CURRENT AND FUTURE SPECTRUM USE BY THE ENERGY, WATER, AND RAILROAD INDUSTRIES

Response to Title II of the Departments of Commerce, Justice, and State, the Judiciary, and Related Agencies Appropriations Act, 2001
Public Law 106-553

U.S. DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration

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APPENDICES

ACRONYMS AND ABBREVIATIONS

AAR	Association of American Railroads
ACE	Atlantic City Electric Company
AEI	Automatic Equipment Identification
AMR	Automatic Meter Reader
APCO	Association of Public-Safety Communications Officials
API	American Petroleum Institute
ATCS	Advanced Train Control System
AWWA	American Water Works Association
BG&E	Baltimore Gas & Electric
BPA	Bonneville Power Administration
CAD	Computer Aided Design
CDPD	Cellular Digital Packet Data
CFR	Code of Federal Regulations
CICC	Critical Infrastructure Communications Coalition
Cinergy	Cinergy Corporation
Cinergy Supp.	Cinergy Corporation's supplemental comments
CMP	Central Maine Power Company
DFS	Data Flow Systems, Inc.
DOD	Department of Defense
DOE	Department of Energy
DOE/CIO	DOE, Chief Information Officer
DOE/IRAC	DOE, Interdepartment Radio Advisory Committee
DOI	Department of Interior
Dominion	Dominion Resources Services, Inc.
DOT	Department of Transportation
DPL	Delmarva Power & Light Company
DTE	The Detroit Edison Company
EBMUD	East Bay Municipal Utility District
EMR	Electronic Meter Reading
EPA	Environmental Protection Agency
EOT	End-of-Train Device
FCC	Federal Communications Commission
FERC	Federal Energy Regulatory Commission
FM	Frequency Modulation
FPL	Florida Power & Light Company
FRA	Federal Railroad Administration
GHz	GigaHertz
GIS	Geographic Information Systems
GPU	GPU Energy, Inc.
HR	House of Representatives
IRAC	Interdepartment Radio Advisory Committee

Itron	Itron, Inc.
kHz	KiloHertz
LAN	Local Area Network
LMCC	Land Mobile Communications Council
LMCS	Land Mobile Communications Service
LMR	Land Mobile Radio
LMS	Location and Monitor Service
MAS	Multiple Address System
Mb/s	Mega bits per second
MB/S	Mega bytes per second
MDD	Mobile Data Dispatch
MHz	MegaHertz
ms	Millisecond
NAES	North Atlantic Energy Service Corporation
NMP	Niagara Mohawk Power Corporation
NRTC	National Rural Telecommunications Cooperative
NTIA	National Telecommunications and Information Administration
OPPD	Omaha Public Power District
OPS	Office of Pipeline Safety
PCS	Personal Communication Service
PL	Public Law
PLC	Power Line Carrier
PLMR	Private Land Mobile Radio
PLMRS	Private Land Mobile Radio Service
PLTF	Power Line Telecommunications Forum
PMA	Power Market Administration
PNR	Pittsburgh Naval Reactors
POFS	Private Operational-Fixed Microwave Service
PSTN	Public Switched Telephone Network
PSWN	Public Safety Wireless Network
PTC	Positive Train Control
PSP	Public Safety Program
RF	Radio Frequency
RFC	Request for Comment
RSPA	Research and Special Programs Administration
SCADA	Supervisory Control And Data Acquisition
SCANA	SCANA Corporation
SMR	Special Mobilized Radio
SRS	Savannah River Site
UHF	Ultra High Frequency
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAT	Utilities Spectrum Assessment Taskforce

USATFR	Utilities Spectrum Assessment Taskforce Final Report
USC	United States Code
USEPA	U.S. Environmental Protection Agency
UTC	United Telecomm Council
VHF	Very High Frequency
WAN	Wide Area Network
Western	Western Area Power Administration
WGP	Williams Gas Pipeline

EXECUTIVE SUMMARY

BACKGROUND

Public Law 106-553, The Departments of Commerce, Justice, and State, the Judiciary, and Related Agencies Appropriations Act, requires the National Telecommunications and Information Administration (NTIA) to consult with other federal agencies and departments responsible for regulating the core operations of entities engaged in the provision of energy, water, and railroad services and to report to Congress no later than one year after the Act's enactment on the current and future use of spectrum by these entities to protect and maintain the Nation's critical infrastructure.

