



SOUTH CAROLINA REVENUE AND FISCAL AFFAIRS OFFICE

STATEMENT OF ESTIMATED FISCAL IMPACT

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Bill Number:	H. 4954	Introduced on January 25, 2024
Author:	Landing	
Subject:	Electromagnetic Pulse Protection	
Requestor:	House Labor, Commerce, and Industry	
RFA Analyst(s):	Manic	
Impact Date:	March 21, 2024	

Fiscal Impact Summary

This bill requires governments, utilities, and other entities to implement protections against an electromagnetic pulse (EMP) to protect critical infrastructure. Critical infrastructure includes facilities and assets located in the state belonging to or associated with the following: federal, state, and local governments; public utilities; health care; first responders; and public schools. The bill requires each entity that owns or is responsible for critical infrastructure to install special equipment intended to harden their system and assets against EMP within one year after the effective date of the act. In addition, the bill requires all the utilities operating in the state, including electrical utilities not within the jurisdiction of the Public Service Commission (PSC), to offer their residential customers an EMP protection program for their personal assets and allow their customers, if they so desire, to establish a payment plan through the customer's monthly utility bill. Further, the bill requires the General Assembly to provide funding in the FY 2024-25 Appropriations Act to assist government entities with critical infrastructure to obtain and install EMP protection. Finally, the bill requires all entities with critical infrastructure to obtain and install EMP hardening equipment within one year after the effective date of the act and imposes a fine of \$100 for each day of noncompliance.

To determine the expenditure impact of this bill, the Revenue and Fiscal Affairs Office (RFA) has surveyed the following agencies: Department of Administration (Admin), SC Law Enforcement Division (SLED), PSC, Office of Regulatory Staff (ORS), Public Service Authority (PSA), SC counties and the Municipal Association of SC (MASC), SC Department of Education (SCDE), and the Adjutant General's Office.

Admin reports that the one-time expenditure to harden its assets and systems against EMP events would total approximately \$15,782,000 in FY 2024-25. Annual recurring costs for maintenance and surveillance are expected to total approximately \$361,000 starting in FY 2025-26. According to the agency, this cost is allocated based on an integrated, four-layer defense methodology that is recommended by the U.S. Department of Homeland Security (DHS). While Admin provides information technology services to a large portion of state government, there may be other costs for agencies that maintain their own systems that are not included in this estimate.

SLED estimates that one-time expenses would total approximately \$4,875,000 in FY 2024-25 to acquire, install, and maintain equipment and components necessary to protect the agency's

systems and assets from an EMP event. Recurring costs thereafter would total \$160,000 for maintenance and surveillance. The agency will request General Fund appropriations for these expenses.

PSC indicates that the bill is expected to have no impact on the agency because the bill does not specify whether the agency will be responsible for approving electrical utilities' EMP protection programs, including the customer payment programs. Also, the agency states that the bill is not clear on the specific agency tasked with the monitoring of compliance and assessment of fines for noncompliance.

ORS indicates that the bill is expected to have no impact because it will be able to manage the additional responsibilities with existing staff and resources.

PSA indicates that the bill will have a substantial impact on the electrical utilities and will take a long implementation period estimated at ten years. The agency estimates a total cost of \$910,360,000 over the ten-year period, of which \$572,500,000 is to be spent on hardening transmission equipment, \$134,000,000 on distribution equipment, \$127,150,000 on generation equipment, \$4,710,000 on communications equipment, and \$72,000,000 on control centers. The agency also cautions that implementation of the above will add complexity and fragility to the existing system and will require significant planned outages of the existing system to install. Further, the agency anticipates hiring 2.0 new FTEs to comply with the requirement to create an EMP protection program for residential customers with total recurring salary and fringe expenses of \$252,000 annually starting in FY 2024-25.

The Office of Adjutant General reports that the impact of this bill on the agency is undetermined because the bill does not provide information about the level of EMP hardening technology and because the agency does not have the subject matter expertise to develop such an estimate.

Based on the responses received, we anticipate that other state agencies may also experience similar expenditures. However, the total expenditures statewide will depend on available appropriations and additional analysis by agencies to determine the complete scope of the upgrades required to meet the specifications in the bill.

SCDE has surveyed school districts and received responses from 33 districts. The majority of districts indicate that the impact of the bill is undetermined due to the lack of details on the requirements towards specific EMP hardening technology to be used, the complexity of the technologies, and the wide variety of infrastructure that may need protection. However, districts indicated they expect the expenditure impact to be significant.

