



**John Cupparo - PacifiCorp**  
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WIRAB-CREPC Webinar  
WECC RPIC Vulnerabilities Initiative  
January 25, 2012

# *Vulnerabilities Initiative*

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- RPIC Lead – John Cupparo
- Scope of Work Developed

<http://www.wecc.biz/committees/BOD/RPIC/Shared%20Documents/Vulnerabilities%20Initiative%20Scope%20of%20Work.pdf>

- Task Force Formed from Subject Matter Experts at the WECC Staff

# *Task Force*

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- John Cupparo – RPIC Lead
- WECC Staff
  - David Godfrey – Planning and Operations
  - Branden Sudduth – Planning Services
  - Donald Davies – Planning Services
  - Doug Tucker – Planning Services
  - Tom Schneider – Compliance Coordination
  - Steve Rueckert – Standards Development
  - Kraig Patterson – Operations
  - Layne Brown – Reliability Assessments

# *Vulnerabilities Initiative Caveats*

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- Ongoing, multi-year effort – work is currently at a very early stage
- Results being presented as an overview, findings are preliminary and may change before report is produced
- Today's presentation is intended to provide an interim project update focusing on one area of the effort – Compliance Violation Data

# *Vulnerabilities Initiative Overview*

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- Utilize data to identify trends indicating potential system risks and vulnerabilities
- Seek to correlate data among multiple functions within WECC – this effort has not yet occurred
- Supplement and add value to work being performed by the NERC Performance Assessment Subcommittee
- Produce an annual “State of the Interconnection” report



# *Four Areas of Focus - 2012*

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## Compliance

- Standards Violation Data

## Outages

- TADS Data
- Protection System and Relay Misoperations Data
- Event Analysis Data

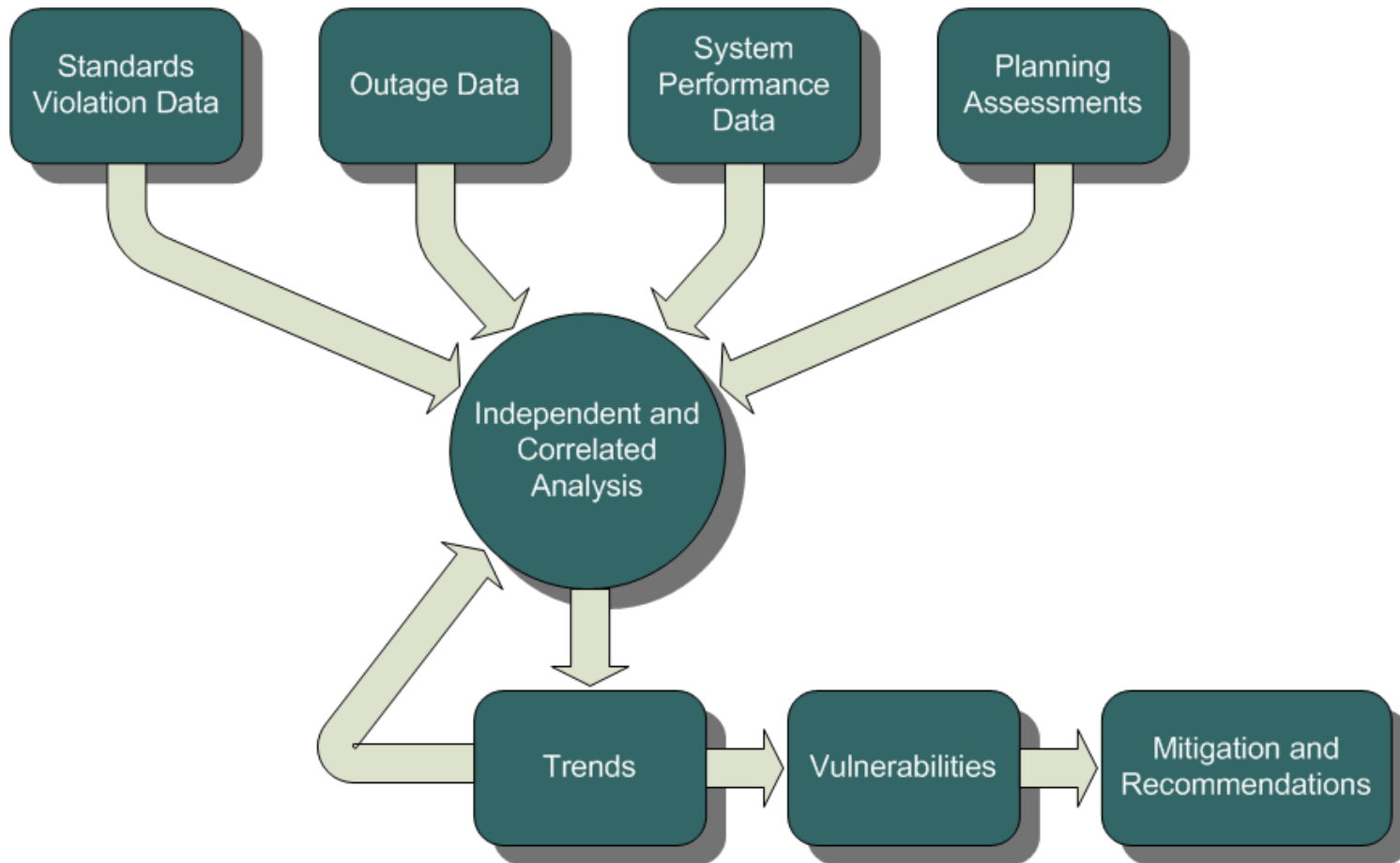
## System Performance

- Real-time Data:
  - Frequency
  - Voltage
  - Line Loading

## Planning

- Adequacy Assessments
- Planning Margins

# Data Analysis Process



# Report Outline

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- Annual Report
- General Audience
- Finalized by end of First Quarter 2012

## Assessment of Reliability Vulnerabilities for the Western Interconnection

About WECC

Chapter 1 – Introduction

- History
- Areas of Focus (Overview)
  - Standards Violation Data
  - Outage Data
    - Facility Forced Outages
    - Event Analysis
  - System Performance Data
  - Planning Assessments
- NERC Efforts

Chapter 2 – Standards Violation Data Analysis

Chapter 3 - Outage Data Analysis

Chapter 4 - System Performance Data Analysis

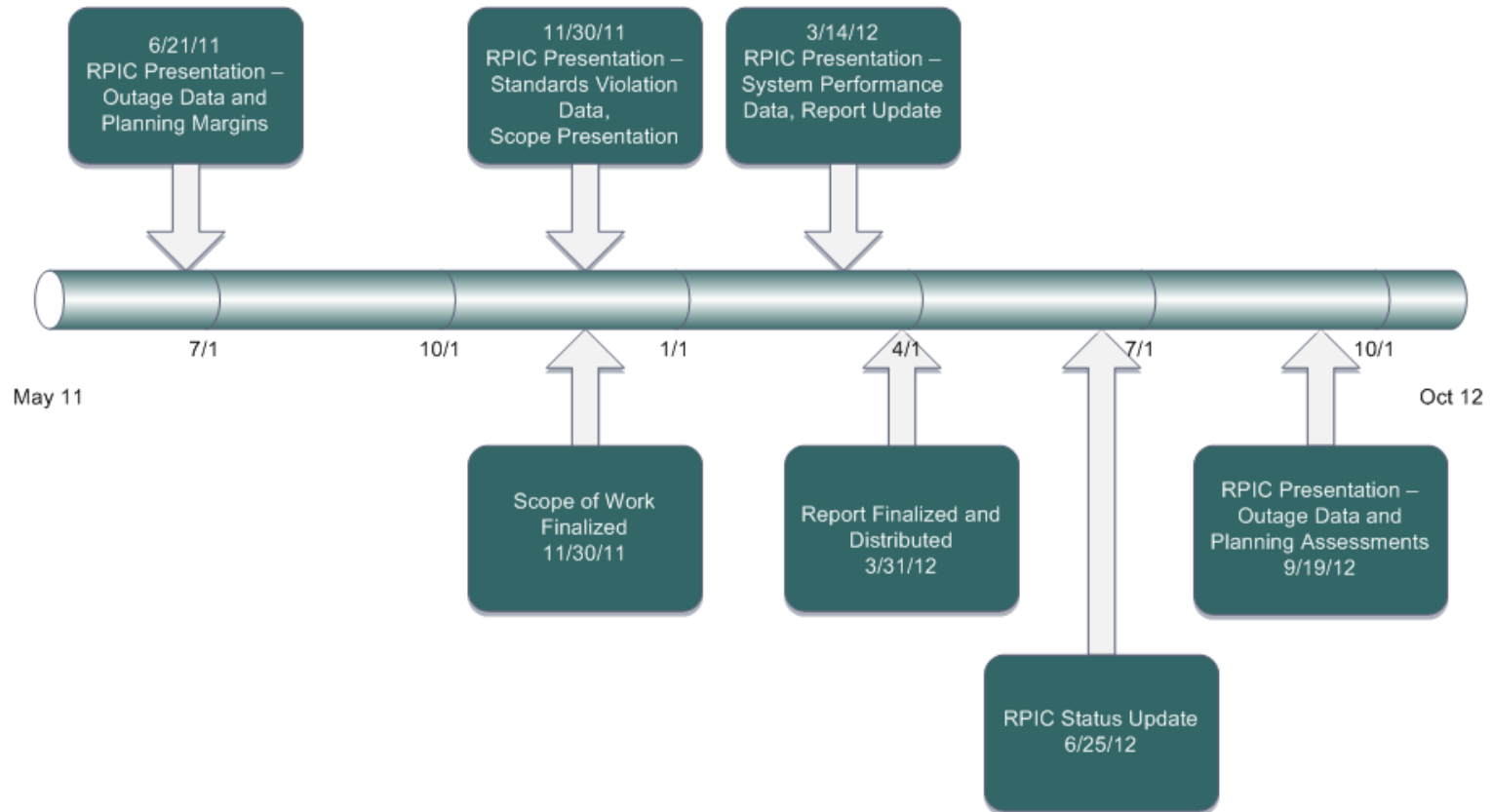
Chapter 5 - Planning Assessment Analysis

Chapter 6 – Data Correlations and Trends

Chapter 7 – Potential Reliability Vulnerabilities

Chapter 8 – Reliability Vulnerabilities Mitigation and Recommendations

# Deliverable Timeline



# *WECC Violation and Reliability Impact Analysis - Context*

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- Seek to correlate and evaluate violation data and trends in context of overall assessment of reliability described above
- Assess and prioritize Reliability and Risks
- High level of interest by FERC, NERC, WIRAB/CREPC, and industry stakeholders in reliability measures, trends, and risks
- Evaluate whether Reliability is improving – are “we” getting “bang for the buck”

# *WECC Violation and Reliability Impact Analysis – Approach and Method*

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- WECC is analyzing violation data to understand the nature, risks, reliability impacts, and trends
- Analysis of standards violations and reliability impacts -- add value to NERC violations analysis
- Focus on **subset** of standards/**requirements** related to NERC Outage Cause Codes
  - Requirements could trigger/contribute to outages
- Covers 4 year period **6/17/2007** – 6/30/2011
- Tables and graphs are progressively more granular – will describe

# Outage Cause Code - 06/17/07 – 06/30/11

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Outage Cause Code	No. of Standards (Details)	No. of Req. (Details)	No. of Entities	No. of Violations
Failed Protective System Equipment	5	12	156	390
Fire	1	2	18	29
Human Error	4	8	42	119
Power System Condition	16	55	79	265
Vandalism, Terrorism or Malicious Acts	25	107	110	929
Vegetation	1	2	18	29
Weather	1	7	21	61