NTIA employed the following methodology to facilitate and expedite the information gathering process from the energy, water, and railroad industries; representative trade organizations; and federal agencies with regulatory oversight of these industries:

- A Request for Comments, with a 60-day comment period, was published in the *Federal Register* on April 9, 2001. NTIA received a total of 19 responses from members of the utilities industry and various trade organizations. The membership of these trade organizations represents major segments of the energy, water, and railroad industries. This report contains a compilation of the responses received to the Request for Comments.

- A letter was sent to Executive Branch agencies that exercise oversight of these industries containing specific questions pertaining to the current and future spectrum requirements of providers of energy, water, and railroad services.

NTIA reviewed the information collected through comments, reports, and other sources of information. NTIA presents its findings in this report based upon such data. NTIA found that providers of energy, water and railroad services submitting comments for this report had concerns regarding their current and future spectrum requirements. In addition, federal agencies who regulate the core operations of these industries (or some aspect of those operations) generally concur with comments by the industry and its representative trade organizations. Specifically, these comments disclosed the following key issues regarding spectrum usage by these industries.

- Continued use of spectrum is essential to the current and future operations of these industries, taking into account industry trends and advances in wireless telecommunications technology. Providers of energy, water and railroad services are vital components of the nation's critical infrastructure.

- Problems of interference caused by congestion in the land mobile portion of the spectrum currently utilized was the issue mentioned most frequently by commenters. The issue of exclusivity (e.g., spectrum that is allocated for specific services) was a key thread throughout the comments.

- According to industry, reliance on commercial services for mission critical functions is hampered by insufficient coverage, reliability, redundancy, and robustness. Additionally, the high cost of commercial wireless services and wireline technologies affect reliance on these technologies.

- Almost all commenters mentioned general frequency bands (e.g., 2.4 GHz and 5 GHz bands) currently used, instead of identifying specific frequencies.

- Many commenters were not specific as to whether spectrum-efficient technology such as trunked systems and narrowbanding are used on currently assigned frequency bands or channels. However, there were notable exceptions, such as the American Association of Railroads' decision to implement the Association of Public Safety Communications Officials' Project 25 protocols to develop a rechannelization plan for its 160 MHz radios.

CURRENT SPECTRUM USE

Currently, the energy, water, and railroad industries use spectrum between 20 megahertz (MHz) and 25 gigahertz (GHz). Although they use numerous frequencies in a variety of bands, all three industries agreed and informed NTIA that spectrum currently used is either congested or quickly approaching critical mass, thus leading to problems of interference.

The technologies and applications used in these bands are vital to the core operations of these industries. Furthermore, in 1996 (by Executive Order No. 13010), President Clinton recognized the railroad, water and energy industries as part of the Nation's critical infrastructure. These entities provide commodities and services that are essential to daily life. Table 1 illustrates the three industries and the spectrum and applications currently used by each.

POSSIBLE FUTURE SPECTRUM REQUIREMENTS

The energy, water, and railroad industries submitted to NTIA suggestions to alleviate their claim of congestion and lack of new spectrum. There is no consensus among the commenters as to where new spectrum can be reallocated or obtained. However, there is consensus that additional spectrum is needed due to what they perceive as current congestion and lack of additional spectrum available for their respective industries. Table 2, on page xx in this section, summarizes the spectrum bands where the energy, water, and railroad industries believe their frequency requirements need to be addressed.

