

0.7

Alchemix Process Quality Review

Score: 44%

Overview

This is a [Alchemix](#) Process Quality Review completed on June 16th 2021. It was performed using the Process Review process (version 0.7.2) and is documented [here](#). The review was performed by Nic of DeFiSafety. Check out our [Telegram](#).

The final score of the review is 44%, a fail. The breakdown of the scoring is in [Scoring Appendix](#). For our purposes, a pass is 70%.

Summary of the Process

Very simply, the review looks for the following declarations from the developer's site. With these declarations, it is reasonable to trust the smart contracts.

- **Here are my smart contracts on the blockchain**
- **Here is the documentation that explains what my smart contracts do**
- **Here are the tests I ran to verify my smart contract**
- **Here are the audit(s) performed on my code by third party experts**
- **Here are the admin controls and strategies**

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Chain

This section indicates the blockchain used by this protocol.

Chain: Ethereum

Guidance:
Ethereum
Binance

Code and Team

This section looks at the code deployed on the Mainnet that gets reviewed and its corresponding software repository. The document explaining these questions is [here](#). This review will answer the questions;

- 1) Are the executing code addresses readily available? (%)
- 2) Is the code actively being used? (%)
- 3) Is there a public software repository? (Y/N)
- 4) Is there a development history visible? (%)
- 5) Is the team public (not anonymous)? (Y/N)

1) Are the executing code addresses readily available? (%)

 Answer: 20%

They are available at website <https://dyor.fi/alcx/#resources> as indicated in the [Appendix](#).

Note: Alchemix gets a 20% because the address repository was not labelled clearly, and was hidden behind: Website --> Launch App --> Stats --> Resources. Majority of users would not be able to find this.

Guidance:

- | | |
|------|--|
| 100% | Clearly labelled and on website, docs or repo, quick to find |
| 70% | Clearly labelled and on website, docs or repo but takes a bit of looking |
| 40% | Addresses in mainnet.json, in discord or sub graph, etc |
| 20% | Address found but labelling not clear or easy to find |
| 0% | Executing addresses could not be found |

How to improve this score

Make the Ethereum addresses of the smart contract utilized by your application available on either your website or your GitHub (in the README for instance). Ensure the addresses is up to date. This is a very important question wrt to the final score.

2) Is the code actively being used? (%)

 Answer: 100%

Activity is 700 transactions a day on contract *StakingPools.sol*, as indicated in the [Appendix](#).

Percentage Score Guidance

| | |
|------|-----------------------------------|
| 100% | More than 10 transactions a day |
| 70% | More than 10 transactions a week |
| 40% | More than 10 transactions a month |
| 10% | Less than 10 transactions a month |
| 0% | No activity |

3) Is there a public software repository? (Y/N)

 Answer: Yes

GitHub: <https://github.com/alchemix-finance>

Is there a public software repository with the code at a minimum, but normally test and scripts also (Y/N). Even if the repo was created just to hold the files and has just 1 transaction, it gets a Yes. For teams with private repos, this answer is No.

4) Is there a development history visible? (%)

 Answer: 20%

With 17 commits and 2 branches, this is a relatively unhealthy software repository.

This checks if the software repository demonstrates a strong steady history. This is normally demonstrated by commits, branches and releases in a software repository. A healthy history demonstrates a history of more than a month (at a minimum).

Guidance:

| | |
|------|--------------------------------------|
| 100% | Any one of 100+ commits, 10+branches |
| 70% | Any one of 70+ commits, 7+branches |
| 50% | Any one of 50+ commits, 5+branches |

| | |
|-----|--|
| 30% | Any one of 30+ commits, 3+branches |
| 0% | Less than 2 branches or less than 10 commits |

How to improve this score

Continue to test and perform other verification activities after deployment, including routine maintenance updating to new releases of testing and deployment tools. A public development history indicates clearly to the public the level of continued investment and activity by the developers on the application. This gives a level of security and faith in the application.