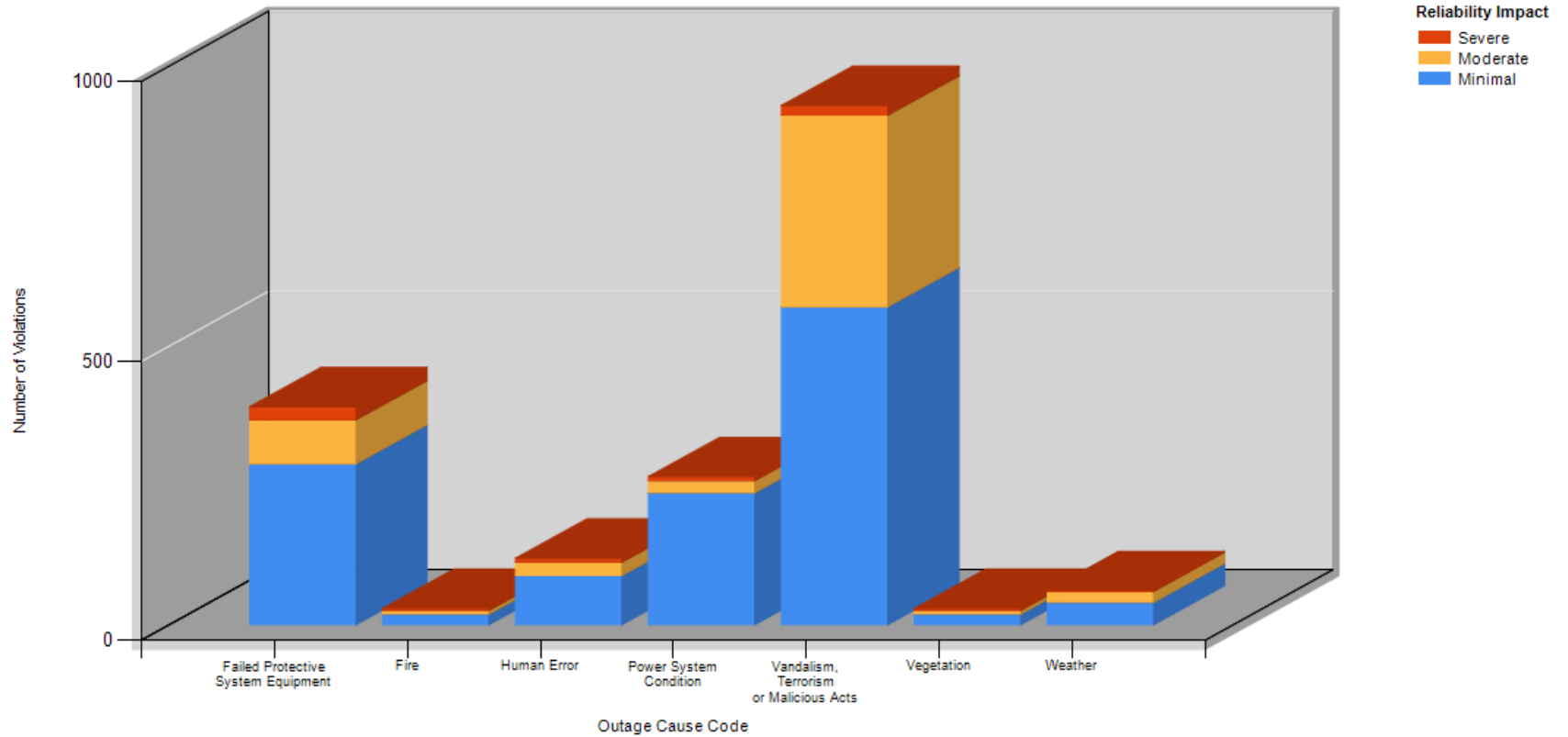
# Outage Cause Code - 06/17/07 – 06/30/11

Outage Cause Code	No. of Standards (Details)	No. of Req. (Details)	No. of Entities	No. of Violations	
Failed Protective System Equipment	5	12	156	390	
	PRC-004	2	16	22	
	PRC-005	4	138	269	
	PRC-008	2	38	69	
	PRC-011	2	10	14	
	PRC-017	2	11	16	
Fire	1	2	18	29	
	FAC-003	2	18	29	
Human Error	4	8	42	119	
	COM-002	1	11	15	
	EOP-005	1	9	10	
	FAC-003	2	18	29	
	PER-002	4	26	65	
Power System Condition	16	55	79	265	
	PRC-023	2	8	9	
	TOP-004	6	11	27	
	TOP-005	3	9	12	
	TOP-006	7	9	18	
	TOP-007	1	2	2	
	TOP-008	4	2	5	
	TOP-STD-007	1	7	29	
	VAR-001	12	16	50	
	VAR-002	5	44	83	
	VAR-STD-002a	1	16	17	
	VAR-STD-002b	1	12	13	
	Vandalism, Terrorism or Malicious Acts	25	107	110	929
		CIP-001	4	64	181
CIP-002		4	25	57	
CIP-003		6	32	92	
CIP-004		4	45	162	
CIP-005		5	22	72	
CIP-006		7	33	108	
CIP-007		9	42	182	
CIP-008		2	13	18	
CIP-009		5	18	57	
Vegetation		1	2	18	29
	FAC-003	2	18	29	
Weather	1	7	21	61	
	EOP-001	7	21	61	



### Number of Violations by Outage Cause Code

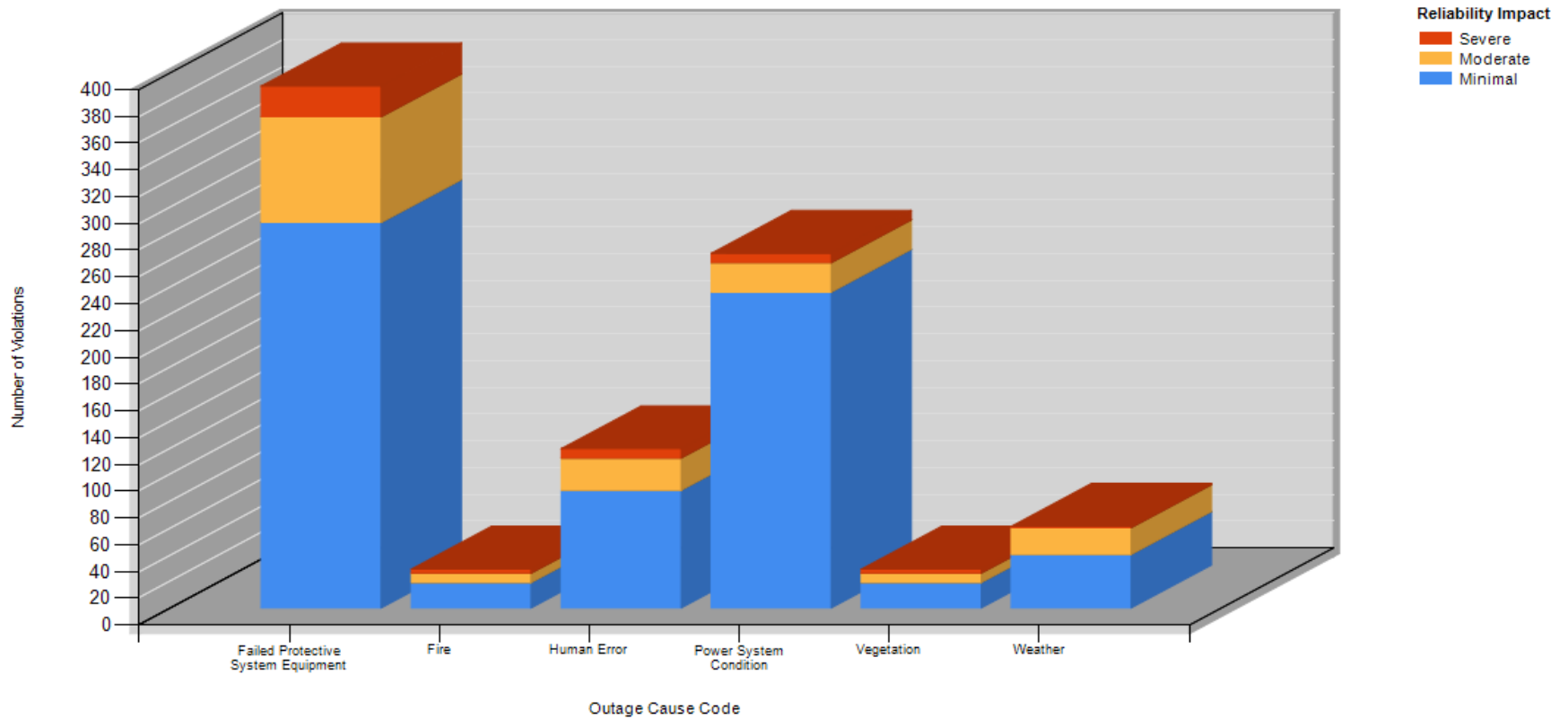
6/17/2007 - 6/30/2011



Reliability Impact	Failed Protective System Equipment	Fire	Human Error	Power System Condition	Vandalism, Terrorism or Malicious Acts	Vegetation	Weather	Total
Minimal	288	19	88	236	569	19	40	1259
Moderate	79	7	24	22	343	7	20	502
Severe	23	3	7	7	17	3	1	61
<b>Total</b>	<b>390</b>	<b>29</b>	<b>119</b>	<b>265</b>	<b>929</b>	<b>29</b>	<b>61</b>	<b>1822</b>