MASC indicates that the impact of the bill on municipalities is undetermined due to the complexity of the technology and may be substantial in magnitude. They also indicate that without government funding, the expenditures associated with implementing EMP hardening measures may be passed through to taxpayers in the form of significantly higher rates or taxes. Also, MASC indicates that implementation of such hardening measures is expected to take longer periods of time particularly given that current lead times on critical elements are

exceeding a year. In addition, they note that the requirement to offer EMP protection programs and payment plans to residential customers may have a negative impact on municipal electrical utilities. Utilities may have limited resources and access to third parties for vetting the quality of residential EMP hardening technologies, which may introduce significant risks for utilities as such technologies may prove unreliable and may fail to provide protection in the case of an EMP. Further, the agency notes that utilities, and ultimately other customers, may take on the additional cost burden of delinquent customers who may refuse to make payments on acquired EMP protection technologies. Based on the information from MASC, RFA expects the impact at the county level to be similarly undetermined and significant.

The revenue impact of this bill is undetermined because the number of entities that will not comply is unknown. The fees would be \$36,500 per year per entity. These fees may be less than the cost of the EMP protections as noted by some responding entities.

Explanation of Fiscal Impact

Introduced on January 25, 2024

State Expenditure

This bill requires governments, utilities, and other entities to implement EMP protections for critical infrastructure. Critical infrastructure refers to the systems and assets that are either physical or virtual in nature and whose incapacity or destruction would have a debilitating impact on the security, economic stability, and public health and safety of South Carolina. Within the definition of critical infrastructure, the bill lists facilities and assets located in the state belonging or associated with the following: federal, state, and local governments; public utilities; health care; first responders; and public schools. The second term defined by the bill – electromagnetic pulse – refers to a burst of either human-made electromagnetic energy or geomagnetic disturbances that have the potential to negatively impact technology systems on Earth or in space.

The bill requires each entity that owns or is responsible for critical infrastructure to install special equipment intended to harden their systems and assets against EMP within one year after the effective date of the act. Also, the bill imposes on all the utilities operating in the state, including electrical utilities not within the jurisdiction of the PSC, to offer their residential customers an EMP protection program for their personal assets and allow their customers, if they so desire, to establish a payment plan through the customer's monthly utility bill. Further, the bill requires the General Assembly to provide funding in the FY 2024-25 Appropriations Act to assist government entities with critical infrastructure to obtain and install EMP protection. Finally, the bill requires all entities with critical infrastructure to obtain and install EMP hardening equipment within one year after the effective date of the act and imposes a fine of \$100 for each day of noncompliance.

Department of Administration. Admin reports that the agency's Office of Technology and Information Services (OTIS) is mainly impacted by the bill's requirements due to its roles as the central provider of information technology to other state governmental agencies and in its requirement to provide Emergency Service Function 2 (ESF-2) communications as part of the

state's Emergency Operation Plan. The agency further indicates that OTIS is responsible for the security and operation of the state's primary data center, which is used by almost half of the state's governmental agencies to process and store their data. Also, OTIS provides network connectivity between agencies and to the Internet through the MetroNet, a fiber-optic data network owned and operated by OTIS throughout the City of Columbia. In addition, OTIS ESF-2 has daily operations to support law enforcement, emergency management, and first responders with critical communications resources, among which are the Palmetto 800 system and the Palmetto Tactical Communications Network (PATCON). The agency notes that the state has a contract with Motorola for the Palmetto 800 system, which ensures the protection of the Palmetto 800 sites and equipment by the company. However, the PATCON sites and ESF-2 radios fall under Admin's (OTIS) responsibility.

In estimating the costs required to protect the agency's assets and systems against EMP events, Admin consulted with the DHS's EMP Protection and Resilience Guidelines for Critical Infrastructure and Equipment (version 2.2). Based on these guidelines, OTIS used an integrated, four-layer defense methodology to develop the EMP protection framework.