5) Is the team public (not anonymous)? (Y/N)

 Answer: No

The only public dev from Alchemix is using the avatar "[Scoopy Trooples](#)", so they are essentially anonymous.

For a yes in this question the real names of some team members must be public on the website or other documentation. If the team is anonymous and then this question is a No.

Documentation

This section looks at the software documentation. The document explaining these questions is [here](#).

Required questions are;

- 6) Is there a whitepaper? (Y/N)
- 7) Are the basic software functions documented? (Y/N)
- 8) Does the software function documentation fully (100%) cover the deployed contracts? (%)
- 9) Are there sufficiently detailed comments for all functions within the deployed contract code (%)
- 10) Is it possible to trace from software documentation to the implementation in code (%)

6) Is there a whitepaper? (Y/N)

 Answer: Yes

Location: <https://alchemix.fi/c76d1d663f6c8247b86a8fca83d5bd1b.pdf>

7) Are the basic software functions documented? (Y/N)

 Answer: No

No software function documentation in their GitHub, GitBooks, Website, or Whitepaper.

How to improve this score

Write the document based on the deployed code. For guidance, refer to the [SecurEth System Description Document](#).

8) Does the software function documentation fully (100%) cover the deployed contracts? (%)

 Answer: 0%

No software function documentation in their GitHub, GitBooks, Website, or Whitepaper.

Guidance:

- 100% All contracts and functions documented
- 80% Only the major functions documented
- 79-1% Estimate of the level of software documentation
- 0% No software documentation

How to improve this score

This score can improve by adding content to the requirements document such that it comprehensively covers the requirements. For guidance, refer to the [SecurEth System Description Document](#). Using tools that aid traceability detection will help.

9) Are there sufficiently detailed comments for all functions within the deployed contract code (%)

 Answer: 52%

Code examples are in the [Appendix](#). As per the [SLOC](#), there is 52% commenting to code (CtC).

The Comments to Code (CtC) ratio is the primary metric for this score.

Guidance:

- 100% CtC > 100 Useful comments consistently on all code
- 90-70% CtC > 70 Useful comment on most code
- 60-20% CtC > 20 Some useful commenting
- 0% CtC < 20 No useful commenting

How to improve this score

This score can improve by adding comments to the deployed code such that it comprehensively covers the code. For guidance, refer to the [SecurEth Software Requirements](#).

10) Is it possible to trace from software documentation to the implementation in code (%)

 Answer: 0%

There is absolutely no software function documentation publicly available in any of their docs, meaning that you cannot trace it back to its code.

Guidance:

- 100% Clear explicit traceability between code and documentation at a requirement level for all code
- 60% Clear association between code and documents via non explicit traceability
- 40% Documentation lists all the functions and describes their functions
- 0% No connection between documentation and code

How to improve this score

This score can improve by adding traceability from requirements to code such that it is clear where each requirement is coded. For reference, check the SecurEth guidelines on [traceability](#).

Testing

This section looks at the software testing available. It is explained in this [document](#). This section answers the following questions;

- 11) Full test suite (Covers all the deployed code) (%)
- 12) Code coverage (Covers all the deployed lines of code, or explains misses) (%)
- 13) Scripts and instructions to run the tests (Y/N)
- 14) Report of the results (%)
- 15) Formal Verification test done (%)
- 16) Stress Testing environment (%)

11) Is there a Full test suite? (%)

 Answer: 40%

Code examples are in the [Appendix](#). As per the [SLOC](#), there is 77% testing to code (TtC).

This score is guided by the Test to Code ratio (TtC). Generally a good test to code ratio is over 100%. However the reviewers best judgement is the final deciding factor.

Guidance:

- 100% TtC > 120% Both unit and system test visible
- 80% TtC > 80% Both unit and system test visible

40% TtC < 80% Some tests visible

0% No tests obvious

How to improve this score

This score can improve by adding tests to fully cover the code. Document what is covered by traceability or test results in the software repository.

