

HACKEN

SMART CONTRACT CODE REVIEW AND SECURITY ANALYSIS REPORT

Customer: Crodex

Date: November 23rd, 2021



This document may contain confidential information about IT systems and the intellectual property of the Customer as well as information about potential vulnerabilities and methods of their exploitation.

The report containing confidential information can be used internally by the Customer, or it can be disclosed publicly after all vulnerabilities are fixed – upon a decision of the Customer.

Document

Name	Smart Contract Code Review and Security Analysis Report for Crodex.
Approved by	Andrew Matiukhin CTO Hacken OU
Type	ERC20 Token; DEX; Staking
Platform	Cronos Chain / Solidity
Methods	Architecture Review, Functional Testing, Computer-Aided Verification, Manual Review
Repository	https://github.com/crodexapp/contracts
Commit	33725cd8d7aa018022a54aaa0e7fa29a89a4c2a4
Technical Documentation	NO
JS tests	NO
Website	crodex.app
Timeline	18 NOVEMBER 2021 - 23 NOVEMBER 2021
Changelog	23 NOVEMBER 2021 - INITIAL AUDIT



Table of contents

Introduction	4
Scope	4
Executive Summary	6
Severity Definitions	8
Audit overview	9
Conclusion	10
Disclaimers	11

Introduction

Hacken OÜ (Consultant) was contracted by Crodex (Customer) to conduct a Smart Contract Code Review and Security Analysis. This report presents the findings of the security assessment of the Customer's smart contract and its code review conducted between November 18th, 2021 - November 23rd, 2021.

Scope

The scope of the project is smart contracts in the repository:

Repository:

<https://github.com/crodexapp/contracts>

Commit:

[33725cd8d7aa018022a54aaa0e7fa29a89a4c2a4](https://github.com/crodexapp/contracts/commit/33725cd8d7aa018022a54aaa0e7fa29a89a4c2a4)

Technical Documentation: No

JS tests: No

Contracts:

[dex/interfaces/IUniswapV2Callee.sol](#)
[dex/UniswapV2Pair.sol](#)
[dex/UniswapV2Factory.sol](#)
[dex/libraries/Math.sol](#)
[dex/interfaces/IUniswapV2ERC20.sol](#)
[dex/Mutlicall.sol](#)
[dex/UniswapV2Router02.sol](#)
[dex/interfaces/IUniswapV2Pair.sol](#)
[dex/libraries/UniswapV2Library.sol](#)
[staking/StakingRewardsFactory.sol](#)
[token/CrodexToken.sol](#)
[staking/RewardsDistributionRecipient.sol](#)
[dex/libraries/UniswapV2LiquidityMathLibrary.sol](#)
[dex/interfaces/IERC20.sol](#)
[dex/interfaces/IUniswapV2Router02.sol](#)
[dex/libraries/UniswapV2OracleLibrary.sol](#)
[dex/interfaces/IUniswapV2Factory.sol](#)
[dex/libraries/SafeMath.sol](#)
[staking/StakingRewards.sol](#)
[dex/UniswapV2ERC20.sol](#)
[staking/interfaces/ISTakingRewards.sol](#)
[dex/libraries/UQ112x112.sol](#)



We have scanned this smart contract for commonly known and more specific vulnerabilities. Here are some of the commonly known vulnerabilities that are considered:

Category	Check Item
Code review	<ul style="list-style-type: none">▪ Reentrancy▪ Ownership Takeover▪ Timestamp Dependence▪ Gas Limit and Loops▪ DoS with (Unexpected) Throw▪ DoS with Block Gas Limit▪ Transaction-Ordering Dependence▪ Style guide violation▪ Costly Loop▪ ERC20 API violation▪ Unchecked external call▪ Unchecked math▪ Unsafe type inference▪ Implicit visibility level▪ Deployment Consistency▪ Repository Consistency▪ Data Consistency
Functional review	<ul style="list-style-type: none">▪ Business Logics Review▪ Functionality Checks▪ Access Control & Authorization▪ Escrow manipulation▪ Token Supply manipulation▪ Assets integrity▪ User Balances manipulation▪ Data Consistency manipulation▪ Kill-Switch Mechanism▪ Operation Trails & Event Generation