Table 1
Spectrum and Applications Currently Used as Indicated by Commenters

	Energy Industry	Water Industry	Railroad Industry
20 MHz	25-50 MHz: PLMRS		
40 MHz	48-50 MHz: Voice Dispatch, Alarms From Remote		
50 MHz	50 MHz Band: PLMRS, MAS		
100 MHz	150-170 MHz: Voice Dispatch, Load Management Control 150-175 MHz: Alarms From Remote Substations, PLMRS		160.215-161.565 MHz: FM Equipment
200 MHz	220 MHz: SCADA		
400 MHz	450-470 MHz: Voice Dispatch, Mobile Data, PLMRS 470-512 MHz: PLMRS		450-460 MHz: End of Train Devices
800 MHz	800 MHz Band: Voice Dispatch, Mobile Data Terminals, Trunked PLMRS 806-821 MHz: PLMRS; 821-824 MHz: PLMRS 851-866 MHz: PLMRS; 866-896 MHz: PLMRS 896-901 MHz: PLMRS		896 MHz: ATCS/PTC
900 MHz	900 MHz Band: MAS 902-928 MHz: SCADA 928-929 MHz: POFS 928/932/941 MHz: MAS; 952/956/959 MHz: MAS 928-952 MHz: SCADA; 929-930 MHz: PLMRS, 932-935 MHz, 932-941 MHz, SCADA, 935-940 MHz, PLMRS, 941-944 MHz, 952-960 MHz, POFS, 956 MHz, Mobile Meter Reading	900 MHz Band: MAS, SCADA 928 MHz: MAS 952 MHz: MAS 956 MHz: MAS	902-928 MHz: LMS 928 MHz: MAS 936 MHz: ATCS/PTC 952 MHz, 956 MHz, MAS
1 GHz	1.427-1.432 GHz, AMR, 1.85-1.99 GHz, POFS		
2 GHz	2 GHz Band, PLMRS, POFS, MAS, SCADA, Point-to-Point 2.4 GHz Band, Point-to-Point Microwave	2 GHz Band,[1] Water Operations Network	2 GHz Band,[2] Point-to-Point Microwave
5 GHz	5 GHz Band, Spread Spectrum 5.8 GHz, 5.9-6.4 GHz, Point-to-Point Microwave		
6 GHz	6 GHz Band, Point-to-Point Microwave 6.5-6.8 GHz, Point-to-Point Microwave 6.525-6.875 GHz, POFS	6 GHz Band,[3] Water Operations Network	6 GHz Band,[4] Point-to-Point Microwave
11 GHz	11 GHz Band,[5] Point-to-Point Microwave		11 GHz Band,[6] Point-to-Point Microwave
18 GHz	18-19 GHz, Point-to-Point Microwave		18 GHz Band,[7] Point-to-Point Microwave
21 GHz	21.2-23.6 GHz, POFS		
23 GHz		23 GHz Band,[8] Water Operations Network	
24 GHz	24.25-25.25 GHz, POFS		

1) 2.11-2.2 GHz, 2.45-2.5 GHz and 2.65-2.69 GHz. 47 CFR § 101.147(a).
2) *Id.*
3) 5.925-6.875 GHz. 47 CFR § 101.147(a).
4) *Id.*
5) 10.7-12.2 GHz. 47 CFR § 101.147(a).
6) *Id.*
7) 18-19 GHz. 47 CFR § 101.147(a).
8) 23-23.6 GHz. 47 CFR § 101.147(a).

Table 2
Summary of Frequency Bands That Could Be Used as Indicated by Commenters

Energy Industry	Water Industry	Railroad Industry
220 MHz Band	216-220 MHz Band	700 MHz Band[1]
450 MHz Band	6 GHz Band	1.4 GHz Band
800 MHz Band	11 GHz Band	
900 MHz Band	23 GHz Band	
1427-1432 MHz Band		
1-12 GHz Band		

1) Although the AAR mentioned the 700 MHz Guard Band, this spectrum will also be available to the energy and water industries by leasing spectrum from the "Guard Band Managers." More information on the 700 MHz band can be found on page 6-3.

The Energy Industry

The United Telecom Council, in its joint comments, recommends that exclusive spectrum for utilities be allocated in the 450 MHz, 800 MHz, and 900 MHz bands for voice and data communications. DTE Energy states that unused television channels should be allocated to utilities on a low powered non-interfering basis for voice and data communications and recommends access to bands between 1 GHz and 12 GHz for fixed narrow and medium-wide data channels as other preferred spectrum.

Itron, Inc., suggests that the 1427-1432 MHz band should be licensed for utility telemetry services such as Automatic Meter Reader and Supervisory Control and Data Acquisition. The National Rural Telecommunications Council states that access to the 220 MHz band for Supervisory Control and Data Aquisition applications allows rural electric and telephone cooperatives to transmit telemetry data over wide distances at reduced costs when compared to land line or high frequency wireless alternatives.

The Water Industry

The American Water Works Association believes the United Telecom Council's Utilities Spectrum Assessment Taskforce Final Report (1998) underestimated spectrum requirements for the utilities industries based on industry trends and the pace of telecommunications technology development. Table 3 is a summary of the Utilities Spectrum Assessment Taskforce (USAT) report spectrum prediction, which was included as an attachment to American Water Works Association's comments and derived from projections of future wireless applications and growth.