Level 1 protection is intended for long mission outages, and the costs are mainly related to lightning rated surge protection devices (SPD), generators and uninterrupted power supply equipment (UPS), use of Wireless Priority Service (WPS) for cellphones, battery operated AM/FM/NOAA radios, and one week of food, water, and other supplies for personnel. Level 2 protection builds upon Level 1 and is relevant when only a few hours of mission outages are allowable. This level adds EMP-rated SPDs, EMP shielding for existing generators, and shortwave radios. At Level 3, the agency would protect against mission outages that are allowed to last not more than a few minutes. Level 3 adds EMP shielded racks, rooms, or facilities to protect critical computers, data centers, phone switches, industrial and substation controls and other electronics. Also at Level 3, additional protections include: EMP tested SPDs and equipment, 30 days of EMP protected power/fuel, and an additional 23 days of food, water, and critical supplies and spares (to increase Level 1 protection up to 30 days of supplies and spares). Finally, the brunt of the implementation cost is at Level 4 where protection is intended against mission outages that are allowed for only a few seconds. At Level 4, the main additional protection includes the use of military HEMP standards, use of EMP shielding in rooms, racks, and buildings, and use of EMP protected double-door entryways.

The one-time implementation cost is expected to be \$15,782,000 in FY 2024-25, and is allocated across the four levels of protection as follows:

- Level 1 - \$49,000
- Level 2 - \$125,000
- Level 3 - \$2,095,000
- Level 4 - \$13,513,000

In addition, Admin estimates annual recurring costs intended for maintenance and surveillance starting in FY 2025-26 to total \$361,000. The recurring costs will be allocated across the four levels as follows:

- Level 1 - \$15,000

- Level 2 - \$6,000
- Level 3 - \$145,000
- Level 4 - \$195,000

While Admin provides information technology services to a large portion of state government, there may be other costs for agencies that maintain their own systems that are not included in this estimate.

State Law Enforcement Department. The agency notes that it will need to implement International Electrotechnical Commission (IEC) EMP and IEMI protection standards which would include shielding level of 30+ dB of protection through 10 GHz for the majority of SLED’s facilities, with an additional shielding level of 80+ dB hardening through 10 GHz specifically for SLED’s Data Center. In addition, SLED will need to:

- install a ground loop around each agency owned facility;
- purchase EMP shielded racks to protect critical computers, phone switches, industrial and substation controls, and other electronics;
- purchase EMP tested surge protection devices and equipment which would be verified regularly;
- institute IEC level hardness maintenance and surveillance to maintain and sustain systems;
- purchase and maintain 30 days of EMP protected power/fuel and store 30 days of food, water, and critical supplies and spares;
- purchase time-urgent EMP resilient communications for radios and antennas;
- purchase and install EMP protected backup power generators with double conversion UPS and EMP Shunts;
- purchase Faraday containers to store any spare electronics;
- join SHARES and purchase HF SHARES radios/antennas.

SLED estimates that the one-time cost of implementing these EMP protection techniques will total approximately \$4,715,300 and there will also be a recurring expense of \$160,000 for IEC level hardness maintenance and surveillance beginning in FY 2024-25. The agency will request General Fund appropriations for these expenses.

Public Service Commission. PSC indicates that the bill will have no fiscal impact on the agency because there is no indication in the bill that the agency must approve electrical utilities’ EMP programs, including the residential customers’ payment plans. In addition, the agency specifies that the bill does not specify minimum investment requirements for EMP protection by electrical utilities. Finally, PSC indicates that it estimates no impact from the bill due to the ambiguity of the bill related to the agency tasked with monitoring the compliance with the bill requirements and assessment of fines in case of noncompliance.

Office of Regulatory Staff. ORS indicates that the additional requirements of the bill that could involve potential review of tariffs, rules, design, planning, timelines, and other EMP protection

processes and customer programs can be accommodated with existing staff and resources. Therefore, the bill is expected to have no impact on the agency.

Public Service Authority. PSA indicates that Santee Cooper's transmission system consists of approximately 5,200 miles of transmission lines and approximately 110 transmission stations throughout South Carolina, 4 major generating stations along with several other smaller generating facilities, approximately 3,000 miles of distribution lines, 59 distribution substations, and 96 communications sites. Santee Cooper also has a primary control center and a backup control center for the operation of Santee Cooper's portion of the bulk electric system as well as a primary control center and a backup control center for the operation of Santee Cooper's distribution system. PSA states that each component associated with the above-mentioned facilities containing electronic technology would need to be protected to harden against an EMP. Also, the agency specifies that where this is not feasible, additional spare components would need to be obtained and stored in facilities protected from an EMP event. Further, PSA observes that cost estimates may vary widely due to the long implementation period (about 10 years) and because information about reliable measures and technologies to harden electrical utilities' systems and assets against an EMP is limited.