## Number of Violations by Outage Cause Code - Excluding Vandalism, Terrorism or Malicious Acts

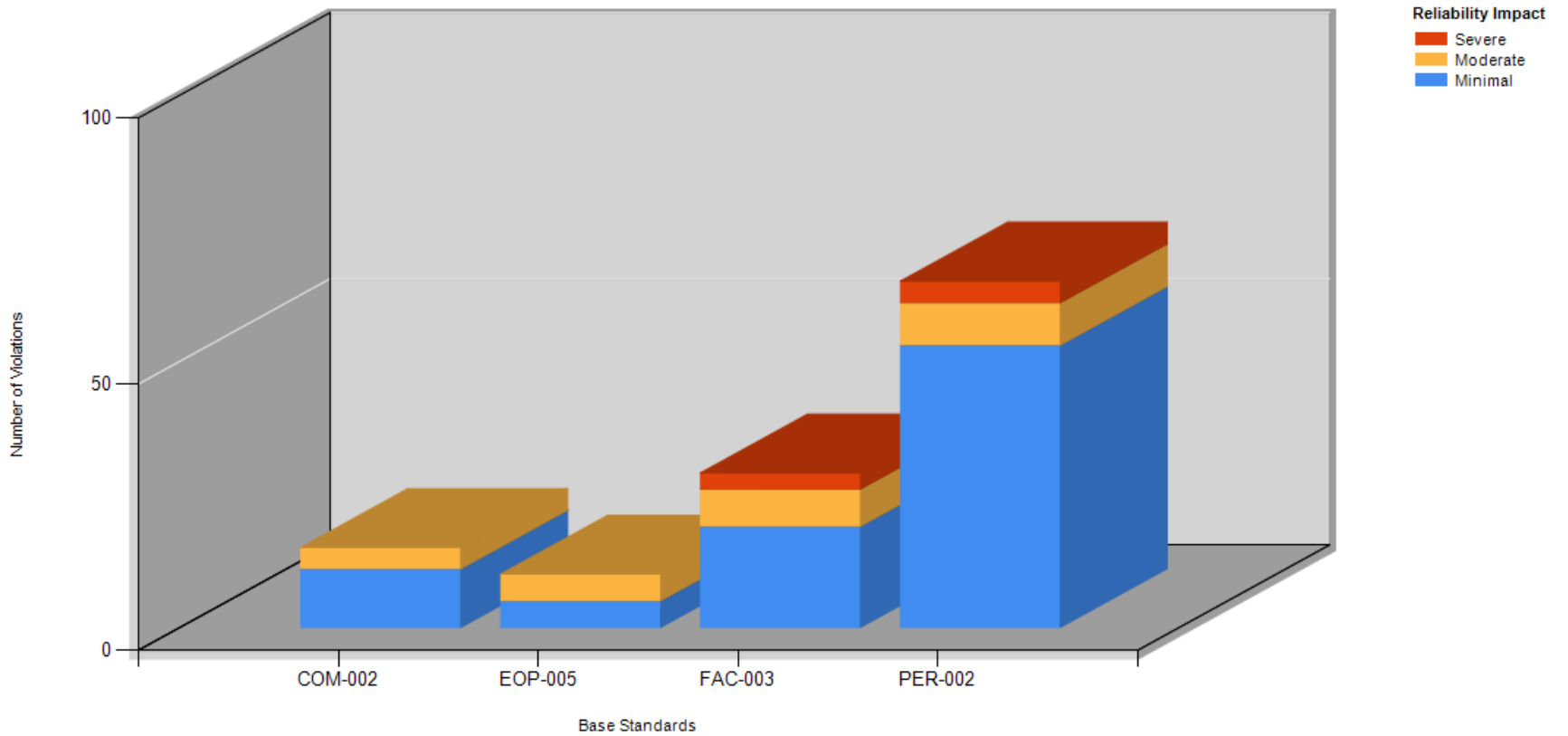
6/17/2007 - 6/30/2011



Reliability Impact	Failed Protective System Equipment	Fire	Human Error	Power System Condition	Vegetation	Weather	Total
Minimal	288	19	88	236	19	40	690
Moderate	79	7	24	22	7	20	159
Severe	23	3	7	7	3	1	44
<b>Total</b>	<b>390</b>	<b>29</b>	<b>119</b>	<b>265</b>	<b>29</b>	<b>61</b>	<b>893</b>

## Human Error

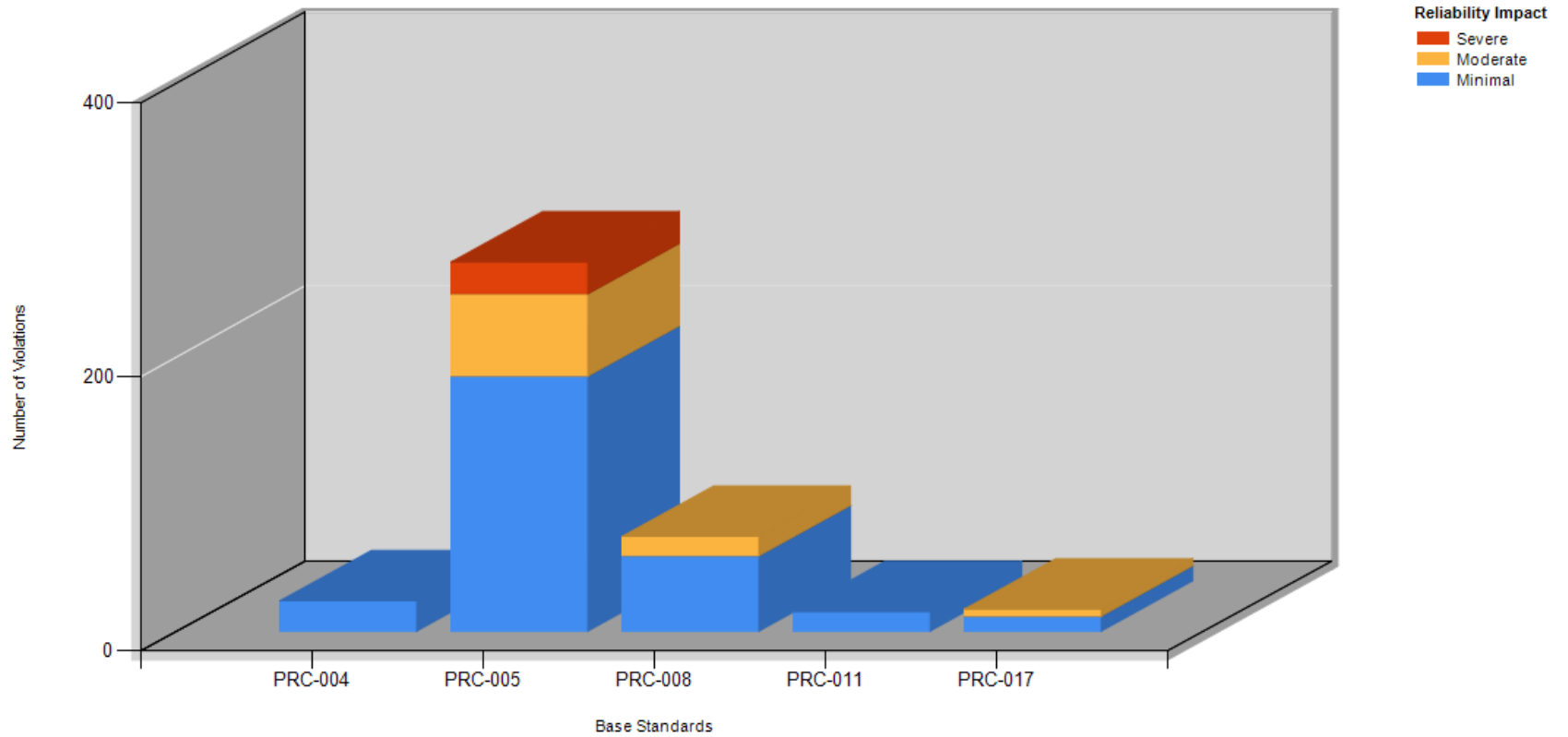
6/17/2007 - 6/30/2011



Reliability Impact	COM-002	EOP-005	FAC-003	PER-002	Total
Minimal	11	5	19	53	88
Moderate	4	5	7	8	24
Severe	0	0	3	4	7
<b>Total</b>	<b>15</b>	<b>10</b>	<b>29</b>	<b>65</b>	<b>119</b>

## Failed Protective System Equipment

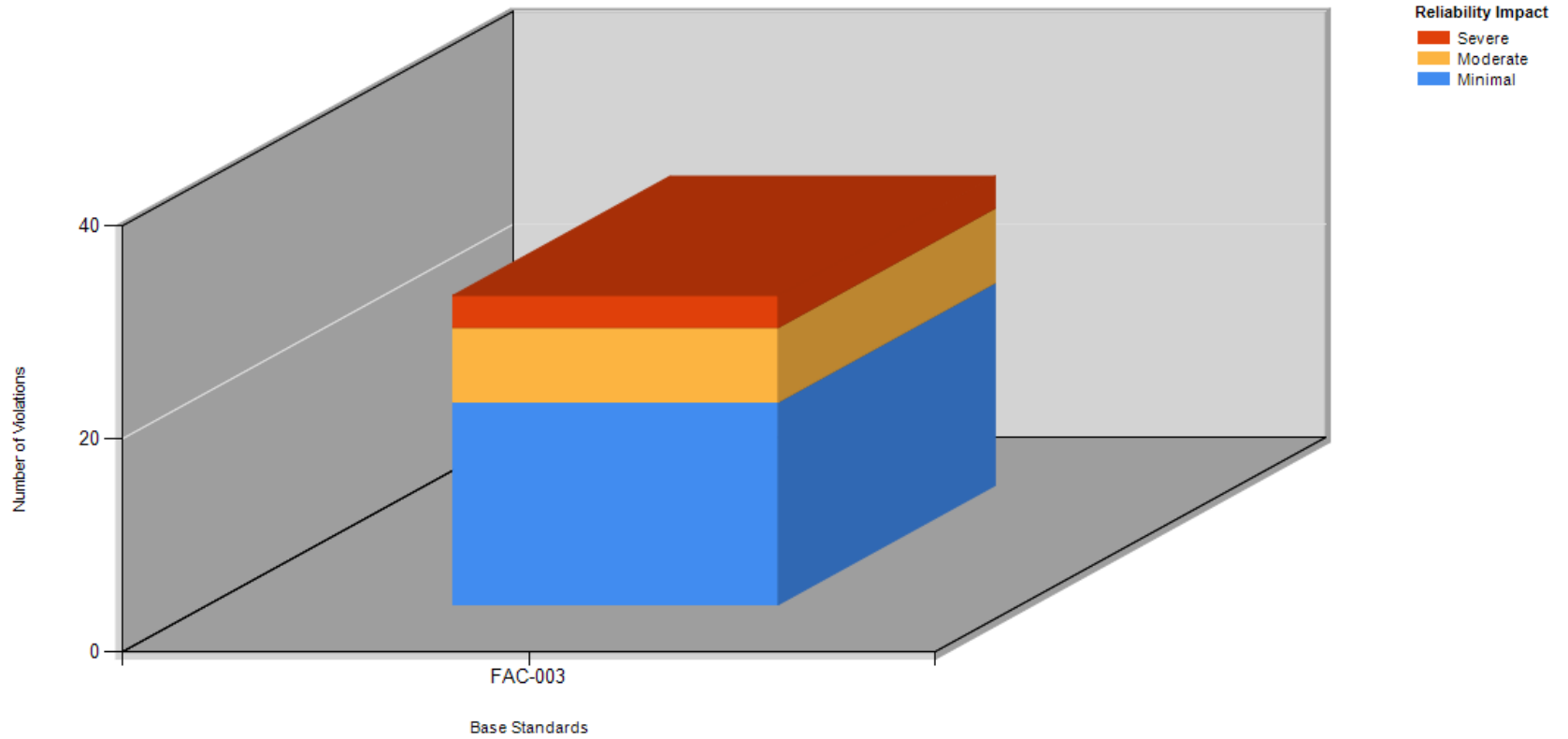
6/17/2007 - 6/30/2011



Reliability Impact	PRC-004	PRC-005	PRC-008	PRC-011	PRC-017	Total
Minimal	22	186	55	14	11	288
Moderate	0	60	14	0	5	79
Severe	0	23	0	0	0	23
<b>Total</b>	<b>22</b>	<b>269</b>	<b>69</b>	<b>14</b>	<b>16</b>	<b>390</b>

