Memorandum from the Office of the Inspector General

August 13, 2018

Steven M. Douglas, LP 3R-C
Jeremy P. Fisher, MR 6D-C
Jacinda B. Woodward, BR 4D-C

REQUEST FOR MANAGEMENT DECISION – AUDIT 2017-15454 – NETWORK ARCHITECTURE – NUCLEAR

As part of our annual audit plan, we audited the network architecture of a Tennessee Valley Authority (TVA) nuclear power plant. Our objective was to determine if the network architecture and assets in use to support a specific nuclear power plant's business and operational functions are compliant with TVA policies, procedures and identified best practices.

In summary, we found TVA management used proven best practices in the design of the corporate physical and wireless networks and the control network. However, we found cabling that was not following manufacturer's guidelines and several control network device configurations deviated from TVA baselines and industry best practices. Specifics of the identified issues were omitted from this report due to their sensitive nature in relation to TVA's cyber security but were formally communicated to TVA management in debriefings on May 9 and May 10, 2018. We recommend TVA's Senior Vice President, Resources and River Management, and Director, Information Technology (IT) Engineering and Operations, work together to identify and deploy a solution that follows manufacturer guidelines and specifications for the cabling issues identified during this audit. We also recommend TVA's Vice President, Nuclear Engineering, ensure the identified network device exceptions are remediated as appropriate. TVA management agreed with the audit findings and recommendations in this report. See Appendices A and B for TVA management's complete response.

BACKGROUND

Network infrastructure provides the communication path between users, processes, applications, and services. It also includes segregation of the corporate and control networks to ensure safety and confidentiality of information. TVA relies on network infrastructure to communicate, access critical applications, and operate its core business functions. Failure of this infrastructure has the potential to affect critical activities and systems such as nuclear outages, plant monitoring systems, and business productivity applications. As part of an ongoing effort to audit TVA's network infrastructure, we selected a nuclear power plant site for review.

OBJECTIVE, SCOPE, AND METHODOLOGY

Our objective was to determine if the network architecture and assets in use to support business and operational functions at a nuclear power plant were compliant with TVA policies, procedures, and identified best practices. The scope of this audit was limited to the control, corporate, and wireless networks and their respective network devices and cable plants. Fieldwork was performed from December 2017 through May 2018. To achieve our objective, we:

- Interviewed IT, Facilities, and Nuclear personnel to obtain information on TVA's architecture of corporate and control networks.
- Obtained and reviewed IT Standard Programs and Processes, 09.003, *Configuration Settings Management.*
- Reviewed architecture of the corporate and control networks to determine if they were appropriately designed, segregated, and monitored.
- Obtained and compared configuration files from corporate and control networks against identified best practices and TVA developed baselines as described in IT Standard Programs and Processes, 09.003, *Configuration Settings Management*.
- Performed a physical walkthrough of the facility while utilizing tools to determine wireless networks available in and around the nuclear complex to determine the network's authentication and encryption configurations.
- Reviewed the corporate network cabling architecture for redundancy and capacity.
- Determined the population of networking devices used to support the corporate and control network for the nuclear power plant by reviewing network diagrams, inventory lists, and output from network device commands.
- Reviewed a judgmental sample of 21 networking devices based on device risk, purpose, location, and potential impact upon failure. Since this was a judgmental sample, the results of the sample cannot be projected to the population.

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

FINDINGS

We reviewed the logical and physical network architecture and identified segregation of networks, which included a corporate network and a control network for power operations. In summary, we found TVA management has used proven best practices in the design of the corporate physical and wireless networks and the control network. However, we found cabling that was not following manufacturer's guidelines and several control network

device configurations deviated from TVA baselines and industry best practices. Specifics of the identified issues were omitted from this report due to their sensitive nature in relation to TVA's cyber security, but were formally communicated to TVA management in debriefings on May 9 and May 10, 2018.

Network Cabling Beyond Industry Specified Distance
We reviewed the corporate network cabling architecture and noted that of the 18 network connections between buildings at the nuclear plant site, 4 were not following manufacturer guidelines and specifications to accommodate the distance between buildings. When operating outside of manufacturer guidelines and specifications, the risk of network failure increases.

Control Network Configuration Issues
TVA has defined a baseline of standard settings for network devices to assist in secure device configuration. We compared a sample of 21 devices from the control network with standard TVA baselines and noted 19 were out of compliance. In addition, we compared the same sample against industry best practices and noted 11 of the 21 devices had exceptions. Deviating from TVA baselines and industry standards can increase risk for vulnerabilities and exposures. TVA management informed us remediation efforts are underway to address the exceptions.