PSA has structured their estimate of the expenditure into five sections:

- 1) Transmission
- 2) Distribution
- 3) Generation
- 4) Communications
- 5) Control centers

The agency indicates that EMP hardening of transmission stations will consist of the following measures:

- *Improved shielding of existing control houses:* 110 control houses at an estimated cost of \$2,000,000 per house.
- *Protecting power circuit breakers in place:* 900 power circuit breakers (PCB) at an estimated cost of \$25,000 per breaker
- *Converting field measurements to digital-over-fiber:* estimated cost is at \$1,000,000 per control house and \$200,000 per PCB
- *Providing spare (disconnected) power transformers:* estimated cost of spare power transformers totals \$40,000,000

In total, PSA estimates it will cost the agency \$572,500,000 to implement EMP hardening of transmission stations. The agency also indicates that additional undetermined costs may arise due to significant planned outages of existing systems as electrical utilities install such systems in place.

PSA further notes that the EMP mitigation assumptions related to distribution stations are based on similar elements as in the case of transmission stations. Specifically, the agency lists that it will need to engage in:

- *Protecting PCBs in place:* 300 PCBs at an estimated cost of \$25,000 per breaker

- *Converting field measurements to digital-over-fiber:* 59 distribution substations at an estimated cost of \$1,000,000 per substation and 300 PCBs at \$200,000 per PCB
- *Providing spare (disconnected) power transformers or mobile substations:* estimated cost totals \$7,500,000

The mitigation cost for distribution stations totals \$134,000,000.

Further, PSA indicates that most generation equipment is contained beneath large steel structures and shielded with appropriate cabling and grounding techniques. As a result, exposure to an EMP is limited when compared to transmission, distribution, and telecommunications systems that span miles of open terrain. The agency points to research which shows that exposure to an EMP may lead to failures of control systems, digital relaying, and possible transformer impacts associated with generating facilities.

PSA also indicates that the mitigation may depend on the type of EMP waveform (E1, E2, or E3). The E1 EMP waveform is a fast broad-band pulse that disrupts systems in general, including long-line electrical systems, computers, sensors, and electronic-based control systems. The E2 waveform is longer and much lower in amplitude than the E1 waveform; it manifests itself by enhancing the EMP currents on long lines in the microsecond and millisecond regime (comparable to current induced by nearby lightning strikes). Finally, the E3 waveform is a low-amplitude, long-duration pulse that induces currents in long power and communication lines, destabilizing or damaging connected equipment such as transformers and solid-state communication line drivers (comparable to solar geomagnetic effects). The agency indicates that it is aware of mitigation techniques against E1 and E3 type EMPs only. As a result, PSA estimates mitigation costs for E1 and E3 EMP protection at the following generation stations:

Generation Stations	E1 Mitigations	E3 Mitigations	Total
Myrtle Beach	\$250,000	\$5,000,000	\$5,250,000
Hilton Head	\$150,000	\$5,000,000	\$5,150,000
Jefferies Hydro	\$250,000	\$15,000,000	\$15,250,000
Cross	\$500,000	\$40,000,000	\$40,500,000
Winyah	\$500,000	\$30,000,000	\$30,500,000
Rainey	\$400,000	\$20,000,000	\$20,400,000
Cherokee	\$100,000	\$10,000,000	\$10,100,000
Total	\$2,150,000	\$125,000,000	\$127,150,000

PSA further notes that Santee Cooper’s current communications shelters are varied in their construction. These shelters predominantly use prefabricated enclosures or concrete masonry unit construction at the 50 stand-alone sites. As a result, additional EMP protection enhancements for these different construction types will vary. The agency estimates that improvements at each stand-alone communication shelter are assumed to require an expenditure of \$85,000 to upgrade transient suppression measures already in place. In addition, for communications infrastructure that is co-located with Transmission-level facilities (with a total

count of 46 sites), it is assumed that primary structure shielding improvements will be concurrently addressed and the improvements at each of these shared locations are assumed to require an expenditure of \$10,000. The estimated expenditure to protect communications shelters against an EMP totals \$4,710,000.

