Location** | zkPiggyAI.sol#L214,230 |
| **Status** | Unresolved |

#### Description

In Solidity, dead code is code that is written in the contract, but is never executed or reached during normal contract execution. Dead code can occur for a variety of reasons, such as:

* Conditional statements that are always false.
* Functions that are never called.
* Unreachable code (e.g., code that follows a return statement).

Dead code can make a contract more difficult to understand and maintain, and can also increase the size of the contract and the cost of deploying and interacting with it.

| function \_burn(address account, uint256 value) internal whenNotPaused {  require(account != address(0), "ERC20: burn from the zero address");  \_totalSupply = \_totalSupply.sub(value);  \_balances[account] = \_balances[account].sub(value);  emit Transfer(account, address(0), value);  }  function \_burnFrom(address account, uint256 amount) internal whenNotPaused {  \_burn(account, amount);  \_approve(account, msg.sender, \_allowances[account][msg.sender].sub(amount));  } |
| --- |

#### 

#### Recommendation

To avoid creating dead code, it's important to carefully consider the logic and flow of the contract and to remove any code that is not needed or that is never executed. This can help improve the clarity and efficiency of the contract.

### 

### L16 - Validate Variable Setters

| **Criticality** | Minor / Informative |
| --- | --- |
| **Location** | zkPiggyAI.sol#L180 |
| **Status** | Unresolved |

#### Description

The contract performs operations on variables that have been configured on user-supplied input. These variables are missing of proper check for the case where a value is zero. This can lead to problems when the contract is executed, as certain actions may not be properly handled when the value is zero.

| owner=\_newonwer |
| --- |

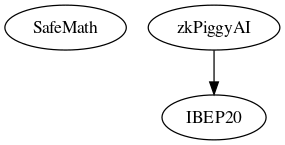
#### Recommendation

By adding the proper check, the contract will not allow the variables to be configured with zero value. This will ensure that the contract can handle all possible input values and avoid unexpected behavior or errors. Hence, it can help to prevent the contract from being exploited or operating unexpectedly.

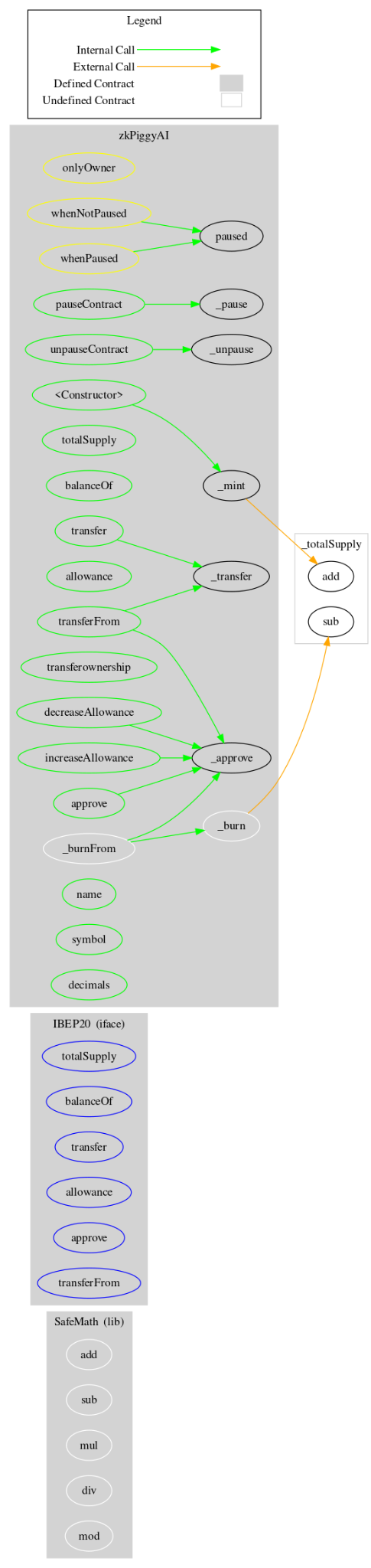
## Functions Analysis

| **Contract** | **Type** | **Bases** |  |  |
| --- | --- | --- | --- | --- |
|  | **Function Name** | **Visibility** | **Mutability** | **Modifiers** |
|  |  |  |  |  |
| **SafeMath** | Library |  |  |  |
|  | add | Internal |  |  |
|  | sub | Internal |  |  |
|  | mul | Internal |  |  |
|  | div | Internal |  |  |
|  | mod | Internal |  |  |
|  |  |  |  |  |
| **IBEP20** | Interface |  |  |  |
|  | totalSupply | External️ |  | -️ |
|  | balanceOf | External️ |  | -️ |
|  | transfer | External️ | ✓ | -️ |
|  | allowance | External️ |  | -️ |
|  | approve | External️ | ✓ | -️ |
|  | transferFrom | External️ | ✓ | -️ |
|  |  |  |  |  |
| **zkPiggyAI** | Implementation | IBEP20 |  |  |
|  |  | Public️ | ✓ | -️ |
|  | paused | Public️ |  | -️ |
|  | \_pause | Internal | ✓ | whenNotPaused |
|  | \_unpause | Internal | ✓ | whenPaused |
|  | pauseContract | Public️ | ✓ | onlyOwner |
|  | unpauseContract | Public️ | ✓ | onlyOwner |
|  | totalSupply | Public️ |  | -️ |
|  | balanceOf | Public️ |  | -️ |
|  | transfer | Public️ | ✓ | whenNotPaused |
|  | allowance | Public️ |  | -️ |
|  | approve | Public️ | ✓ | -️ |
|  | transferownership | Public️ | ✓ | onlyOwner |
|  | transferFrom | Public️ | ✓ | whenNotPaused |
|  | increaseAllowance | Public️ | ✓ | whenNotPaused |
|  | decreaseAllowance | Public️ | ✓ | whenNotPaused |
|  | \_transfer | Internal | ✓ | whenNotPaused |
|  | \_mint | Internal | ✓ |  |
|  | \_burn | Internal | ✓ | whenNotPaused |
|  | \_approve | Internal | ✓ | whenNotPaused |
|  | \_burnFrom | Internal | ✓ | whenNotPaused |
|  | name | Public️ |  | -️ |
|  | symbol | Public️ |  | -️ |
|  | decimals | Public️ |  | -️ |

## Inheritance Graph



## Flow Graph



## Summary

zkPiggyAI contract implements a token mechanism. This audit investigates security issues, business logic concerns, and potential improvements. There are some functions that can be abused by the owner like stopping transactions. A multi-wallet signing pattern will provide security against potential hacks. Temporarily locking the contract or renouncing ownership will eliminate all the contract threats.

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Cyberscope is a blockchain cybersecurity company that was founded with the vision to make web3.0 a safer place for investors and developers. Since its launch, it has worked with thousands of projects and is estimated to have secured tens of millions of investors’ funds.

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**The Cyberscope team**

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