12) Code coverage (Covers all the deployed lines of code, or explains misses) (%)

 Answer: 30%

No indication of code coverage, and there is an evident but incomplete set of tests.

Guidance:

100% Documented full coverage

99-51% Value of test coverage from documented results

50% No indication of code coverage but clearly there is a reasonably complete set of tests

30% Some tests evident but not complete

0% No test for coverage seen

How to improve this score

This score can improve by adding tests achieving full code coverage. A clear report and scripts in the software repository will guarantee a high score.

13) Scripts and instructions to run the tests (Y/N)

 Answer: No

No scripts or instructions to run tests were found in their repo.

How to improve this score

Add the scripts to the repository and ensure they work. Ask an outsider to create the environment and run the tests. Improve the scripts and docs based on their feedback.

14) Report of the results (%)

 Answer: 0%

No test report evident in their repo.

Guidance:

100% Detailed test report as described below

70% GitHub Code coverage report visible

0% No test report evident

How to improve this score

Add a report with the results. The test scripts should generate the report or elements of it.

15) Formal Verification test done (%)

 Answer: 0%

No evidence of an Alchemix Formal Verification was found.

16) Stress Testing environment (%)

 Answer: 0%

No test-net smart contract addresses were found.

Security

This section looks at the 3rd party software audits done. It is explained in this [document](#). This section answers the following questions;

17) Did 3rd Party audits take place? (%)

18) Is the bounty value acceptably high?

17) Did 3rd Party audits take place? (%)

 Answer: 70%

[Certik did a Alchemix audit on May 18th 2021.](#)

Alchemix was launched in early April 2021. Token was launched May 17th 2021.

Guidance:

100% Multiple Audits performed before deployment and results public and implemented or not required

- 90% Single audit performed before deployment and results public and implemented or not required
- 70% Audit(s) performed after deployment and no changes required. Audit report is public
- 50% Audit(s) performed after deployment and changes needed but not implemented
- 20% No audit performed
- 0% Audit Performed after deployment, existence is public, report is not public and no improvements deployed OR smart contract address' not found, question

18) Is the bounty value acceptably high (%)

 Answer: 50%

Program can be found at <https://immunefi.com/bounty/alchemix/>.

Live since March 1st 2021, max reward is 50k.

Guidance:

- 100% Bounty is 10% TVL or at least \$1M AND active program (see below)
- 90% Bounty is 5% TVL or at least 500k AND active program
- 80% Bounty is 5% TVL or at least 500k
- 70% Bounty is 100k or over AND active program
- 60% Bounty is 100k or over
- 50% Bounty is 50k or over AND active program
- 40% Bounty is 50k or over
- 20% Bug bounty program bounty is less than 50k
- 0% No bug bounty program offered

Active program means a third party actively driving hackers to the site. Inactive program would be static mention on the docs.

Access Controls

This section covers the documentation of special access controls for a DeFi protocol. The admin access controls are the contracts that allow updating contracts or coefficients in the protocol. Since these contracts can allow the protocol admins to "change the rules", complete disclosure of capabilities is vital for user's transparency. It is explained in this [document](#). The questions this section asks are as follow;

- 19) Can a user clearly and quickly find the status of the admin controls?
- 20) Is the information clear and complete?
- 21) Is the information in non-technical terms that pertain to the investments?
- 22) Is there Pause Control documentation including records of tests?

19) Can a user clearly and quickly find the status of the access controls (%)

 Answer: 70%

Found at <https://alchemix-finance.gitbook.io/alchemix-finance/alchemix-dao#governance-process>.

Guidance:

- 100% Clearly labelled and on website, docs or repo, quick to find
- 70% Clearly labelled and on website, docs or repo but takes a bit of looking
- 40% Access control docs in multiple places and not well labelled
- 20% Access control docs in multiple places and not labelled
- 0% Admin Control information could not be found

20) Is the information clear and complete (%)

 Answer: 25%

- a) Transmuter was described as upgraded in their docs. This is the only reference to upgradability. 10%
- b) There are MultiSig capabilities defined, but no direct references for who the signators are in their GitBooks and Whitepaper. 15% (NOTE: the multisig signatores are indicated in the audit but not in their docs)
- c) No capabilities for change in the contracts is described in any of their documentation.