# Fire

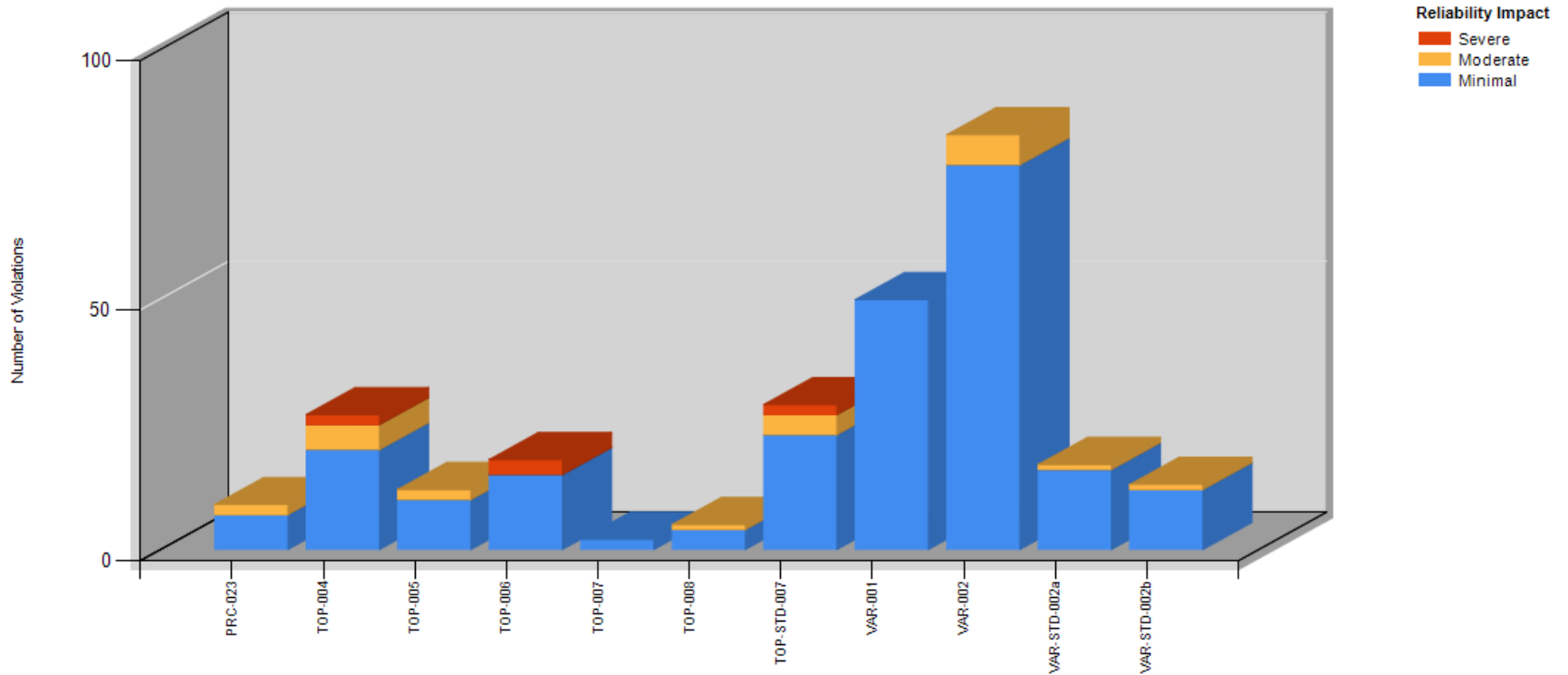
6/17/2007 - 6/30/2011



Reliability Impact	FAC-003	Total
Minimal	19	19
Moderate	7	7
Severe	3	3
<b>Total</b>	<b>29</b>	<b>29</b>

### Power System Condition

6/17/2007 - 6/30/2011

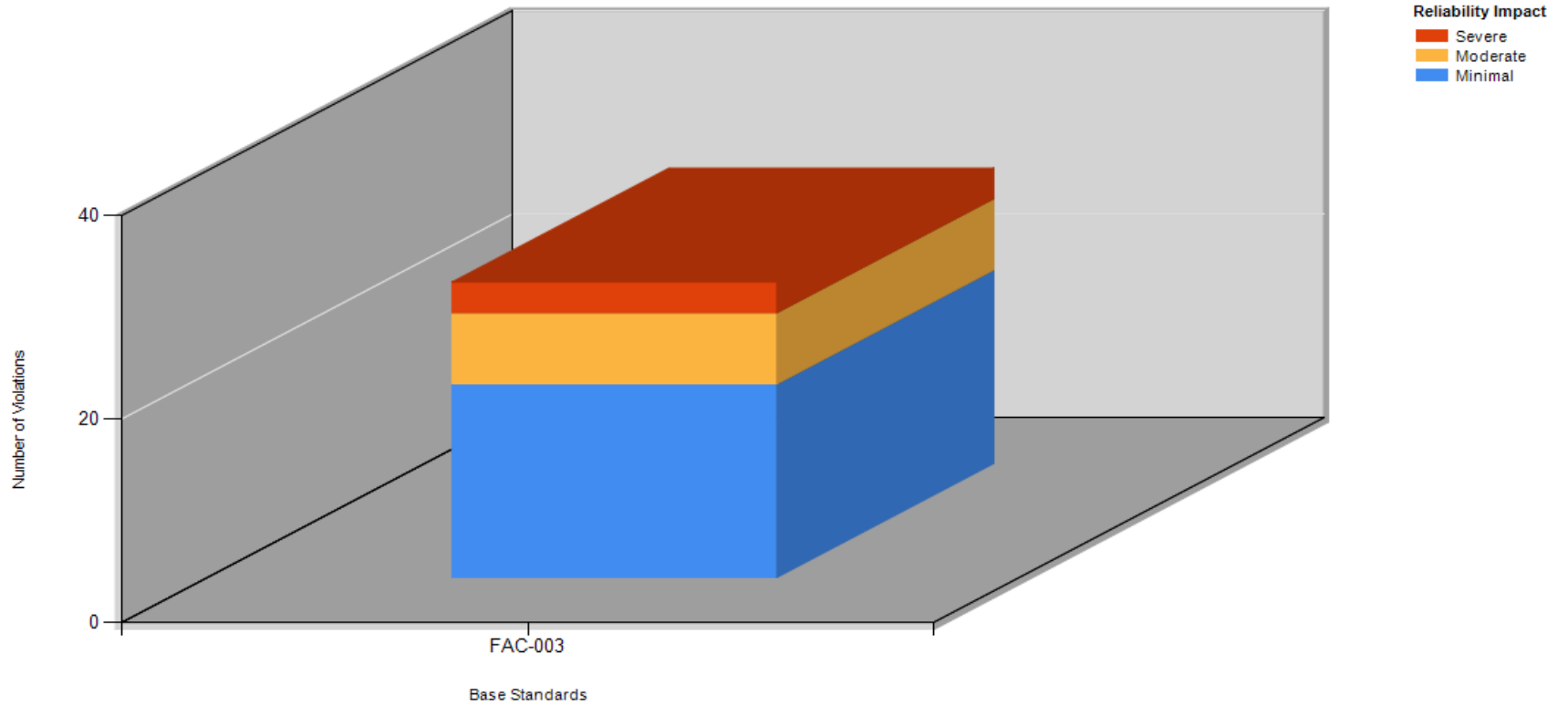


Base Standards

Reliability Impact	PRC-023	TOP-004	TOP-005	TOP-006	TOP-007	TOP-008	TOP-STD-007	VAR-001	VAR-002	VAR-STD-002a	VAR-STD-002b	Total
Minimal	7	20	10	15	2	4	23	50	77	16	12	236
Moderate	2	5	2	0	0	1	4	0	6	1	1	22
Severe	0	2	0	3	0	0	2	0	0	0	0	7
<b>Total</b>	<b>9</b>	<b>27</b>	<b>12</b>	<b>18</b>	<b>2</b>	<b>5</b>	<b>29</b>	<b>50</b>	<b>83</b>	<b>17</b>	<b>13</b>	<b>265</b>

# Vegetation

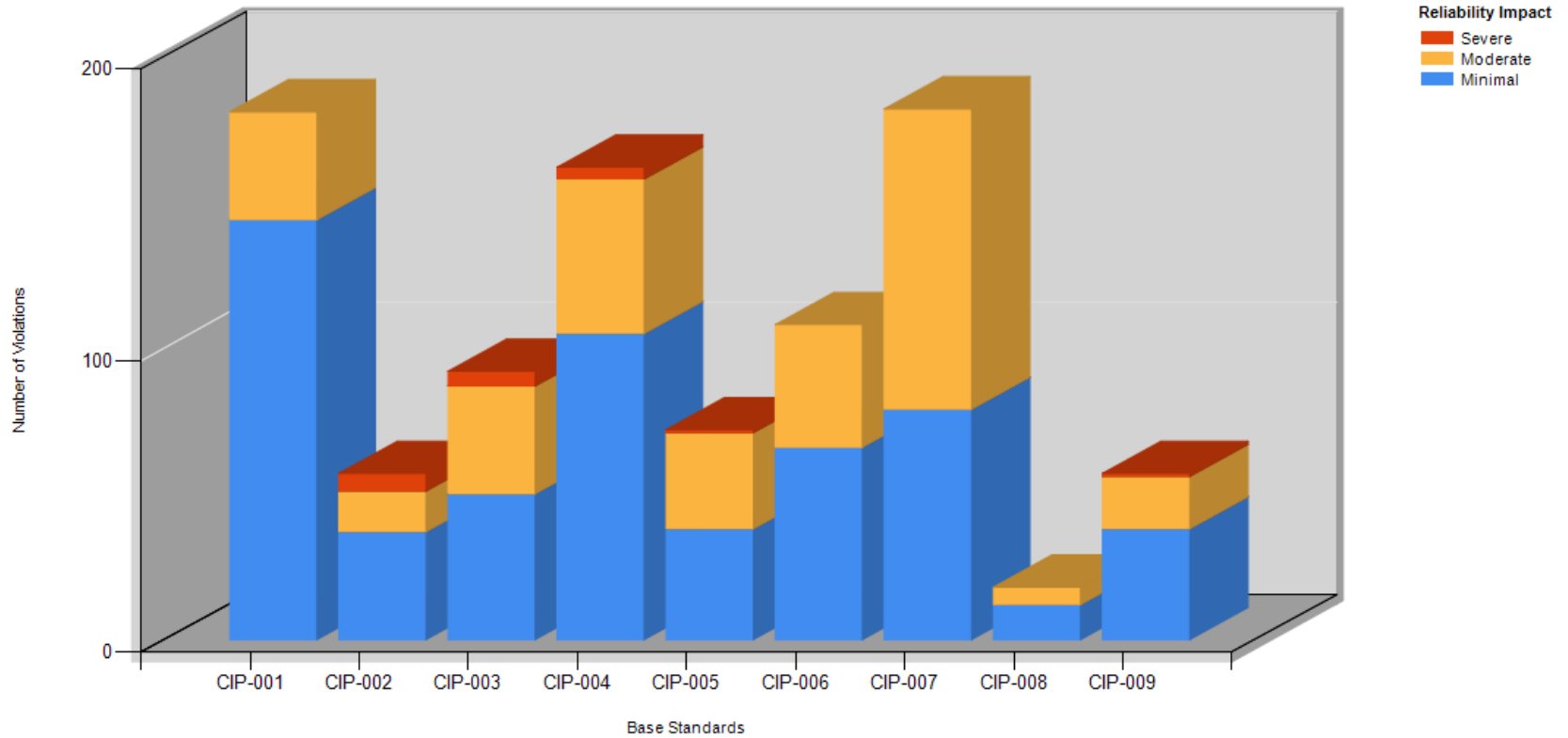
6/17/2007 - 6/30/2011



Reliability Impact	FAC-003	Total
Minimal	19	19
Moderate	7	7
Severe	3	3
<b>Total</b>	<b>29</b>	<b>29</b>

