MONTANA-DAKOTA
UTILITIES CO.
A Division of MDU Resources Group, Inc.

400 North Fourth Street
Bismarck, ND 58501
(701) 222-7900

October 9, 2008

Ms. Patricia Van Gerpen
Executive Director
South Dakota Public Utilities
Commission
State Capitol Building
500 East Capitol
Pierre, SD 57501

Re: Request for partial Waiver of
49 CFR, Part 192.479, 192.481(a)
Docket No. PS07-001

Dear Ms. Van Gerpen:

Montana-Dakota Utilities Co. (Montana-Dakota), a Division of MDU Resources Group, Inc., herewith submits additional information in support of its request for a partial Waiver of Part 192.481 to allow atmospheric corrosion inspection frequency at least once every 4 calendars years, but with intervals not to exceed 51 months as submitted on January 12, 2007 in the above referenced Docket.

As noted in the Company's request, Section 192.481 subsection (a) requires inspection of onshore pipe exposed to the atmosphere for evidence of atmospheric corrosion at least once every three calendar years not to exceed 39 months. Montana-Dakota's request for a waiver would allow the atmospheric corrosion survey to be conducted concurrent with the Company's current 4 year leak survey without jeopardizing the integrity of the pipeline or public safety.

Scott Besmer, Senior Staff Engineer, in Montana-Dakota's gas distribution department worked with Martin Bettmann, the Commission's Pipeline Safety Program Manager, in regard to this request for a waiver. Mr. Bettmann provided his recommendation regarding the Company's request to the Commission on October 18, 2007. As noted therein, Mr. Bettmann recommended approval with certain conditions as referenced below. Montana-Dakota does not oppose the addition of the conditions recommended by Mr. Bettmann.

Mr. Bettmann's recommended conditions to approval of Montana-Dakota's request:

Atmospheric corrosion control monitoring will be conducted in conjunction with distribution system leakage surveys:

a. Outside of business districts, atmospheric corrosion control monitoring and leakage surveys must be conducted at least once every four calendar years at intervals not exceeding 51 months.
b. Inside of business districts, atmospheric corrosion control monitoring and leakage surveys must be conducted at least once every calendar year at intervals not exceeding 15 months.

Atmospheric corrosion control monitoring of regulator stations, essential and emergency valves, and other above ground piping that may be monitored pursuant to the 49 CFR, Part 192.721, will be conducted at the same time that those facilities are maintained or patrolled.

In addition, the operator must identify, inspect, and notify SDPUC of those areas requiring atmospheric corrosion control monitoring more frequently than once every three calendar years. These areas include "hot spots" where there are greater atmospheric corrosion rates such as areas subject to road salts and chemicals, industrial chemicals in the atmosphere, inside regulator/meter sets that are subject to corrosive environments; and other areas that show accelerated atmospheric corrosion.

Montana-Dakota does not track atmospheric corrosion survey costs as a separate cost item as field employees perform this task in conjunction with the leak survey test. It is estimated that the incremental cost of performing the atmospheric corrosion survey along with the leak survey test to be approximately $2,200. Montana-Dakota estimates the cost of conducting the atmospheric corrosion survey separately from the leak survey test to be approximately $41,140. The proposal to conduct the atmospheric corrosion survey along with leak surveys will continue to provide efficiencies without compromising pipeline integrity.

This partial waiver will apply to exposed natural gas pipelines according to CFR 49 Part 192.479. Accordingly, in maintaining conformance to CFR 49 Part 192.479(c) which states; "Except portions of pipelines in offshore splash zones or soil to air surfaces, the operator need not protect from atmospheric corrosion any pipeline for which the operator demonstrates by test, investigation, or experience appropriate to the environment of the pipeline that corrosion will – (1) only be a light surface oxide; or (2) not affect the safe operation of the pipeline before the next scheduled inspection." Montana-Dakota reviewed Bridges/ Exposed Mains, District Station Inspections, Isolated Valve Inspections, Miscellaneous Customer/Employee Inspection and FI Leak Survey records from 1998-2006 to identify any instances of atmospheric corrosion.