Score: 10%+15%=25%

Guidance:

All the contracts are immutable -- 100% OR

- a) All contracts are clearly labelled as upgradeable (or not) -- 30% AND
- b) The type of ownership is clearly indicated (OnlyOwner / MultiSig / Defined Roles) -- 30% AND
- c) The capabilities for change in the contracts are described -- 30%

How to improve this score

Create a document that covers the items described above. An [example](#) is enclosed.

21) Is the information in non-technical terms that pertain to the investments (%)

 Answer: 90%

Guidance:

- 100% All the contracts are immutable
- 90% Description relates to investments safety and updates in clear, complete non-software language

- | | |
|-----|---|
| 30% | Description all in software specific language |
| 0% | No admin control information could not be found |

How to improve this score

Create a document that covers the items described above in plain language that investors can understand. An [example](#) is enclosed.

22) Is there Pause Control documentation including records of tests (%)

 Answer: 40%

Pause Control mentioned in <https://alchemix-finance.gitbook.io/alchemix-finance/vaults>, with no further details or testing.

Guidance:

- | | |
|------|---|
| 100% | All the contracts are immutable or no pause control needed and this is explained OR |
| 100% | Pause control(s) are clearly documented and there is records of at least one test within 3 months |
| 80% | Pause control(s) explained clearly but no evidence of regular tests |
| 40% | Pause controls mentioned with no detail on capability or tests |
| 0% | Pause control not documented or explained |

How to improve this score

Create a document that covers the items described above in plain language that investors can understand. An [example](#) is enclosed.

Appendices

Author Details

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I started with Ethereum just before the DAO and that was a wonderful education. It showed the importance of code quality. The second Parity hack also showed the importance of good process. Here my aviation background offers some value. Aerospace knows how to make reliable code using quality processes.

I was coaxed to go to EthDenver 2018 and there I started [SecuEth.org](#) with Bryant and Roman. We created guidelines on good processes for blockchain code development. We got [EthFoundation funding](#) to assist in their development.

Process Quality Reviews are an extension of the SecurEth guidelines that will further increase the quality

processes in Solidity and Vyper development.

DeFiSafety is my full time gig and we are working on funding vehicles for a permanent staff.

Scoring Appendix

| | Total | Alchemix | |
|---|--------|----------|--------|
| | Points | Answer | Points |
| PQ Audit Scoring Matrix (v0.7) | Total | 260 | 115.5 |
| Code and Team | | | 44% |
| Code Documentation | | | |
| 6) Is there a whitepaper? (Y/N) | 5 | Y | 5 |
| 7) Are the basic software functions documented? (Y/N) | 10 | Y | 10 |
| 8) Does the software function documentation fully (100%) cover the deployed contracts? (%) | 15 | 20% | 3 |
| 9) Are there sufficiently detailed comments for all functions within the deployed contract code (%) | 5 | 0% | 0 |
| 10) Is it possible to trace from software documentation to the implementation in code (%) | 10 | 0% | 0 |
| Testing | | | |
| 11) Full test suite (Covers all the deployed code) (%) | 20 | 40% | 8 |
| 12) Code coverage (Covers all the deployed lines of code, or explains misses) (%) | 5 | 30% | 1.5 |
| 13) Scripts and instructions to run the tests? (Y/N) | 5 | N | 0 |
| 14) Report of the results (%) | 10 | 0% | 0 |
| 15) Formal Verification test done (%) | 5 | 0% | 0 |
| 16) Stress Testing environment (%) | 5 | 0% | 0 |
| Security | | | |
| 17) Did 3rd Party audits take place? (%) | 70 | 70% | 49 |
| 18) Is the bug bounty acceptable high? (%) | 10 | 50% | 5 |
| Access Controls | | | |
| 19) Can a user clearly and quickly find the status of the admin controls | 5 | 70% | 3.5 |
| 20) Is the information clear and complete | 10 | 25% | 2.5 |
| 21) Is the information in non-technical terms | 10 | 90% | 9 |
| 22) Is there Pause Control documentation including records of tests | 10 | 40% | 4 |
| Section Scoring | | | |
| Code and Team | 50 | 30% | |
| Documentation | 45 | 40% | |
| Testing | 50 | 19% | |
| Security | 80 | 68% | |
| Access Controls | 35 | 54% | |