### Vandalism, Terrorism or Malicious Acts

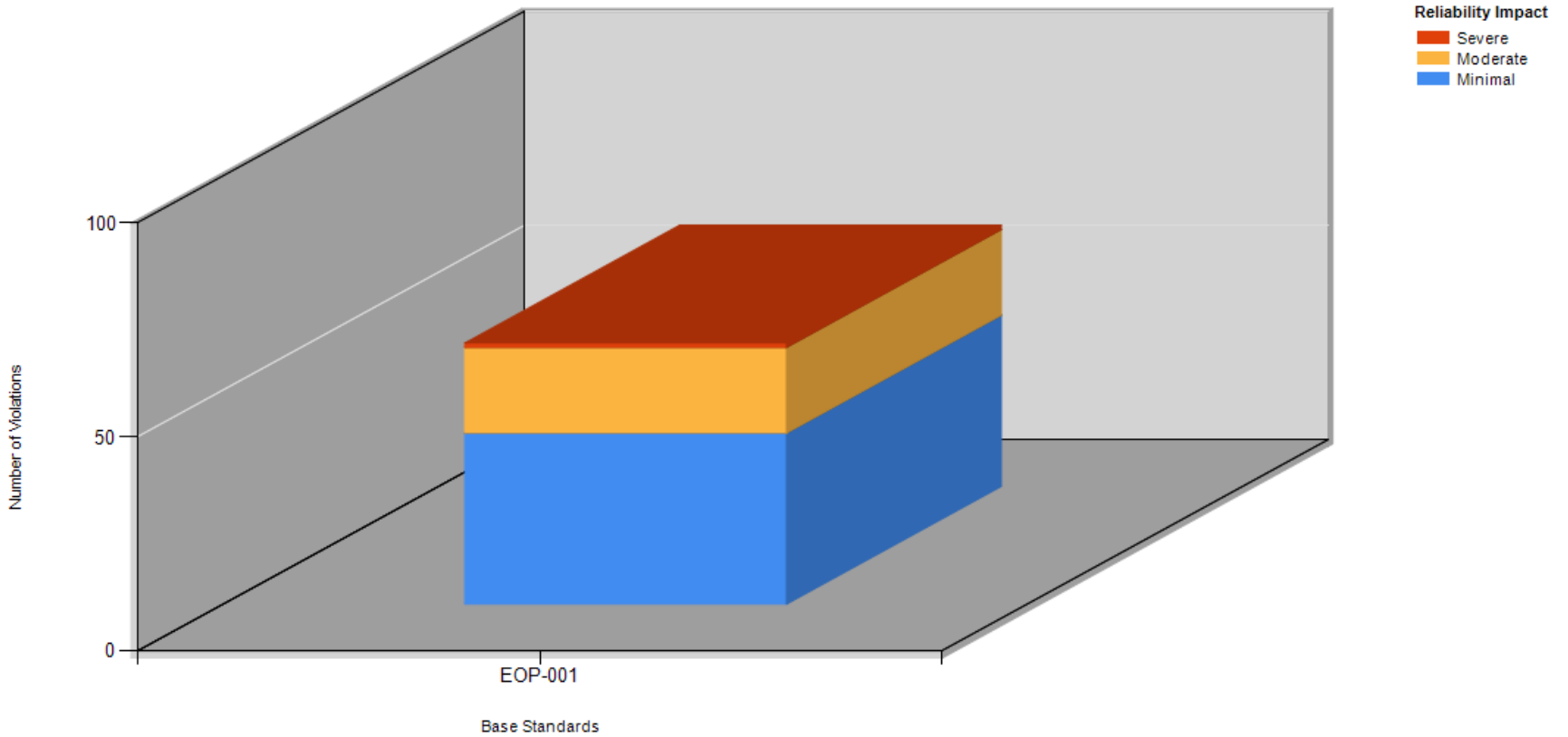
6/17/2007 - 6/30/2011



Reliability Impact	CIP-001	CIP-002	CIP-003	CIP-004	CIP-005	CIP-006	CIP-007	CIP-008	CIP-009	Total
Minimal	144	37	50	105	38	66	79	12	38	569
Moderate	37	14	37	53	33	42	103	6	18	343
Severe	0	6	5	4	1	0	0	0	1	17
<b>Total</b>	<b>181</b>	<b>57</b>	<b>92</b>	<b>162</b>	<b>72</b>	<b>108</b>	<b>182</b>	<b>18</b>	<b>57</b>	<b>929</b>

# Weather

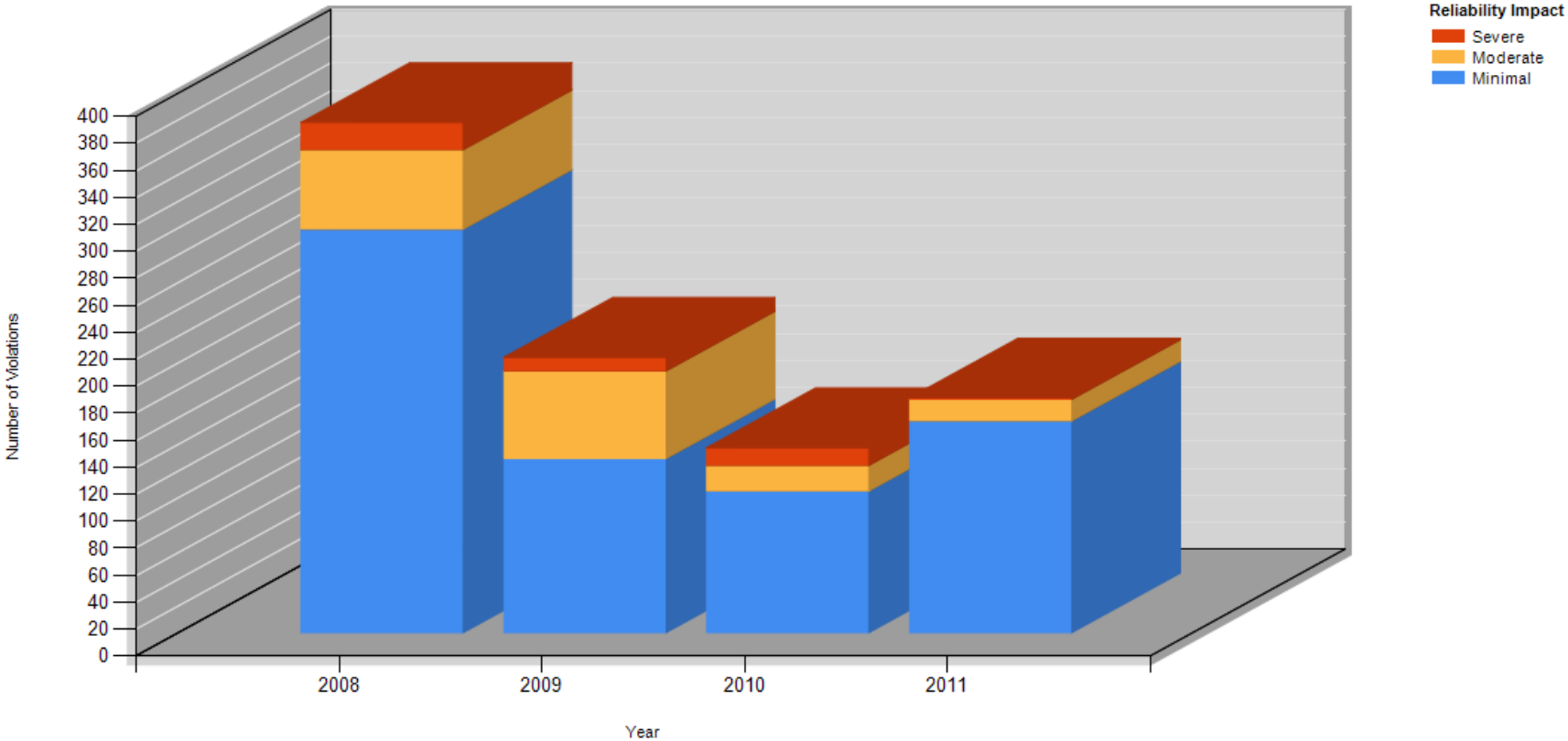
6/17/2007 - 6/30/2011



Reliability Impact	EOP-001	Total
Minimal	40	40
Moderate	20	20
Severe	1	1
<b>Total</b>	<b>61</b>	<b>61</b>

Number of Violations by Year - Excluding Vandalism, Terrorism or Malicious Acts

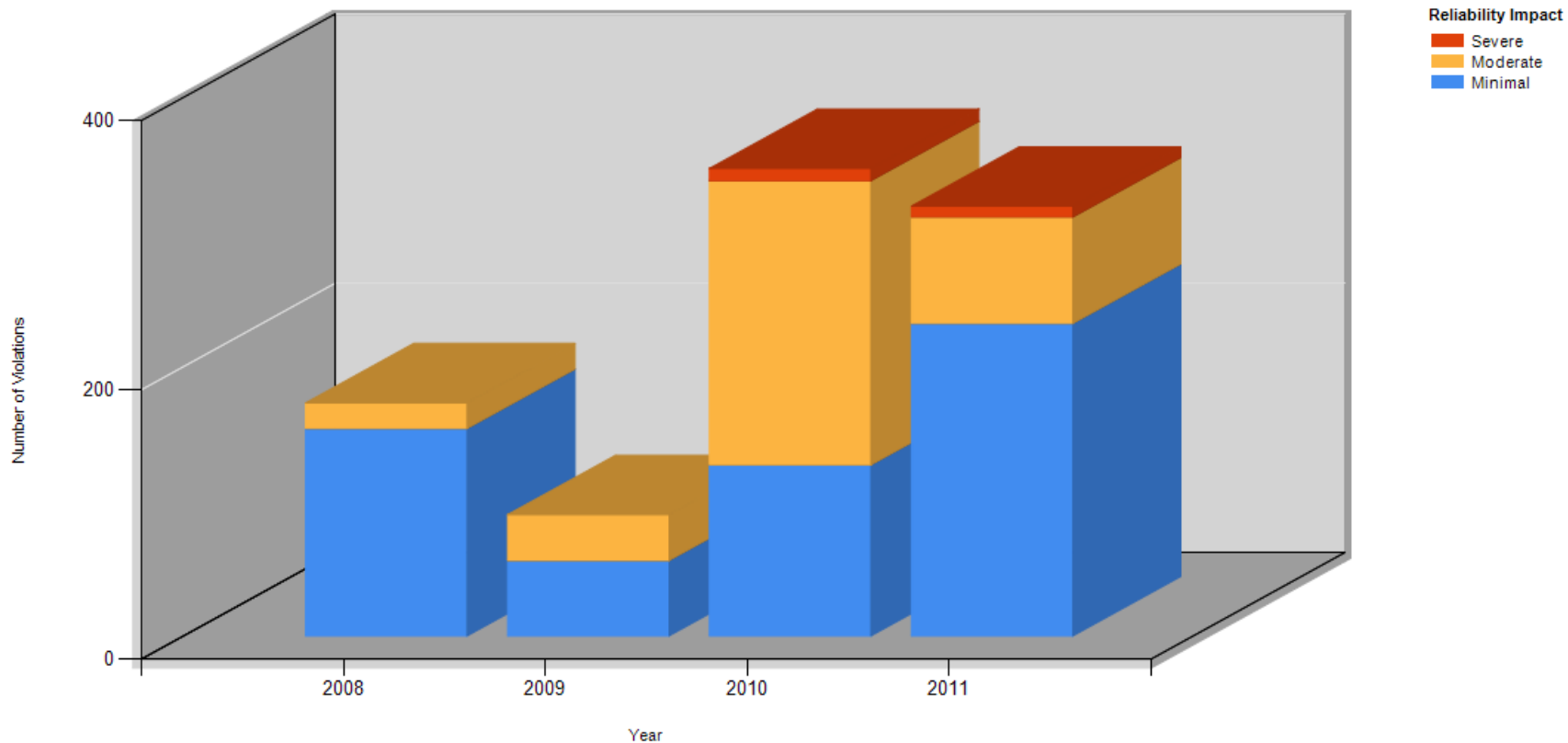
2008 - 2011



Reliability Impact	2008	2009	2010	2011	Total
Minimal	299	129	105	157	690
Moderate	59	65	19	16	159
Severe	20	10	13	1	44
<b>Total</b>					<b>893</b>