Those records identify 6 instances of atmospheric corrosion in the state of South Dakota as indicted in the below table:

SD Corrosion

Year	Instances of Corrosion	Total Leaks	Corrosion Instances as % of Leaks
2006	1	218	0.46%
2005	1	229	0.44%
2004	1	214	0.47%
2003	1	157	0.64%
2002	1	456	0.22%
2001	0	245	0.00%
2000	1	276	0.36%
1999	0	203	0.00%
1998	0	174	0.00%

Montana-Dakota's research shows extending the atmospheric corrosion survey requirements by 1 year (from three years to four years) does not jeopardize the integrity of a pipeline nor public safety. As identified in the table above, Montana-Dakota reported 218 jurisdictional leaks in 2006, with corrosion leaks accounting for less than 0.46% of all jurisdictional leaks on Montana-Dakota's natural gas system in South Dakota. Additionally, Montana-Dakota's South Dakota's natural gas system annual corrosion leak frequency is 0.64% or less of all jurisdictional leaks for the years 1998 through 2006 supporting the Company's position that atmospheric corrosion is minimal.

As noted in the response to Staff's Data Request No. 1-2, Montana-Dakota also reviewed information filed by Ameren Services Company in a similar case before the Illinois Commerce Commission regarding studies performed by the American Society for Testing and Material (ASTM) of atmospheric corrosion that typically consist of exposing bare test specimens to a wide variety of conditions at sites scattered across the United States using standard test panels. The study indicates an extremely low atmospheric corrosion rate in the Midwest.

To insure pipeline integrity and public safety, Montana-Dakota's current leak survey frequency is conducted once every four years; exceeding the frequency interval requirement as stated in Part192.723 (2). Accordingly, the benefits to conducting the atmospheric corrosion survey in conjunction with the leak survey include pipeline integrity and public safety as hazardous leaks will be detected sooner. Additionally, the increased leak survey frequency more effectively focuses efforts on leak detection in conjunction with visual inspections of above ground piping to identify problem areas before hazardous leaks occur to insure a safe natural gas system and public safety. Additionally, by using leak survey technicians, the operator qualification leak detection program requirements focus on below ground facilities in addition to visual inspections of above ground facilities identifying areas of concern before they become hazards.

Therefore, granting this partial waiver that will allow extending the survey interval frequency one year for atmospheric corrosion inspection will not affect the safe operation of the system.

Also attached are the responses provided to Staff's data request submitted to Mr. Martin Bettmann on September 7, 2007. Montana-Dakota's similar requests for a partial waiver have been approved by the North Dakota Public Service Commission and the Montana Public Service Commission with conditions similar to those recommended by the South Dakota Commission Staff. The U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration subsequently concurred with the partial waiver requests authorized in Montana and North Dakota.

Montana-Dakota requests that the Commission accept Staff's recommendation to allow the waiver with the conditions noted above.

Sincerely,

Donald R. Ball

Donald R. Ball
Vice President-Regulatory Affairs

Attachments
cc: D. Gerdes

September 7, 2007

Mr. Martin Bettman
South Dakota Public Utilities Commission
500 East Capitol Avenue
Pierre, SD 57501

Re: MDU Docket No. PS07-001 Data Request No. 1

Dear Mr. Bettman:

Attached are responses to SD Public Utilities Commission's questions regarding Montana-Dakota Utilities Co.'s request for a partial atmospheric corrosion waiver. If after review, there are additional questions, please do not hesitate to contact me.

Thank you for your time and consideration.

Sincerely,

Scott Besmer
Sr. Staff Engineer

C: Frank Morehouse – General Office
Doug Lee – General Office
Tamie Aberle – General Office
Jim Mann – Rapid City
Pat Darras - Bismarck

Montana-Dakota Utilities Co.

August 2007

MDU Docket No. PS07-001
Data Request No. 1

1-1. Provide a written report of all atmospheric corrosion discovered by various MDU personnel within SD since January 1, 1998. The report should contain the following information: Date Discovered, Location (to include town and type of facility, i.e. meter set, regulator station, valve, etc.) Discovered By (job title only), Date Repaired, and any appropriate comments.