Executive Summary

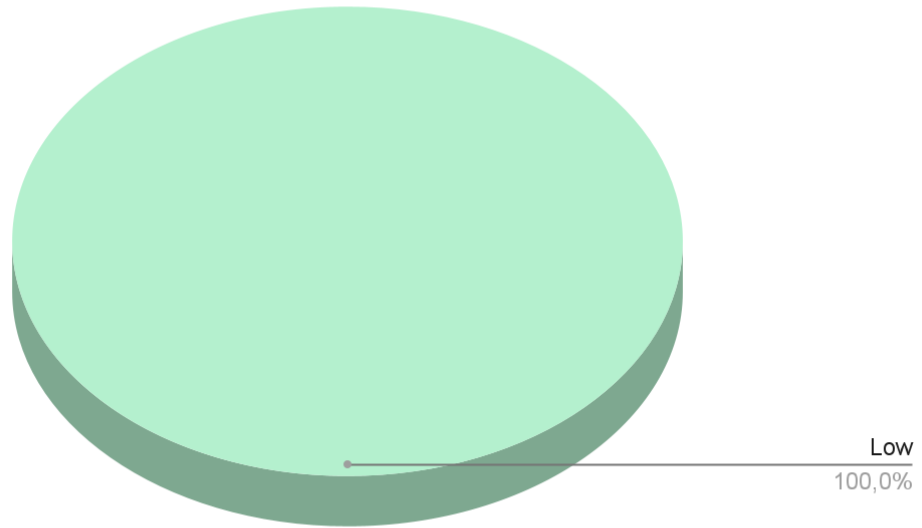
According to the assessment, the Customer's smart contracts are well-secured.



Our team performed an analysis of code functionality, manual audit, and automated checks with Mythril and Slither. All issues found during automated analysis were manually reviewed, and important vulnerabilities are presented in the Audit overview section. All found issues can be found in the Audit overview section.

As a result of the audit, security engineers found **3** low severity issues.

Graph 1. The distribution of vulnerabilities after the audit.



Severity Definitions

Risk Level	Description
Critical	Critical vulnerabilities are usually straightforward to exploit and can lead to assets loss or data manipulations.
High	High-level vulnerabilities are difficult to exploit; however, they also have a significant impact on smart contract execution, e.g., public access to crucial functions
Medium	Medium-level vulnerabilities are important to fix; however, they can't lead to assets loss or data manipulations.
Low	Low-level vulnerabilities are mostly related to outdated, unused, etc. code snippets that can't have a significant impact on execution

Audit overview

■ ■ ■ ■ Critical

No critical issues were found.

■ ■ ■ High

No high severity issues were found.

■ ■ Medium

No medium severity issues were found.

■ Low

1. Accessing a state variable in the loop.

It is more sufficient to save “stakingTokens.length” into a local variable and read it in the loop instead.

Contracts: StakingRewardsFactory.sol

Function: notifyRewardAmounts

Recommendation: Please save “stakingTokens.length” to local variable.

2. A public function that could be declared external.

public functions that are never called by the contract should be declared **external** to save gas.

Contracts: StakingRewardsFactory.sol

Function: notifyRewardAmounts

Recommendation: Use the **external** attribute for functions never called from the contract.

3. Too many digits.

Literals with many digits are difficult to read and review.

Contracts: CrodexToken.sol

Function: constructor

Recommendation: Please use scientific notation with ether suffix (ex: *100e3 ether*).



Conclusion

Smart contracts within the scope were manually reviewed and analyzed with static analysis tools.

The audit report contains all found security vulnerabilities and other issues in the reviewed code.

As a result of the audit, security engineers found **3** low severity issues.



Disclaimers

Hacken Disclaimer

The smart contracts given for audit have been analyzed in accordance with the best industry practices at the date of this report, in relation to cybersecurity vulnerabilities and issues in smart contract source code, the details of which are disclosed in this report (Source Code); the Source Code compilation, deployment, and functionality (performing the intended functions).

The audit makes no statements or warranties on the security of the code. It also cannot be considered as a sufficient assessment regarding the utility and safety of the code, bug-free status, or any other statements of the contract. While we have done our best in conducting the analysis and producing this report, it is important to note that you should not rely on this report only – we recommend proceeding with several independent audits and a public bug bounty program to ensure the security of smart contracts.

Technical Disclaimer

Smart contracts are deployed and executed on a blockchain platform. The platform, its programming language, and other software related to the smart contract can have vulnerabilities that can lead to hacks. Thus, the audit can't guarantee the explicit security of the audited smart contracts.