Finally, in relation to protecting control centers against an EMP, PSA indicates that it would be more cost effective to construct new control center facilities designed to withstand an EMP rather than attempt to retrofit the existing facilities. The agency lists the following preliminary cost estimates for these facilities:

- *Primary Energy Control Center* – \$25,000,000
- *Backup Energy Control Center* – \$20,000,000
- *Primary Distribution Control Center* – \$15,000,000
- *Backup Distribution Control Center* – \$12,000,000

The full estimated cost of hardening control centers against an EMP totals \$72,000,000.

In total, adding the transmission, distribution, generation, communications, and control centers' EMP hardening costs, the non-recurring cost that electrical utilities may face over the next ten years adds up to \$910,360,000.

Finally, the agency also indicates it will need to hire 2.0 new FTEs to comply with the requirement to create an EMP protection program for residential customers with total recurring compensation expenses of \$252,000 annually starting in FY 2024-25.

Adjutant General. The Adjutant General's Office indicates that the bill lacks clarity related to the specific requirements of the EMP hardening technology that must be acquired and installed. The agency indicates that EMP protection can vary from lightning arrestors on antenna cables, to sealing entire facilities from EMP penetration, with significant cost differentials. Also, the agency points out that due to the complexity of the technology, it would require third-party experts (facility/structural engineers, IT engineers, etc.) to help develop such estimates. Further, the Adjutant General notes that even with access to such subject matter experts, it may take a considerable amount of time for an accurate study of the costs associated with implementing EMP hardening techniques on more than 250 facilities under the agency's responsibility. The agency indicates that a reasonable plan to harden its infrastructure would include, at a minimum, replacing all IT and communications wiring/fiber, radio and satellite communication equipment, electrical wiring and transformer units, IT switches and servers, computers, cellphones and desk phones, controller units for equipment, generators and HVACs, and facility and arms rooms access control and security systems. Given the complexity of the requirements and the need to hire third party experts for planning, designing, and implementation processes in addition to the purchase of EMP hardening technologies, the impact of the bill on the Adjutant General's Office is undetermined.

Overall, based on the responses received, we anticipate that other state agencies may also experience similar expenditures to those noted for the agencies above. However, the total expenditures statewide will depend on available appropriations to fund expenses and additional

analysis by agencies to determine the complete scope of the upgrades required to meet the specifications in the bill.

State Revenue

The bill requires all entities with critical infrastructure to obtain and install EMP hardening equipment within one year after the effective date of the act and imposes a fine of \$100 for each day of noncompliance.

The revenue impact of this bill is undetermined because the number of entities that will not comply is unknown. The fees would be \$36,500 per year per entity. These fees may be less than the cost of the EMP protections as noted by some responding entities.

Local Expenditure

RFA has surveyed all forty-six counties and MASC and received a response only from MASC. MASC indicates that it is aware of two cities that have started studying EMP hardening techniques in preparation for an EMP event.

The first comprehensive effort to determine costs for protecting the distribution grid against EMP threats (both natural and manmade) is the Lake Wylie Pilot Study commenced in York County in 2015. The study applied a “bottom-up” approach in considering the electric grid issues for Rock Hill and the rest of York County. The findings of the study indicated that the cost to protect the distribution grid based on the same standards used for critical military systems (Military Standard MIL-STD-188-125) had an implementation cost of \$22 million or approximately \$100 per York County citizen (in 2019 numbers) as well as additional less significant annual maintenance costs. In today’s economy, Rock Hill staff estimate that the implementation of such EMP hardening techniques would cost over \$100 million. Additionally, MASC indicates that lead times on transformers without EMP protections are at 60 weeks, and longer for those with EMP protection. The City of Rock Hill has not implemented the recommendations of the study due to the prohibitive cost.

Also, the City of Aiken staff participate in an EMP working group with SCMD, SLED, and other emergency services in the state. The group focuses on studying ways of strengthening communications system resilience in an EMP event. One of the findings of the EMP working group is that the implementation of EMP hardening into new construction would increase the cost of construction by approximately 30 percent, while retrofitting existing facilities would be even more costly. City of Aiken staff also report that the cost to protect the city’s critical infrastructure (public safety facilities and equipment, radio repeater system, water and sewer system infrastructure, the city’s IT network, etc.) would involve the addition of fiber optic converters for all network lines, generator protection, commercial power protection, backup radio repeaters, etc., which may conservatively cost hundreds of thousands of dollars. Also, MASC notes that such efforts would require years to comprehensively study, fund and implement and could not be completed within one year and without significant state or federal financial aid.