Date Discovered	Repair Date	Address	Town	Detected By	Facility
4-5-07	4-5-07	908 Leblanc	Rapid City	Serviceperson	Service Riser
9-15-06	5-11-07	Dunlap Ave Bridge	Deadwood	Serviceperson	Main-Bridge Crossing
8-26-05	8-26-05	827 Franklin Street	Rapid City	Serviceperson	Service Riser
8-26-04	9-16-04	311 Custer Lot 120	Belle Fourche	MDU Contractor	Service Riser
12-4-03	12-4-03	200 Charles St. Lot 28	Deadwood	Working Foreman	Service Riser
8-23-02	8-23-02	430 D. Main	Lead	MDU Contractor	Service Riser
2001	None Reported				
6-14-00	6-14-00	421 Summit	Belle Fourche	MDU Contractor	Service Riser
1999	None Reported				
1998	None Reported				

1-2. In paragraph 3 of the waiver request reference is made to "Research" shows that extending the corrosion survey requirements to four years does not jeopardize the integrity of the pipeline nor public safety. Please provide a copy of the referenced research material.

See attached Illinois Commerce Commission, Docket No. 05-0113, Supplemental Direct Testimony of Ken Davis. "The American Society for Testing and Material (ASTM) has performed studies of atmospheric corrosion that typically consist of exposing bare test specimens to a wide variety of conditions at sites scattered across the United States using standard test panels. The weight loss and penetration of the specimens is recorded and used to predict average corrosion rates for various atmospheres. Many of these results indicate an average loss of metal in mils per year (1 mil = .001") and are displayed in tables and graphs that will be referred to later...The results of the referenced ASTM studies indicate that the corrosion rates of industrial and rural atmospheres in the Midwest are low compared to areas near the coasts...All of the cited studies indicate an extremely low atmospheric corrosion rate in the Midwest in which carbon steel typically deteriorated at 3 mils (.003") or less per year...Using the most aggressive atmospheric corrosion rate cited, the minimum life expectancy of distribution pipe, it if were left uncoated, is 24 years...The ASTM studies also demonstrate that with appropriate survey and remediation programs, the atmospheric corrosion survey interval can be safely and reasonably extended beyond 3 years without impacting the integrity of above ground facilities."

1-3. Provide by year for the last five full years the number of atmospheric corrosion leaks compared to all other categories of above ground leaks.

Year	Atmospheric Corrosion	All Other Categories of Above Ground Leaks
2006	0	9
2005	1	2
2004	1	5
2003	1	3
2002	1	5

1-4. Provide a comparison of the number of leak per mile of distribution pipe found during routine annual business district leak surveys compared to non-business district leak surveys by year for the last ten calendar years (1998-2007).

Year	Business District	Non-Business District
2007	Data not complete	
2006	2% of leaks discovered	10% of leaks discovered
2005	Not identifiable in records.	
2004	Not identifiable in records.	
2003	Not identifiable in records.	
2002	Not identifiable in records.	
2001	Not identifiable in records.	
2000	Not identifiable in records.	
1999	Not identifiable in records.	
1998	Not identifiable in records.	

Ameren Exhibit 4.0

ILLINOIS COMMERCE COMMISSION

DOCKET NO. 05-0113

SUPPLEMENTAL DIRECT TESTIMONY

OF

KEN DAVIS

Submitted On Behalf

Of

UNION ELECTRIC COMPANY d/b/a AmerenUE,
CENTRAL ILLINOIS LIGHT COMPANY d/b/a AmerenCILCO,
CENTRAL ILLINOIS PUBLIC SERVICE COMPANY d/b/a AmerenCIPS and
ILLINOIS POWER COMPANY d/b/a AmerenIP

December 7, 2005

ILLINOIS COMMERCE COMMISSION

DOCKET NO. 05-0113

SUPPLEMENTAL DIRECT TESTIMONY

OF

KEN DAVIS

Q. Please state your name, title, and business address.

A. My name is Ken Davis. My title is Pipeline Integrity Coordinator. My business address is 607 E. Adams St. Springfield, IL 62739. I am employed by Ameren Services Company, which provides technical, advisory and financial services to the Ameren Companies, among others.