Table 3
USAT Final Report Spectrum Requirements

Year	2000	2004	2010
Additional Bandwidth Required	1.0 MHz	1.9 MHz	6.3 MHz

Another commenter, Data Flow Systems, specifically recommends that the 216-220 MHz band be dedicated to water utility telemetry uses nationwide.

The Railroad Industry

The Association of American Railroads suggests that the 700 MHz "guard band," recently auctioned by the FCC, be considered as a source of additional spectrum and that it be divided into geographic sectors, each with a separate band manager. The Association of American Railroads notes that one impediment to this suggestion is that the 700 MHz band is currently occupied by broadcast television stations.

The Association of American Railroads also suggests the 1.4 GHz band as a source for the proposed Land Mobile Communications Service for itself and other members of the Land Mobile Communications Council. The Association of American Railroads and other members of the Land Mobile Communications Council have previously asked the Federal Communications Commission for spectrum in the 1.4 GHz band (specifically, the 1390-1395 MHz/1427-1429 MHz/1432-1435 MHz bands), and to limit auctions in the 1392-1395 MHz and 1432-1435 MHz bands to band managers.

SUMMARY/CONCLUSIONS

In its investigation into the use of spectrum by these industries, NTIA recognizes the vital roles the railroad, water, and energy industries play in the Nation's critical infrastructure. The events of September 11, 2001, have underlined the importance of these industries and the role they play not only in our daily lives, but in times of disaster response and recovery. When the World Trade Center collapsed, utilities needed to be shut off or restored. It was important for sufficient water pressure to be continuously available for firefighting, and when the airlines were grounded, people and commerce relied more on the railroad industry for transportation.

Since this report is based predominantly on comments received from the industry and public, and information from federal agencies with oversight or regulatory authority over these industries, NTIA is unable to validate specific requirements and issues highlighted herein, such as exclusivity and congestion. However, NTIA suggests some of these issues may be addressed or mitigated with the use of advanced communications technology or newly allocated frequency bands, such as the 700 MHz guard bands.

NTIA believes the significance of these industries and the urgency of these issues may have changed as a result of the September 11th events. Therefore, it is of utmost importance that the Federal Communications Commission revisit these critical issues in order to accommodate the increasing role these industries play in maintaining quality of life.

SECTION 1
INTRODUCTION

BACKGROUND

The National Telecommunications and Information Administration (NTIA) is the Executive Branch agency principally responsible for developing and articulating domestic and international telecommunications policy. NTIA's responsibilities include establishing policies concerning spectrum assignments, allocation and use, and providing various departments and agencies with guidance to ensure that their conduct of telecommunication activities is consistent with these policies.[1] Accordingly, NTIA conducts studies and makes recommendations regarding telecommunications policies and presents Executive Branch views on telecommunications matters to the Congress, the Federal Communications Commission (FCC), and the public.

NTIA is responsible for managing the Federal Government's use of the radio frequency spectrum. The FCC is responsible for managing the spectrum used by the private sector, and state and local governments. In support of its responsibilities, the NTIA has undertaken numerous spectrum-related studies assessing spectrum utilization, studied the feasibility of reallocating spectrum used by governments or relocating government systems, identified existing or potential compatibility problems between systems, provided recommendations for resolving any compatibility conflicts, and recommended changes to promote efficient and effective use of the radio spectrum and improving spectrum management procedures.

Public Law (PL) 106-553 appropriated funds to the Departments of Commerce, Justice, and State, the Judiciary, and Related Agencies for fiscal year 2001, and directs NTIA to submit to Congress a study of the current and future use of spectrum by providers of energy, water, and railroad services to protect and maintain the Nation's critical infrastructure.[2] NTIA must submit this report to Congress no later than 12 months after PL 106-553 was enacted.[3] The statute also requires the Chairman of the FCC to submit a subsequent report to Congress addressing any needs identified in NTIA's study. The FCC's report must be submitted to Congress within six months after the release of NTIA's study. This document constitutes NTIA's study required by PL 106-553.

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[1] National Telecommunications and Information Administration, U.S. Dept. of Commerce, Manual of Regulations and Procedures for Federal Radio Frequency Management, at Chapter 2 (Jan. 2000).