### Vandalism, Terrorism or Malicious Acts by Year

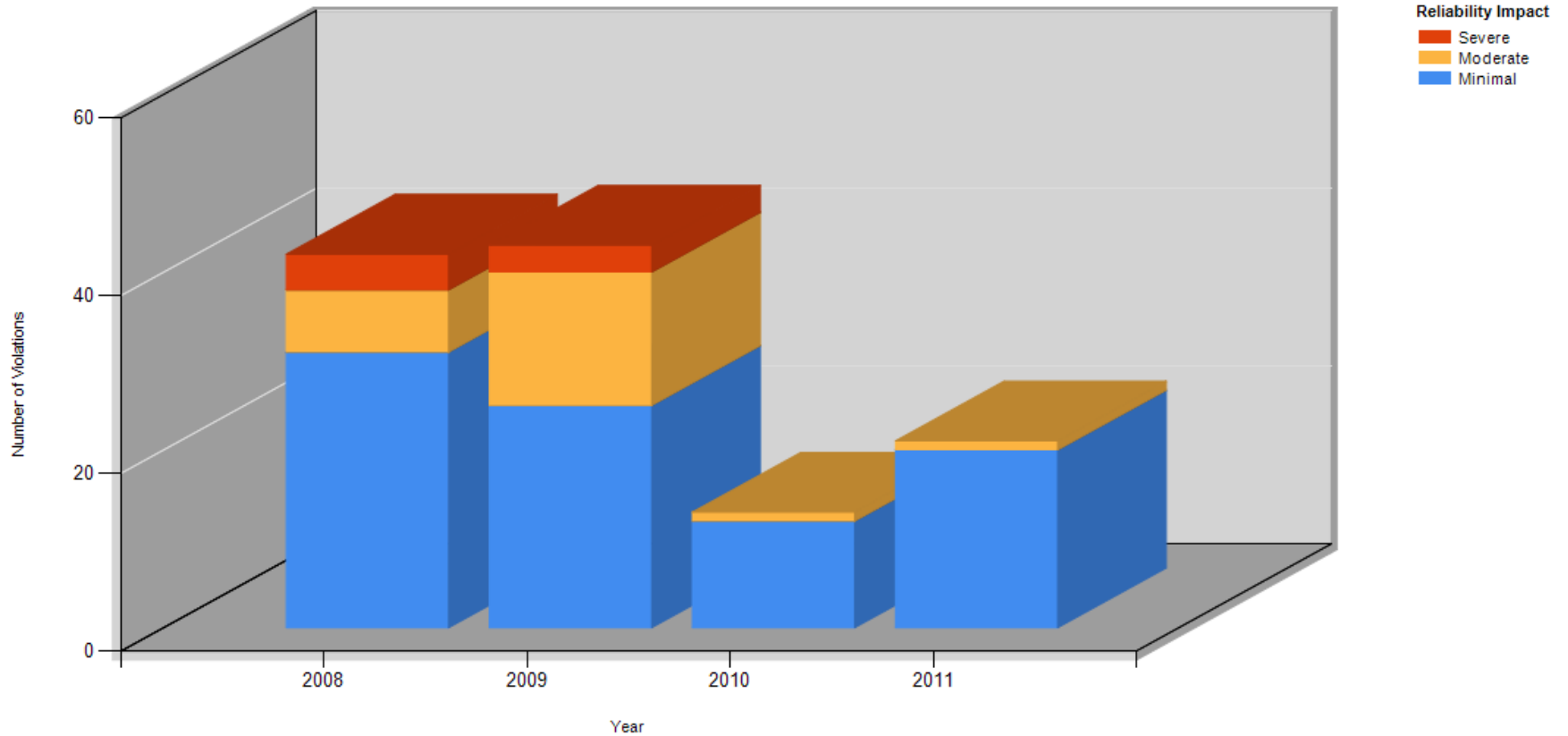
2008 - 2011



Reliability Impact	2008	2009	2010	2011	Total
Minimal	154	56	127	232	569
Moderate	19	34	211	79	343
Severe	0	0	9	8	17
<b>Total</b>	<b>173</b>	<b>90</b>	<b>347</b>	<b>319</b>	<b>929</b>

## Human Error by Year

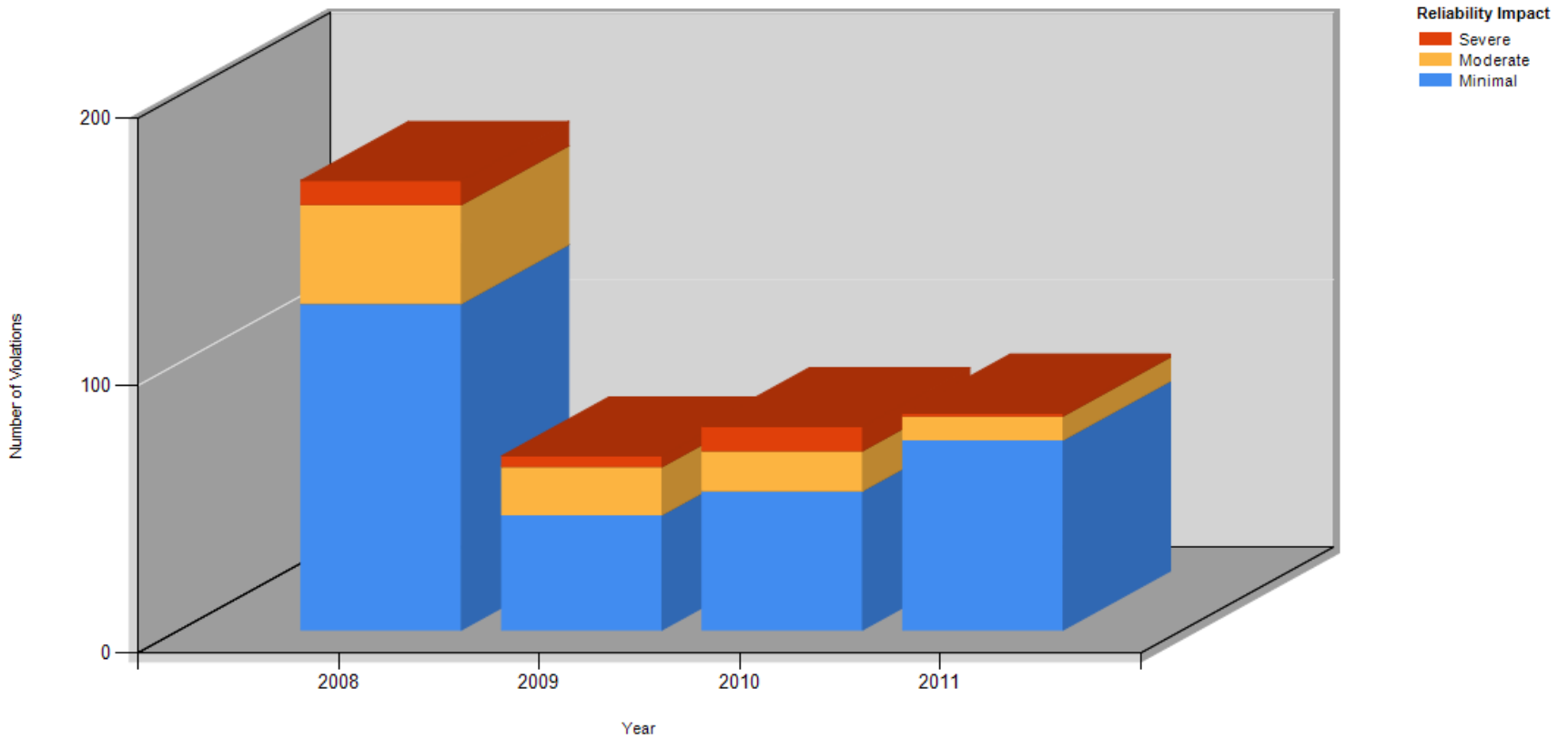
2008 - 2011



Reliability Impact	2008	2009	2010	2011	Total
Minimal	31	25	12	20	88
Moderate	7	15	1	1	24
Severe	4	3	0	0	7
<b>Total</b>	<b>42</b>	<b>43</b>	<b>13</b>	<b>21</b>	<b>119</b>

## Failed Protective System Equipment by Year

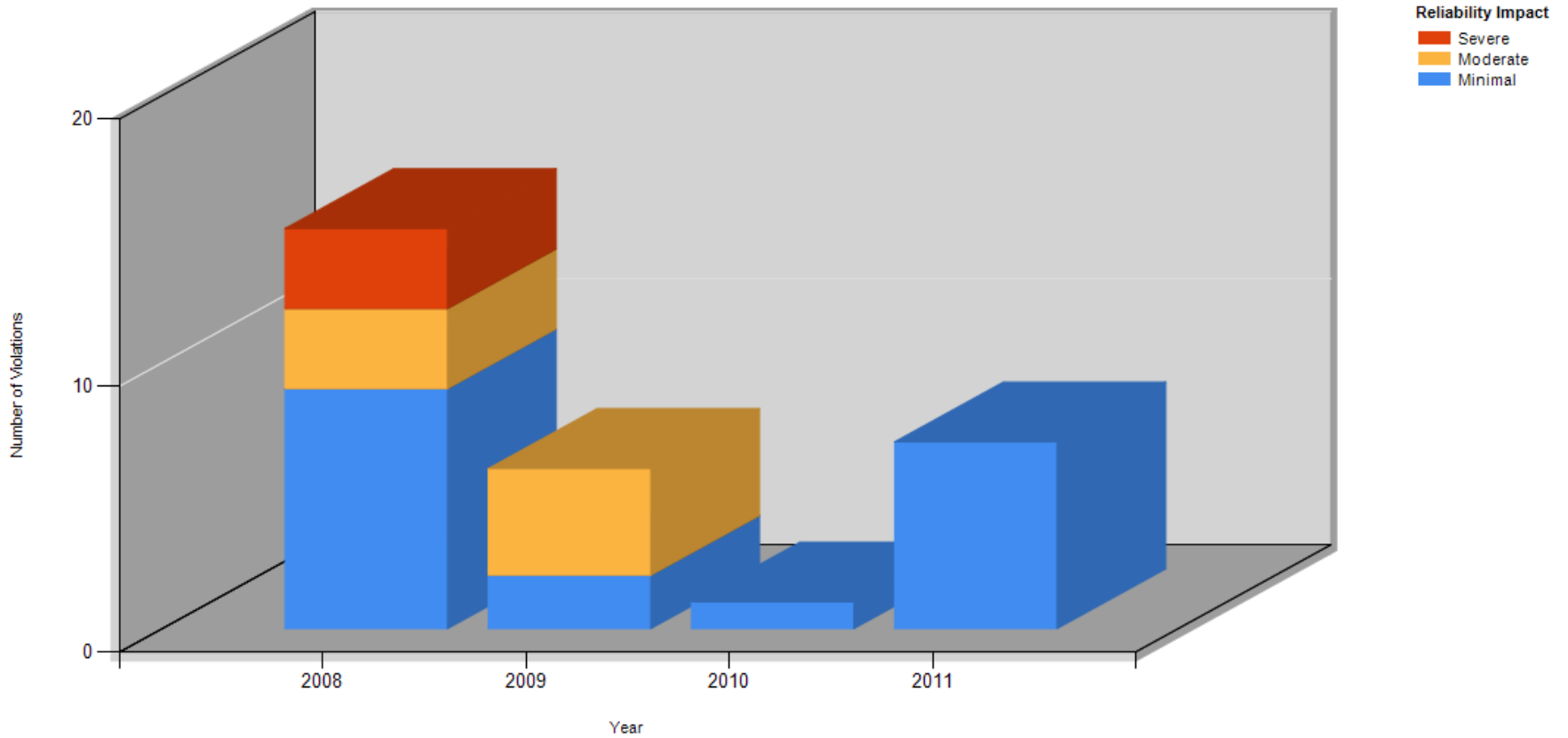
2008 - 2011



Reliability Impact	2008	2009	2010	2011	Total
Minimal	122	43	52	71	288
Moderate	37	18	15	9	79
Severe	9	4	9	1	23
<b>Total</b>	<b>168</b>	<b>65</b>	<b>76</b>	<b>81</b>	<b>390</b>