Q. Please state your education and experience as it relates to corrosion of distribution piping and related matters.

A. I received my Bachelor of Arts in Management from the University of Illinois-Springfield, and my Masters in Business Administration from Millikin University. I belong to the National Association of Corrosion Engineers (NACE), and I am a NACE certified Senior Corrosion Technologist #4433 as well as a NACE certified Cathodic Protection Specialist #4433. I have over 14 years of corrosion related experience and have attended numerous NACE education courses that include Basic Corrosion, Cathodic Protection Data Interpretation, Internal Corrosion, and Cathodic Protection Design I.

Q. What is the purpose of your testimony?

A. My testimony will provide additional support for the waiver sought by the Ameren Companies, and more specifically provide justification as to why the waiver should be granted to extend the atmospheric corrosion survey. I will demonstrate the rate of atmospheric corrosion in the Midwest is extremely low and that extending the survey beyond three calendar years will not impact the integrity of the above ground facilities.

Q. What is atmospheric corrosion?

A. Atmospheric corrosion is defined as the gradual degradation or alteration of a material by contact with substances in the atmosphere, such as oxygen, carbon dioxide, water vapor, and sulfur and chlorine compounds (ASM International, Metals Handbook- Volume 13, (ASM International 1987), p. 2.). Atmospheric corrosion of above grade gas piping is affected primarily by two factors: the atmosphere and the material. The material at above grade gas facilities is primarily carbon steel pipe and is subject to corrosion in most atmospheres if left un-coated. If coated properly, atmospheric corrosion can be readily controlled in most environments. Ameren Services' Gas Policy 09 requires all new above ground gas facilities are coated and that the coatings on existing facilities are maintained.

Q. What types of atmospheric corrosion occur in the Ameren Companies service territories?

A. There are primarily four types of corrosive atmospheres: industrial, marine, rural, and indoor. In the Ameren Companies' service territories, industrial, rural, and indoor atmospheres can be found. An industrial atmosphere is characterized by pollution in the form of sulfur compounds, various forms of chlorides, and nitrogen oxides that combine with rain, fog, or dew to create a corrosive film on exposed steel (National Association of Corrosion Engineers, Basic Corrosion, (National Association of Corrosion Engineers 1984), p. 222.). A rural atmosphere contains organic and inorganic dusts instead of chemical contaminants which combine with the various forms of moisture to create a corrosive atmosphere that is typically milder than the industrial atmosphere (National Association of Corrosion Engineers, Basic Corrosion, (National Association of Corrosion Engineers 1984), p. 222.). An indoor atmosphere will be found inside a business or home that is frequented by people and has an environment that could be moist but contains no strong or concentrated chemical contaminants.

Q. What is the rate of atmospheric corrosion on the Ameren Companies' above grade natural gas facilities?

A. Low relative to other areas of the country, particularly in comparison to the coastal areas. The American Society for Testing and Materials (ASTM) has performed studies of atmospheric corrosion that typically consist of exposing bare test specimens to a wide variety of conditions at sites scattered across the United States using standard test panels. The weight loss and penetration of the specimens is recorded and used to predict average corrosion rates for various atmospheres. Many of these results indicate an average loss of metal in mils per year (1 mil = .001") and are displayed in tables and graphs that will be referred to later.

While the Ameren Companies service territories are largely rural, due to the concentration of factories in certain areas, the following areas in Illinois could be considered to have industrial atmospheres: Decatur, Danville, Peoria, Tuscola, Champaign-Urbana, LaSalle-Peru, Quincy, and St. Louis metro east (Illinois side). Conservatively, the balance of the service territories can be considered rural or semi-industrial. The results of the referenced ASTM studies indicate that the corrosion rates of industrial and rural atmospheres in the Midwest are low compared to areas near the coasts. This can be observed in the following table summarized from the attachment Table 1. (1 mil = .001"):

Location	Environment Type	Corrosion Rate mpy *
Detroit, MI	Industrial	0.57
Morenci, MI	Suburban	0.77
Potter County, PA	Rural	0.8
Columbus, OH	Industrial	1.5
Cleveland, OH	Industrial	1.5
East Chicago, IN	Industrial	3.3
Middletown, OH	Semi-Industrial	1.1
Bethlehem, PA	Industrial	1.5
Cape Kennedy,FL	Marine	5.2 - 42
Point Reyes, CA	Marine	19.7

* mpy = mils per year

Note: The complete table from which the above data was taken is attached as "Table 1" (National Association of Corrosion Engineers, NACE Corrosion Engineer's Reference Book, (National Association of Corrosion Engineers 1991), p. 81.). Ameren Ex. 4.1.