RECOMMENDATIONS

1. We recommend TVA's Senior Vice President, Resources and River Management, and Director, IT Engineering and Operations, work together to identify and deploy a solution that follows manufacturer guidelines and specifications for the 4 network connections identified.

   TVA Management's Comments – TVA management agreed with the audit findings and recommendations in this report. See Appendix A for TVA management's complete response.

2. We also recommend TVA's Vice President, Nuclear Engineering, ensure the identified network device exceptions are remediated as appropriate.

   TVA Management's Comments – TVA management agreed with the audit findings and recommendations in this report and stated remediation actions were complete. See Appendix B for TVA management's complete response

Auditor's Response – We were unable to verify that remediation actions had been completed at the time the final report was issued. Accordingly, we will continue to work with TVA management to confirm remediation actions have been completed.

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This report is for your review and information. Please advise us of your management decision within 60 days from the date of this report. Information contained in this report will be subject to public disclosure. If you have any questions, please contact Megan E. Spitzer, Auditor, at (865) 633-7394 or Sarah E. Huffman, Director, IT Audits, at (865) 633-7345. We appreciate the courtesy and cooperation received from your staff during the audit.

David P. Wheeler
Assistant Inspector General
(Audits and Evaluations)
WT 2C-K

MES:FAJ
Attachments
cc (Attachments):
TVA Board of Directors
Michael A. Balduzzi, LP 4A-C
Andrea S. Brackett, WT 5D-K
Janet J. Brewer, WT 7C-K
Jason J. Castro, MP 5G-C
David M. Czufin, LP 4A-C
Robertson D. Dickens, WT 9C-K
Michael J. Durr, LP 4G-C
Joseph P. Grimes, LP 6A-C
John D. Hall, BR 1C-C
William D. Johnson, WT 7B-K
Dwain K. Lanier, MR 6D-C
Justin C. Maierhofer, WT 7B-K
Jill M. Matthews, WT 2C-K
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Michael D. Skaggs, WT 7B-K
Laura L. Snyder, MP 5G-C
John. M Thomas III, MR 6D-C
Keith R. Youngblood, MP 3B-C
OIG File No. 2017-15454

July 20, 2018

David Wheeler, ET 3C-K

RESPONSE TO REQUEST FOR MANAGEMENT DECISION – AUDIT 2017-15454 – NETWORK ARCHITECTURE – NUCLEAR

Our response to your request for comments regarding the subject draft report is attached. Please let us know if your staff has any concerns with TVA's comments.

We would like to thank Sarah Huffman, Megan Spitzer, and the audit team for their professionalism and cooperation in conducting this audit. If you have any questions, please contact Krystal Brandenburg or John Hall.

Jeremy Fisher
Director, IT Planning & Operations
Information Technology
MP 5C-C

David Bowling on behalf of Jacinda Woodward
Senior Vice President
Resources & River Management
BR 4D-C

cc (Attachment):

Michael Balduzzi, LP 4A-C
Andrea Brackett, WT 5D-K
Krystal Brandenburg, MP 2B-C
Jason Castro, MP 5G-C
David Czufin, LP 4A-C
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OIG File No. 2017-15454

AUDIT 2017-15454
Network Architecture – Nuclear
Response to Request for Comments

ATTACHMENT A
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	Recommendations	Comments
1	We recommend TVA's Senior Vice President, Resources and River Management, and Director, IT Engineering and Operations, work together to identify and deploy a solution that follows manufacturer guidelines and specifications for the 4 network connections identified.	Management agrees.

Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402-2801

July 20, 2018

David Wheeler, ET 3C-K

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Our response to your request for comments regarding the subject draft report is attached. Please let us know if your staff has any concerns with TVA's comments.

We would like to thank Sarah Huffman, Megan Spitzer, and the audit team for their professionalism and cooperation in conducting this audit. If you have any questions, please contact Jason Castro or Michael Durr.

Michael Durr
Director Design & Computer Engineering

Steven Douglas
Vice President Nuclear Engineering

cc (Attachment):
Michael Balduzzi, LP 4A-C
David Czufin, LP 4A-C
Joe Grimes, LP 6A-C
Curtis Hudson, WT 2C-K
Sarah Huffman, WT 2C-K
Megan Spitzer, WT 2C-K

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ATTACHMENT A
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	Recommendations	Comments
2	We also recommend TVA's Vice President, Nuclear Engineering, ensure the identified network device exceptions are remediated as appropriate	Management agrees, the issues identified were minor in nature and had no adverse impact to the nuclear cyber security program, all remediation actions have been completed as of the date of this letter