Executing Code Appendix

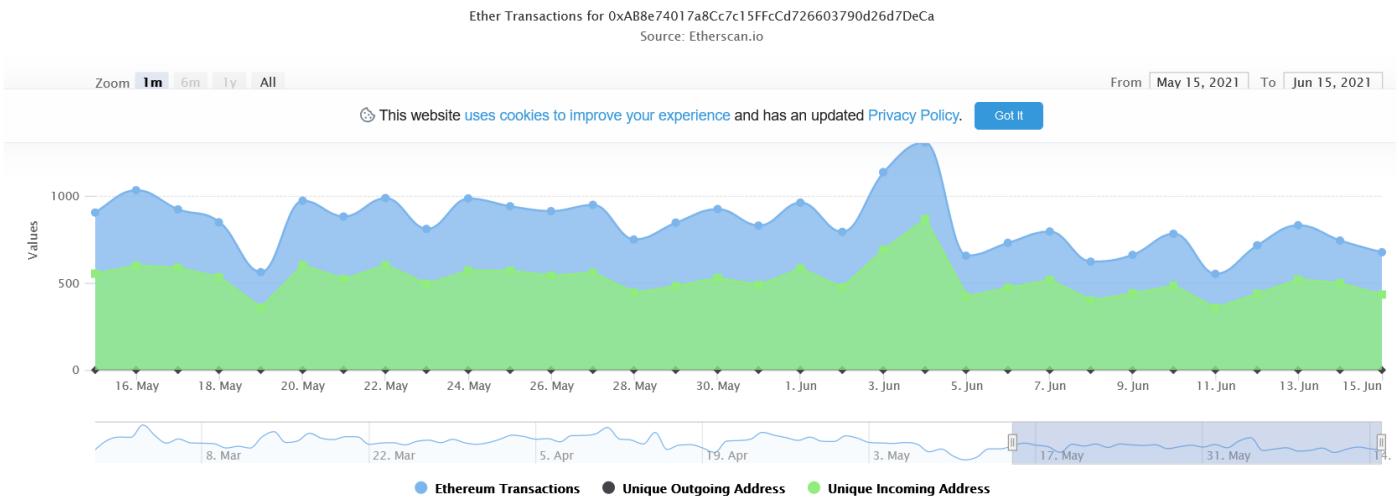
```

ALCX: 0xdBdb4d16EdA451D0503b854CF79D55697F90c8DF →
AIUSD: 0xBC6DA0FE9aD5f3b0d58160288917AA56653660E9 →
Alchemist: 0xc21D353FF4ee73C572425697f4F5aaD2109fe35b →
Transmuter: 0xaB7A49B971AFdc7Ee26255038C82b4006D122086 →
YearnVaultAdapter: 0x014dE182c147f8663589d77eAdB109Bf86958f13 →
StakingPools: 0xAB8e74017a8Cc7c15FFcCd726603790d26d7DeCa →
TimeToken: 0x869d1b8610c038A6C4F37bD757135d4C29ae8917 →
MultiSigWalletWithTimelock: 0x8392E6664242FA56123E71949B52d883aE57a225