Additional support for this low Midwest corrosion rate is found in the following attachments:

Table 2; the most aggressive metal loss was 7.3 mils (.0073") in 15.5 years in Monroeville, PA, or 0.5 mils (.0005") per year (National Association of Corrosion Engineers, NACE Corrosion Engineer's Reference Book, (National Association of Corrosion Engineers 1991), p. 82,). Ameren Ex 4.2.

Chart 1; the calculated average reduction of thickness is 8 to 10 mils (.008" to .010") in 10 years or 1.6 to 2 mils (.0016" to .002") per year (National Association of Corrosion Engineers, NACE Corrosion Engineer's Reference Book, (National Association of Corrosion Engineers 1991), p. 80,). Ameren Ex. 4.3.

Chart 2; the calculated average reduction in thickness is 8 mils (.008") for 16 years or .5 mils (.0005") per year (National Association of Corrosion Engineers, Basic Corrosion, (National Association of Corrosion Engineers 1984), p. 227). Ameren Ex. 4.4.

All of the cited studies indicate an extremely low atmospheric corrosion rate in the Midwest in which carbon steel typically deteriorates at 3 mils (.003") or less per year. While it can be noted that Midwest corrosion rates vary widely, the most aggressive rate cited in the studies reviewed for bare carbon steel is 3.3 mils (.0033") per year.

Q. **What is the potential impact of this rate of atmospheric corrosion on the Ameren Companies distribution piping facilities?**

A. Utilizing the most aggressive corrosion rates in the Midwest for each study cited, projections can be made to determine the number of years until there is a 70% wall loss, if pipeline steel becomes exposed to the atmosphere, which then requires remedial action per the Code of Federal Regulations. The distribution piping facilities with the thinnest wall subject to atmospheric corrosion at an Ameren Company are facilities constructed of ¾" diameter piping with a nominal wall thickness of 113 mils (.113"). Wall losses for this piping are projected at the most aggressive corrosion rates cited in the studies above and summarized in the table below:

Three Quarter Inch Diameter Piping Wall Loss Projections

	Midwest Industrial, Most Aggressive Rate * mpy	% of Wall Loss in One Year	Years until 70% of Wall is Lost**
Table 1	3.3 (.0033")	2.92%	24
Table 2	0.49 (.00049")	0.43%	161
Chart 1	0.5 (.0005")	0.44%	158
Chart 2	0.5 (.0005")	0.44%	158

* mpy is mils per year

** Based on the following code, 70% was used as the maximum wall loss. CFR 49 192.487 (a) states "...each segment of generally corroded distribution line pipe with a remaining wall thickness less than that required for the maximum allowable operating pressure of the pipeline, or a remaining wall thickness less than 30% of the nominal wall thickness, must be replaced" (Code of Federal Regulations, Title 49 - Transportation, Part 192.487, 2004.).

Using the most aggressive corrosion rate cited above, the minimum life expectancy of distribution pipe, if it were left uncoated, is 24 years before replacement is required.

Q. What conclusions can you draw from the above studies and information?

A. In the Ameren Companies' service territories, ASTM studies indicate that atmospheric corrosion rates for bare carbon steel are extremely low. Using the most aggressive atmospheric corrosion rate cited, the minimum life expectancy of distribution pipe, if it were left uncoated, is 24 years. The studies referenced indicate that a three-year atmospheric survey, while it may be appropriate for the coastal regions, is extremely conservative for the Midwest. The ASTM studies also demonstrate that with appropriate survey and remediation programs, the atmospheric corrosion survey interval can be safely and reasonably extended beyond 3 years without impacting the integrity of above ground facilities.