## Fire by Year

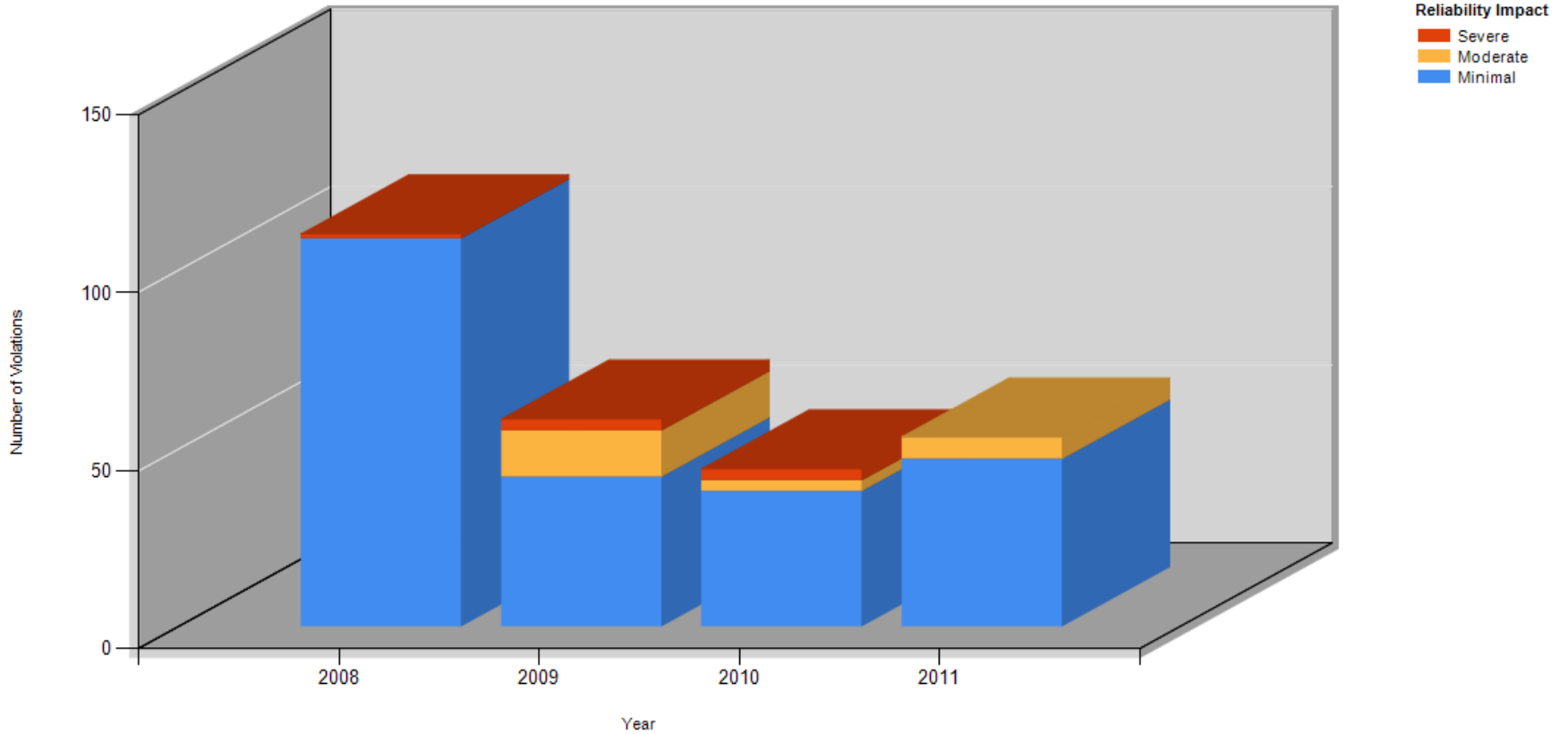
2008 - 2011



Reliability Impact	2008	2009	2010	2011	Total
Minimal	9	2	1	7	19
Moderate	3	4	0	7	7
Severe	3	0	0	3	3
<b>Total</b>	<b>15</b>	<b>6</b>	<b>1</b>	<b>7</b>	<b>29</b>

## Power System Condition by Year

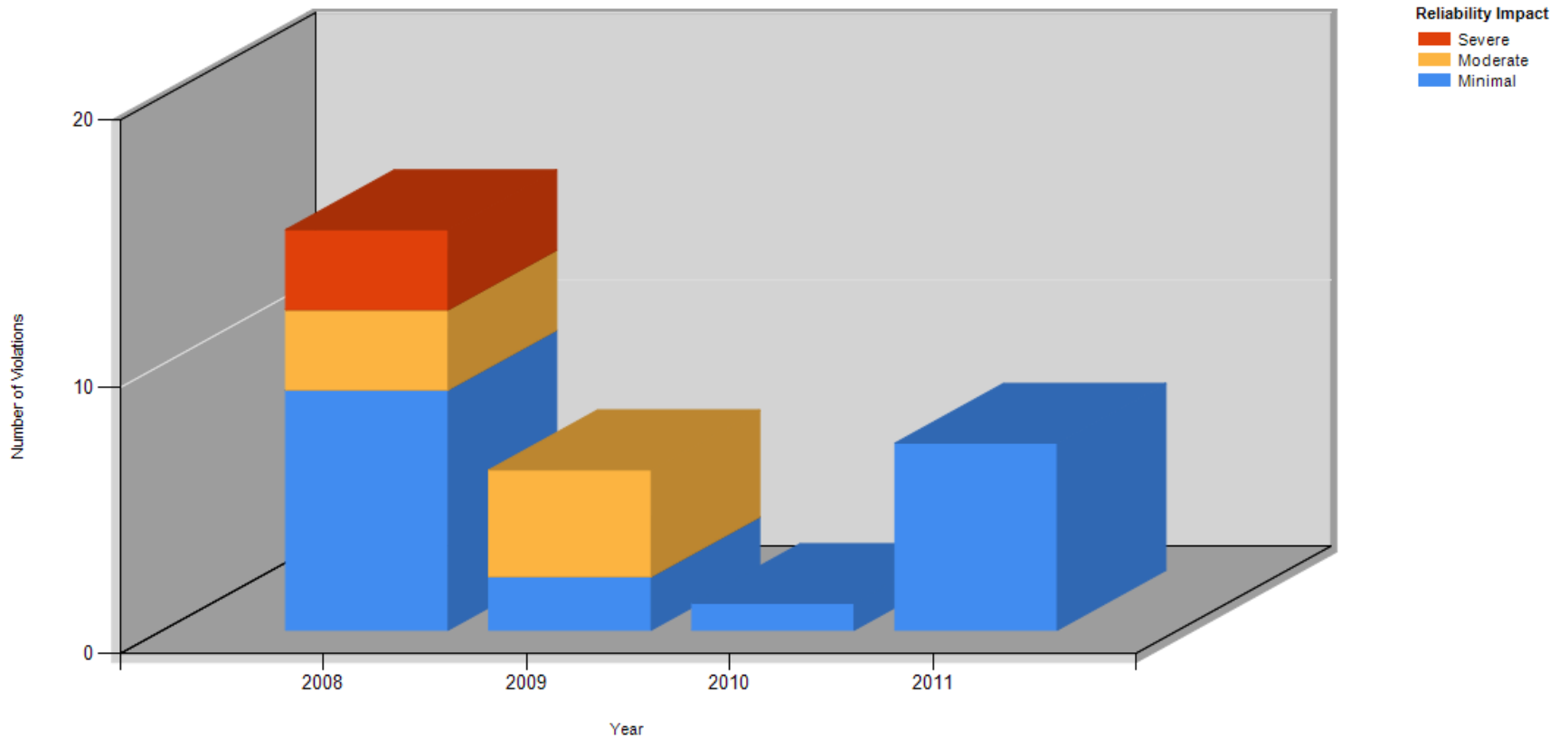
2008 - 2011



Reliability Impact	2008	2009	2010	2011	Total
Minimal	109	47	42	38	236
Moderate	0	13	3	3	22
Severe	1	3	0	0	7
<b>Total</b>	<b>110</b>	<b>63</b>	<b>48</b>	<b>44</b>	<b>265</b>

## Vegetation by Year

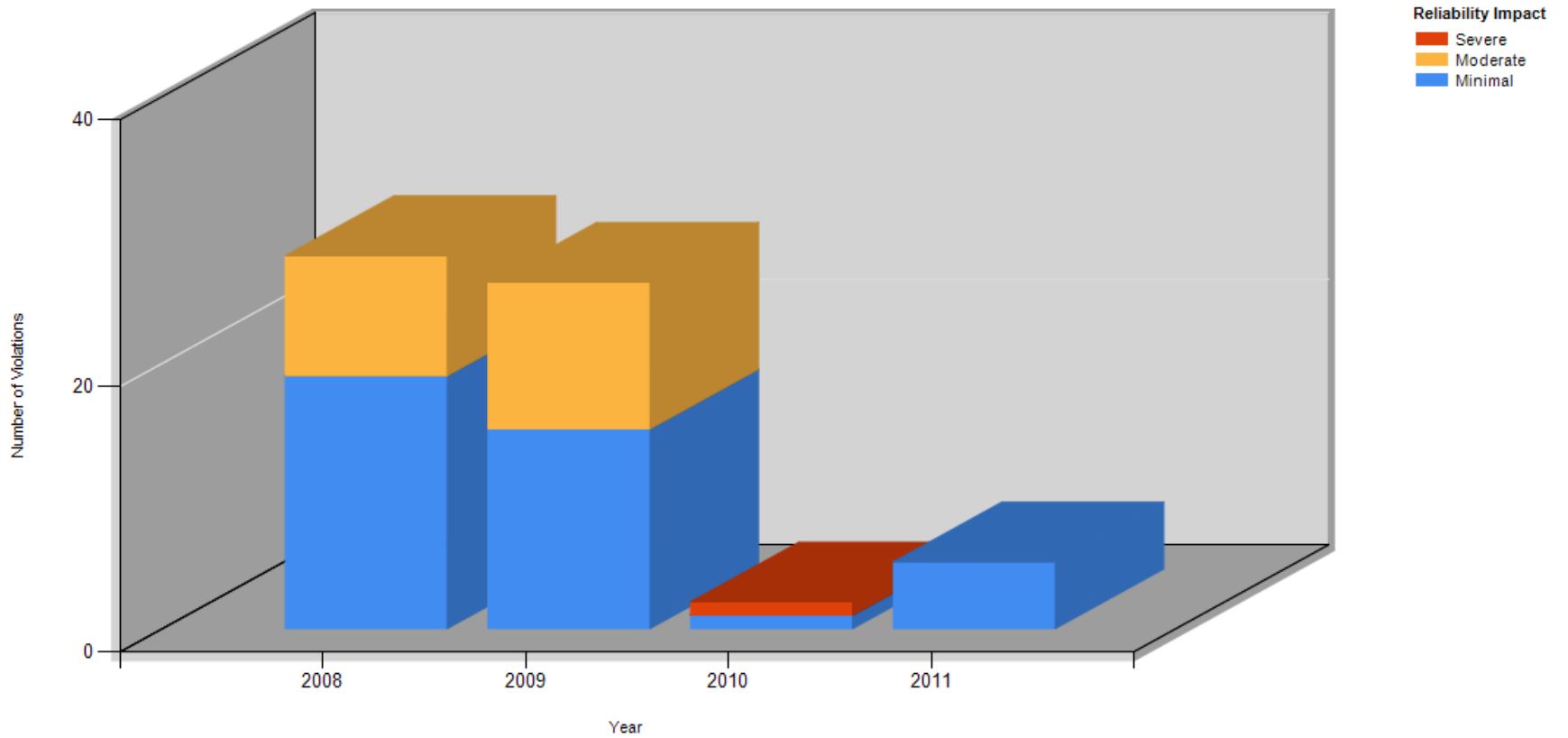
2008 - 2011



Reliability Impact	2008	2009	2010	2011	Total
Minimal	9	2	1	7	19
Moderate	3	4	0	0	7
Severe	3	0	0	0	3
<b>Total</b>	<b>15</b>	<b>6</b>	<b>1</b>	<b>7</b>	<b>29</b>