```

```
TransmuterB: 0xf3cFfaEEa177Db444b68FB6f033d4a82f6D8C82d →
TransmuterVaultAdapter: 0x491EAFC47D019B44e13Ef7cC649bbA51E15C61d7 →
SLP token: 0xc3f279090a47e80990fe3a9c30d24cb117ef91a8 →
Curve LP token: 0x43b4FdFD4Ff969587185cDB6f0BD875c5Fc83f8c →
```

Code Used Appendix



Example Code Appendix

```
1 event TokensClaimed(
2     address indexed user,
3     uint256 indexed poolId,
4     uint256 amount
5 );
6
7 /// @dev The token which will be minted as a reward for staking.
8 IMintableERC20 public reward;
9
10 /// @dev The address of the account which currently has administrative capabilities over
11 address public governance;
12
13 address public pendingGovernance;
14
15 /// @dev Tokens are mapped to their pool identifier plus one. Tokens that do not have an
16 /// will return an identifier of zero.
17 mapping(IERC20 => uint256) public tokenPoolIds;
18
19 /// @dev The context shared between the pools.
20 Pool.Context private _ctx;
21
22 /// @dev A list of all of the pools.
23 Pool.List private _pools;
24
```

```
25 /// @dev A mapping of all of the user stakes mapped first by pool and then by address.
26 mapping(address => mapping(uint256 => Stake.Data)) private _stakes;
27
28 constructor(
29     IMintableERC20 _reward,
30     address _governance
31 ) public {
32     require(_governance != address(0), "StakingPools: governance address cannot be 0x0");
33
34     reward = _reward;
35     governance = _governance;
36 }
37
38 /// @dev A modifier which reverts when the caller is not the governance.
39 modifier onlyGovernance() {
40     require(msg.sender == governance, "StakingPools: only governance");
41     _;
42 }
43
44 /// @dev Sets the governance.
45 /**
46 /// This function can only called by the current governance.
47 /**
48 /// @param _pendingGovernance the new pending governance.
49 function setPendingGovernance(address _pendingGovernance) external onlyGovernance {
50     require(_pendingGovernance != address(0), "StakingPools: pending governance address can't be 0x0");
51     pendingGovernance = _pendingGovernance;
52
53     emit PendingGovernanceUpdated(_pendingGovernance);
54 }
55
56 function acceptGovernance() external {
57     require(msg.sender == pendingGovernance, "StakingPools: only pending governance");
58
59     address _pendingGovernance = pendingGovernance;
60     governance = _pendingGovernance;
61
62     emit GovernanceUpdated(_pendingGovernance);
63 }
64
65 /// @dev Sets the distribution reward rate.
66 /**
67 /// This will update all of the pools.
68 /**
69 /// @param _rewardRate The number of tokens to distribute per second.
70 function setRewardRate(uint256 _rewardRate) external onlyGovernance {
71     _updatePools();
72
73     _ctx.rewardRate = _rewardRate;
74
75     emit RewardRateUpdated(_rewardRate);
76 }
77
```

```

78  /// @dev Creates a new pool.
79  ///
80  /// The created pool will need to have its reward weight initialized before it begins ge
81  ///
82  /// @param _token The token the pool will accept for staking.
83  ///
84  /// @return the identifier for the newly created pool.
85  function createPool(IERC20 _token) external onlyGovernance returns (uint256) {
86      require(tokenPoolIds[_token] == 0, "StakingPools: token already has a pool");
87
88      uint256 _poolId = _pools.length();
89

```

SLOC Appendix

Solidity Contracts

| Language | Files | Lines | Blanks | Comments | Code | Complex |
|----------|-------|-------|--------|----------|------|---------|
| Solidity | 34 | 6313 | 1022 | 1805 | 3486 | 360 |

Comments to Code $1805/3486 = 52\%$

Javascript Tests

| Language | Files | Lines | Blanks | Comments | Code | Complex |
|------------|-------|-------|--------|----------|------|---------|
| JavaScript | 7 | 3332 | 540 | 111 | 2681 | 11 |

Tests to Code $2681/3486 = 77\%$