Q. Does this conclude your testimony?

A. Yes.

Ameren Exhibit 4.1

TABLE 1

CORROSION RATES OF CARBON STEEL CALIBRATING SPECIMENS AT VARIOUS LOCATIONS

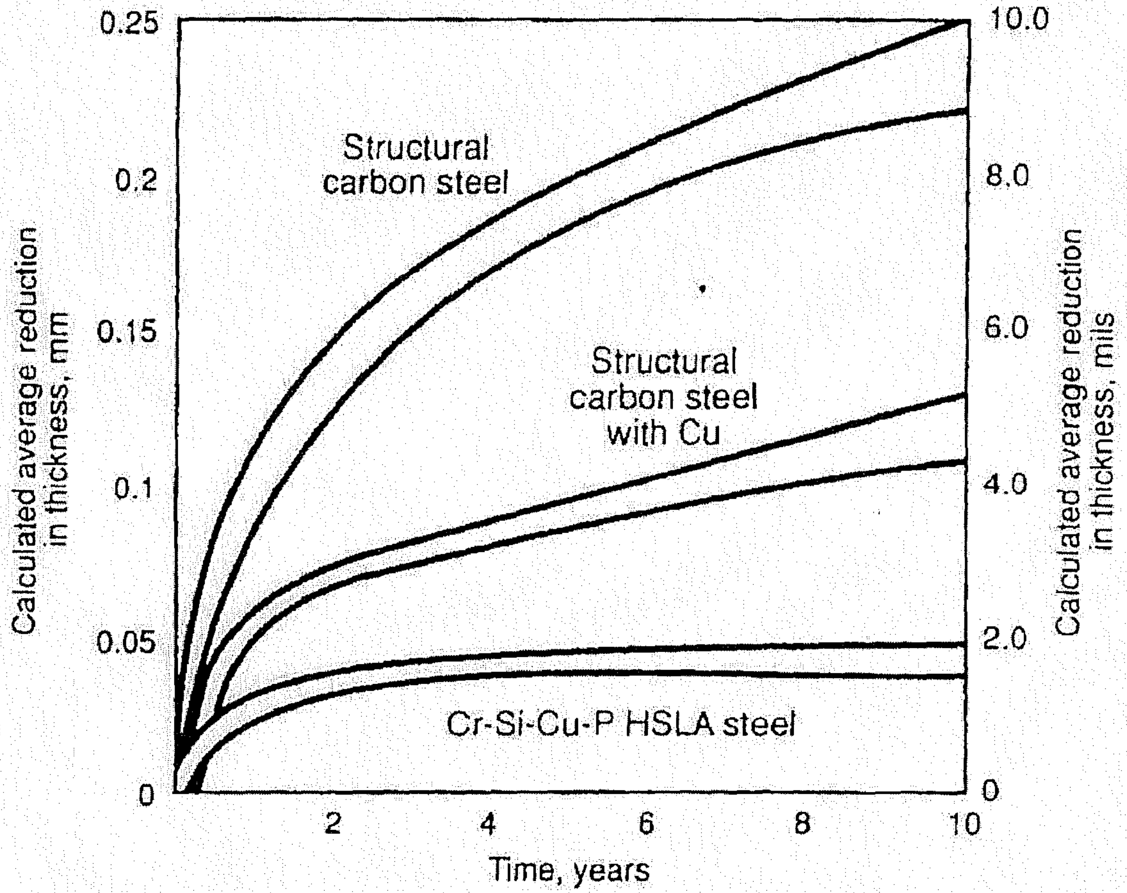
Location	Type of environment	Corrosion rate (a) µm/y	mpy
Norman Wells, NWT, Canada	Polar	0.76	0.03
Phoenix, AZ	Rural arid	4.6	0.18
Esquimalt, Vancouver Island BC, Canada	Rural marine	13	0.5
Detroit, MI	Industrial	14.5	0.57
Fort Amidor Pier, CZ	Marine	14.5	0.57
Morenci, MI	Urban	19.5	0.77
Potter County, PA	Rural	20	0.8
Waterbury, CT	Industrial	22.8	0.89
State College, PA	Rural	23	0.9
Montreal, Que, Canada	Urban	23	0.9
Durham, NH	Rural	28	1.1
Middletown, OH	Semi-industrial	28	1.1
Pittsburgh, PA	Industrial	30	1.2
Columbus, OH	Industrial	33	1.3
Trail, BC, Canada	Industrial	33	1.3
Cleveland, OH	Industrial	38	1.5
Bethlehem, PA	Industrial	38	1.5
London, Battersea, England	Industrial	46	1.8
Monroeville, PA	Semi-industrial	48	1.9
Newark, NJ	Industrial	51	2.0
Manila, Philippine Islands	Tropical marine	51	2.0
Limon Bay, Panama, CZ	Tropical marine	61	2.4
Bayonne, NJ	Industrial	79	3.1
East Chicago, IN	Industrial	84	3.3
Brazos River, TX	Industrial marine	94	3.7
Cape Kennedy, FL (60 ft elev., 60 yd) from ocean)	Marine	132	5.2
Kure Beach, NC (800 ft from ocean)	Marine	147	5.8
Cape Kennedy, FL (30 ft elev., 60 yd from ocean)	Marine	165	6.5
Daytona Beach, FL	Marine	295	11.6
Cape Kennedy, FL (ground level, 60 yd from ocean)	Marine	442	17.4
Point Reyes, CA	Marine	500	19.7
Kure Beach, NC (80 ft from ocean)	Marine	533	21.0
Galeta Point Beach, Panama, CZ	Marine	686	27.0
Cape Kennedy, FL (beach)	Marine	1070	42.0