## Weather by Year

2008 - 2011



Reliability Impact	2008	2009	2010	2011	Total
Minimal	19	15	1	5	40
Moderate	9	11	0	0	20
Severe	0	0	1	0	1
<b>Total</b>	<b>28</b>	<b>26</b>	<b>2</b>	<b>5</b>	<b>61</b>

# *NERC Standards Driven Index (SDI)*

## *06/17/07 – 06/30/11*

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<b>No. of Standards (Details)</b>	<b>No. of Req. (Details)</b>	<b>No. of Entities</b>	<b>No. of Violations</b>
EOP-001	1	7	8
EOP-003	1	3	3
EOP-005	1	9	10
EOP-008	1	20	24
FAC-003	2	19	32
FAC-009	1	38	41
PER-001	1	7	7
PER-002	4	26	66
PRC-004	2	16	22
PRC-005	2	104	162
TOP-001	3	9	20
TOP-002	1	6	7
TOP-004	2	6	11
TOP-006	1	4	5
TOP-008	1	3	3
VAR-001	1	7	7

# *WECC Violation Results for NERC Standards Driven Index (SDI)*

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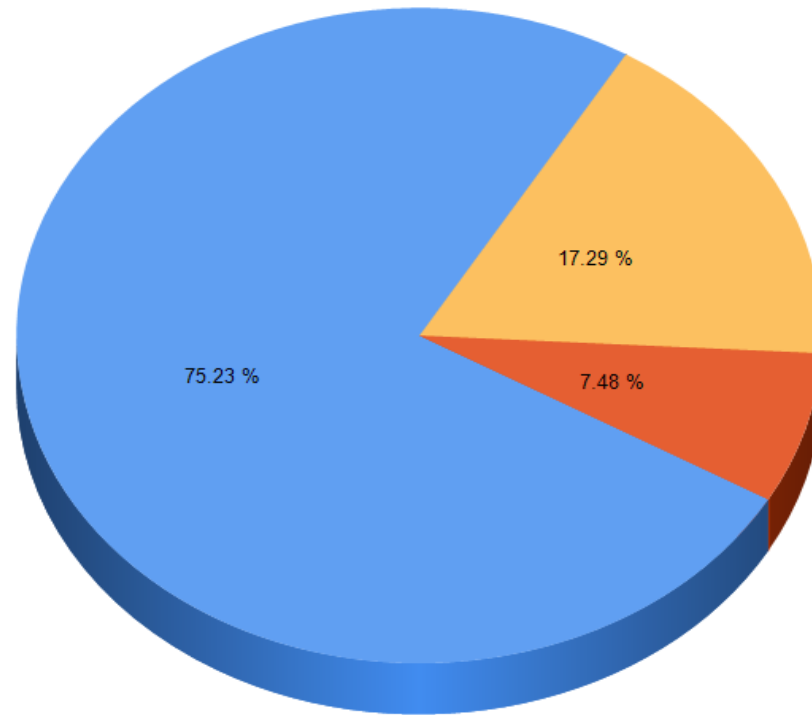
- WECC also performed similar violations analysis on subset of 26 Requirements included in NERC's SDI (High VRF; Severe Reliability Impact)
- Covers same period 6/17/2007-6/30/2011
- NERC very interested in WECC Vulnerabilities project and detailed results

NERC Standards Driven Index (SDI)

Violations by Impact to BPS

6/17/2007 - 6/30/2011

Minimal  
Moderate  
Severe

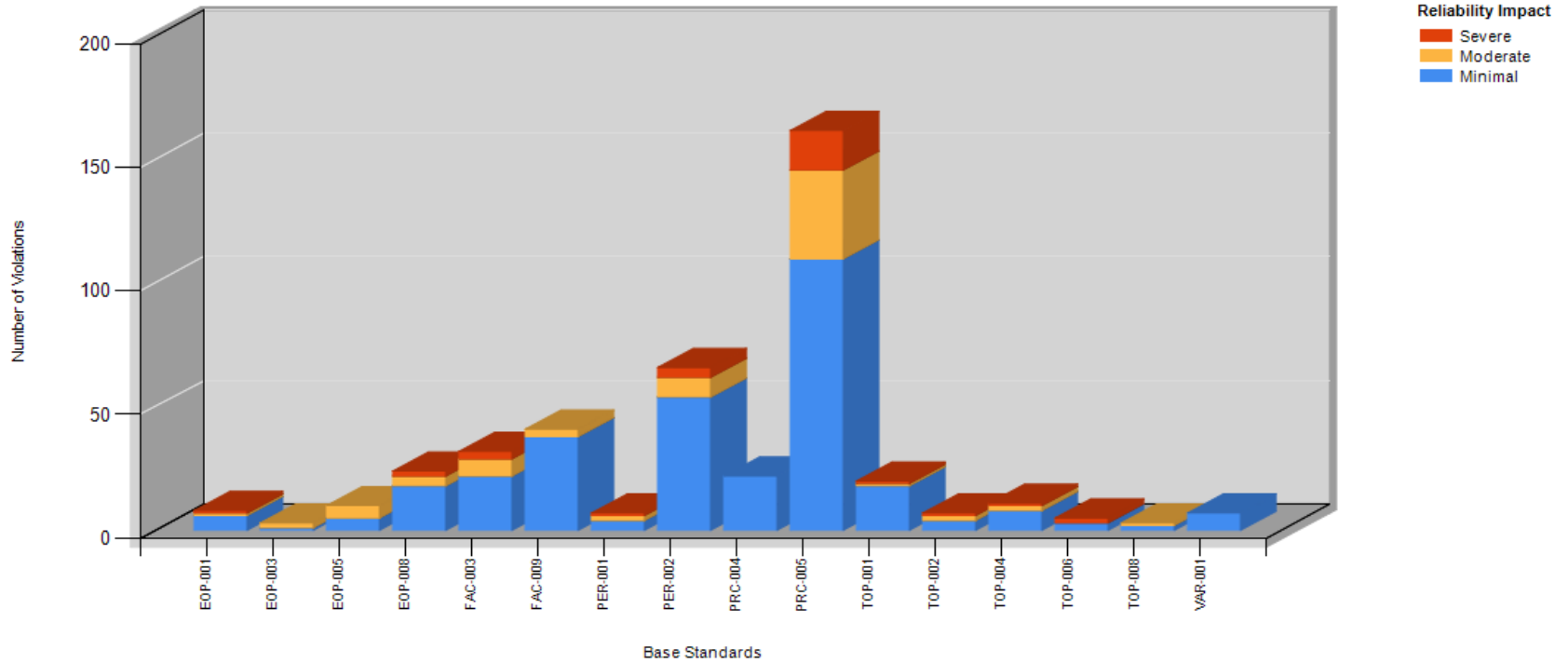


<b>Minimal</b>	<b>322</b>
<b>Moderate</b>	<b>74</b>
<b>Severe</b>	<b>32</b>
<b>Total</b>	<b>428</b>

## NERC Standards Driven Index (SDI)

### Number of Violations by NERC Standards Driven Index (SDI)

6/17/2007 - 6/30/2011

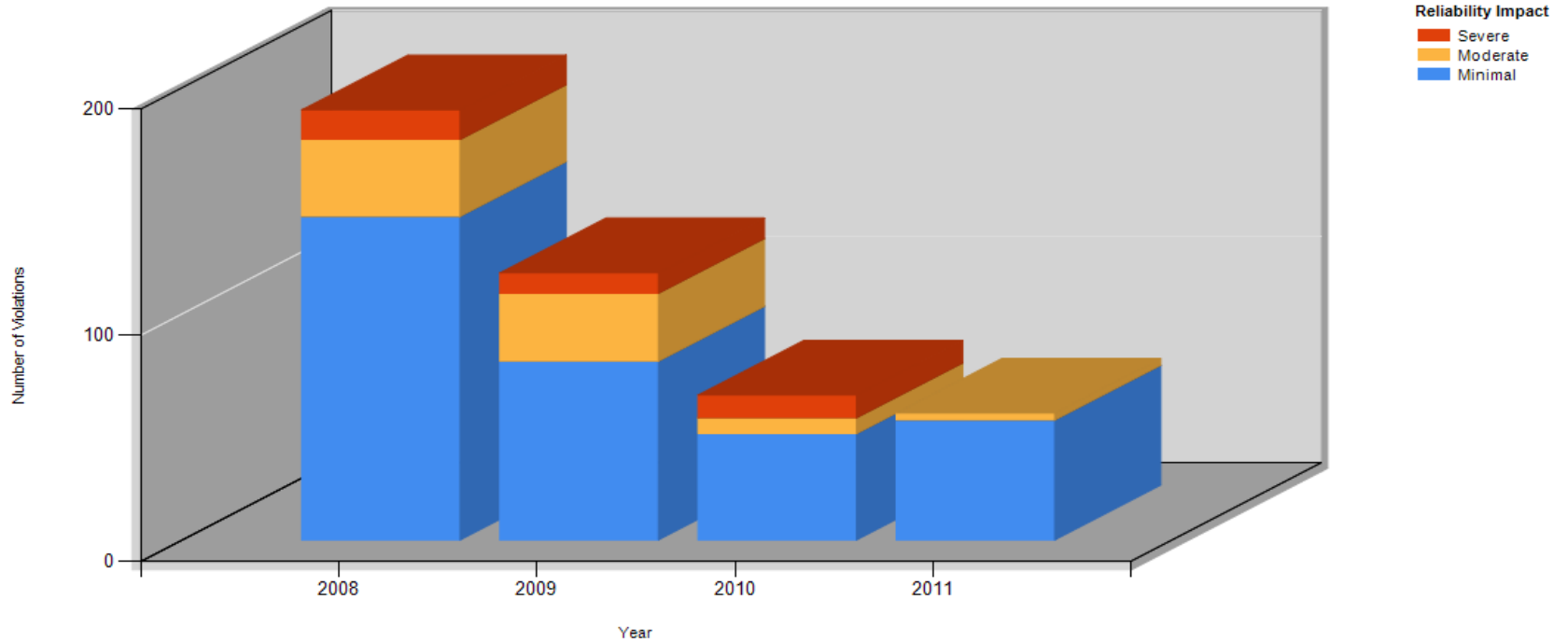


Reliability Impact	EOP-001	EOP-003	EOP-005	EOP-008	FAC-003	FAC-009	PER-001	PER-002	PRC-004	PRC-005	TOP-001	TOP-002	TOP-004	TOP-006	TOP-008	VAR-001	Total
Minimal	6	1	5	18	22	38	4	54	22	110	18	4	8	3	2	7	322
Moderate	1	2	5	4	7	3	2	8	0	36	1	2	2	0	1	0	74
Severe	1	0	0	2	3	0	1	4	0	16	1	1	1	2	0	0	32
<b>Total</b>	<b>8</b>	<b>3</b>	<b>10</b>	<b>24</b>	<b>32</b>	<b>41</b>	<b>7</b>	<b>66</b>	<b>22</b>	<b>162</b>	<b>20</b>	<b>7</b>	<b>11</b>	<b>5</b>	<b>3</b>	<b>7</b>	<b>428</b>

### NERC Standards Driven Index (SDI)

#### Number of Violations by NERC Standards Driven Index (SDI)

2008 - 2011



Reliability Impact	2008	2009	2010	2011	Total
Minimal	143	79	47	53	322
Moderate	34	30	7	3	74
Severe	13	9	10	0	32
<b>Total</b>	<b>190</b>	<b>118</b>	<b>64</b>	<b>56</b>	<b>428</b>

# Questions?

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