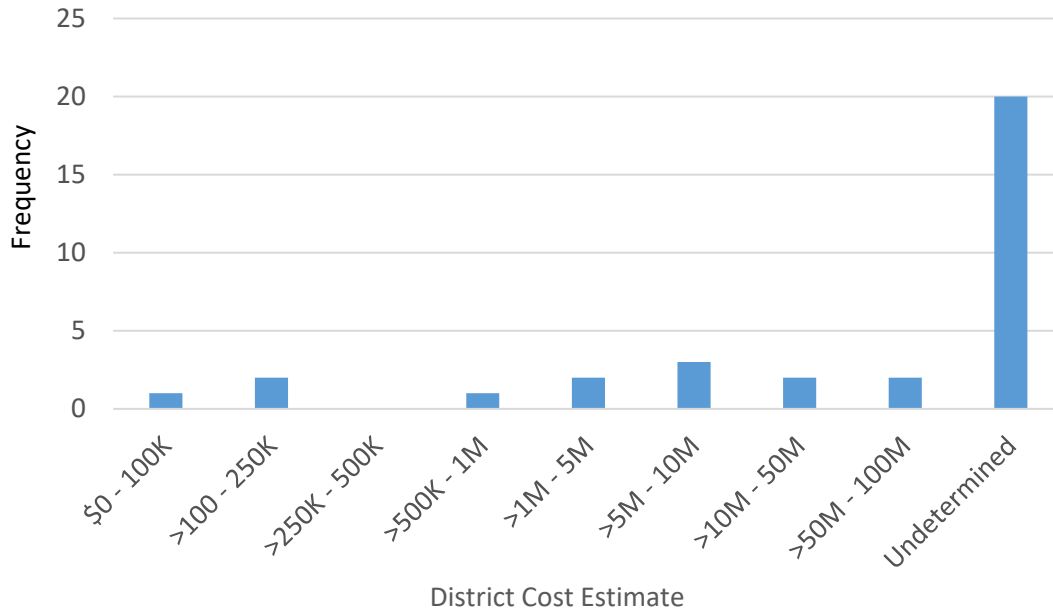
MASC concludes that without significant grant funding, the additional cost to install EMP hardening equipment is not feasible for the 271 cities and towns and the 21 municipal electrical utilities in South Carolina. The association also indicates that without government funding, the expenditures related with implementing EMP hardening measures will be passed through to taxpayers in the form of significantly higher rates or taxes. Also, MASC indicates that implementation of such hardening measures is expected to take longer periods of time particularly given that current lead times on critical elements are exceeding a year.

In addition, the association points out that the requirement to offer EMP protection programs and payment plans to residential customers may have a negative impact on municipal electrical utilities. MASC notes that utilities may have limited resources and access to third parties for vetting the quality of residential EMP hardening technologies, which may introduce significant risks for utilities as such technologies may prove unreliable and may fail to provide protection in the case of an EMP. Further, the association notes that utilities, and ultimately other customers, may take on the additional cost burden of delinquent customers who may refuse to make payments on acquired EMP protection technologies.

Based on the response from MASC indicating the complexity of the requirements, the limited capacity of municipal governments and utilities, long lead times for studying, designing and planning EMP hardening techniques, in addition to the complicated purchase process of EMP hardening technologies, the expenditure impact of the bill on municipalities is undetermined and expected to be significant. Based on the information from MASC, RFA expects the impact at the county level to be similarly undetermined and significant.

SCDE surveyed the school districts and received 33 responses related to the impact of this bill. The level of impact varies widely across districts. However, the majority of the districts report that the expenditure impact of the bill is undetermined due to the complexity of the work needed to protect the district's infrastructure. Districts also point to the lack of specificity in the bill related to the level of required protection and the assets that are considered critical. Another important aspect that may influence costs, mentioned in the responses provided by districts, is the lack of capacity / contractors / third-parties capable of providing such services in the state, which may result in bidding up estimates as school districts may start competing against each other as well as other entities required to harden their systems and assets against an EMP. In this respect, a district indicated that it may be economical to pay fines rather than be forced to pay exorbitant invoices on work that is conditioned by short deadlines. Several districts also indicated that expenditures related to EMP protection may be considerably higher than the cost of equipment replacement. The chart below shows the frequency distribution of responses for the impact of the bill across the 33 districts that submitted a response.

Distribution of EMP Protection Expenditure Impact on SC School Districts



Local Revenue

N/A

Frank A. Rainwater, Executive Director