(a) Two-year average.

Ameren Source: NACE Corrosion Engineer's Reference Book, 1991, p. 81

Source: Metals Handbook, 9th ed., Volume 1, p. 720, ASM 1978.

ATMOSPHERIC CORROSION OF STEEL vs TIME IN AN INDUSTRIAL ATMOSPHERE



Corrosion of three types of steels in an industrial atmosphere.
Source: Metals Handbook, 9th ed., Volume 13, p. 1304, ASM 1987

Ameren Source: NACE Corrosion Engineer's Reference Book, 1991, p. 80

TABLE 2

CORROSION OF STRUCTURAL STEEL IN VARIOUS ENVIRONMENTS

		Average Reduction in Thickness, Mils[a]					
Type of Atmosphere	Time, Yr.	Structural Carbon Steel	Structural Copper Steel	UNS K11510[b]	UNS K11430[c]	UNS K11630[d]	UNS K11576[e]
Industrial	3.5	3.3	2.6	1.3	1.8	1.4	2.2
(Newark, NJ)	7.5	4.1	3.2	1.5	2.1	1.7	—
	15.5	5.3	4.0	1.8	—	2.1	—
Semi-industrial	1.5	2.2	1.7	1.1	1.4	1.2	1.6
(Monroeville, PA)	3.5	3.7	2.5	1.2	2.1	1.4	2.4
	7.5	5.1	3.2	1.4	2.4	1.7	—
	15.5	7.3	4.7	1.8	—	1.8	—
Semi-industrial	1.5	1.8	1.4	1.0	1.3	1.0	1.5
(South Bend, PA)	3.5	2.9	2.2	1.3	1.9	1.5	2.4
	7.5	4.6	3.2	1.8	2.7	1.9	—
	15.5	7.0	4.8	2.2	—	2.5	—
Rural	2.5	—	1.3	0.8	1.2	—	—
(Potter County, PA)	3.5	2.0	1.7	1.1	1.4	1.2	1.8
	7.5	3.0	2.5	1.3	1.5	1.5	—
	15.5	4.7	3.8	1.4	—	2.0	—
Moderate marine	0.5	0.9	0.8	0.6	0.8	0.7	1.0
(Kure Beach, NC,	1.5	2.3	1.9	1.1	1.7	1.2	1.7
800 ft from ocean)	3.5	4.9	3.3	1.8	2.5	1.9	2.2
	7.5	5.6	4.5	2.5	3.7	2.9	—
Severe marine	0.5	7.2	4.3	2.2	3.8	1.1	0.7
(Kure Beach, NC,	2.0	36.0	19.0	3.3	12.2	—	2.1
80 ft from ocean)	3.5	57.0	38.0	—	28.7	3.9	3.9
	5.0	f	f	19.4	38.8	5.0	—

a) To obtain equivalent values in µm, multiply listed value by 25. b) ASTM A242 (type 1). c) ASTM A588 (gradeA). d) ASTM A514 (type B) and A517 (grade B). e) ASTM A514 (type F) and A517 (grade F). f) Specimen corroded completely away.

Source: Metals Handbook, 9th ed., Volume 1, p. 723, ASM 1978.

Ameren Source: NACE Corrosion Engineer's Reference Book, 1991, p. 82