[2] *See* Federal Funding, Fiscal Year 2001, Pub. L. No. 106-553, 114 Stat. 2762, 2762A-73 (2000).

[3] The events of September 11, 2001, prevented the National Telecommunications and Information Administration (NTIA) from being able to complete its report by the date mandated in the law. As a result, NTIA has informed Congress of the delay.

OBJECTIVE

In accordance with the requirements of PL 106-553, the objective of this report is to investigate and determine current spectrum usages and potential future spectrum requirements of entities providing energy, water and railroad services. Consistent with the requirements of the statute, these determinations were made after seeking public comments and consultation with the other federal departments and agencies responsible for regulating the core operations of these entities.

APPROACH

To comply with the requirements of PL 106-553 and the specific objectives stated above, the following steps were taken:

1. Members of the Interdepartment Radio Advisory Committee (IRAC) were given background information pertaining to the requirements of PL 106-553 and their assistance was solicited.[4]
2. A Request for Comments (RFC) was published in the *Federal Register* soliciting comments on current and future spectrum requirements for entities engaged in energy, water, and railroad activities.[5]
3. As part of NTIA's study, a letter was sent to federal departments and/or agencies that exercise oversight over the energy, water, and railroad industries, soliciting their comments on current and future spectrum requirements for these entities.[6]
4. Information pertaining to current spectrum use by providers of energy, water, and railroad services; their future spectrum requirements; and pertinent regulatory issues was obtained from a variety of sources, including:
   - The Public Safety Wireless Network (PSWN),
   - The Federal Communications Commission,

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[4] The IRAC, consisting of representatives of 20 federal agencies, serves in an advisory capacity to the Assistant Secretary of Commerce for Communications and Information. The IRAC, in existence since 1922, assists the Assistant Secretary in the discharge of his responsibilities pertaining to use of the electromagnetic spectrum. The IRAC was given informational updates on February 27, 2001, and July 10, 2001. Furthermore, NTIA met with private sector organizations engaged in energy, water and railroad activities to obtain background information about their respective industry. NTIA also met with federal departments and/or agencies who regulate these industries.

[5] 66 Fed. Reg., 18448 (April 9, 2001). See copy of the published RFC in Appendix B.

[6] Letter from William T. Hatch, Associate Administrator, Office of Spectrum Management, National Telecommunications and Information Administration (NTIA) (July 5, 2001), [hereinafter Federal Letter]. See Appendix C.

- Data sources available within NTIA, and
- Relevant public literature articles, reports, and studies that describe spectrum use by entities providing energy, water, and railroad services.

NTIA reviewed the information collected through comments, reports, and other sources of information. NTIA presents its findings in this report based upon such data. NTIA did not independently validate the energy, water, and railroad industries' current and future spectrum requirements.

Letter Soliciting Responses from Federal Agencies

On July 5, 2001, NTIA sent letters to federal departments and agencies responsible for regulating the energy, water, and railroad industries and requested they respond to the following questions by August 6, 2001:[7]

1. Please provide a brief description of your agency's mission, including the extent to which it provides regulatory oversight for any of the energy, water or railroad industry. Please indicate the aspects of the industry that your agency regulates, e.g., safety, industry standards, market supply, distribution, transport, disposals, and pricing, and provide citations to your regulations.
2. Does your agency also promulgate regulations concerning communications or spectrum-related issues? Please provide the citation to these regulations and summarize your agency's regulation(s) regarding current spectrum requirements and usage by the industry.
3. Will the industry your agency regulates require additional spectrum allocations in the future? If so, please provide details.
4. Are wireless technologies crucial to compliance of these regulation(s)? Are they crucial to maintaining the nation's critical infrastructure? What alternatives to wireless technologies can be utilized?
5. Do you consult with the industry certified frequency coordinator regarding spectrum allocations? If so, please provide contact information.

[7] *See generally* Federal Letter. NTIA received replies from the Environmental Protection Agency (EPA), the Department of Energy (DOE) and the Federal Energy Regulatory Commission (FERC). Copies of these responses are on file at NTIA. Copies of these responses may be obtained by contacting NTIA's Office of Public Affairs.

Request for Comments from the Public

Public Law 106-553 mandates that NTIA study the current and future spectrum requirements of the water, energy, and railroad industries. To assist in this effort, NTIA published a Request for Comments (RFC) in the *Federal Register* on April 9, 2001, to solicit comments from industry and the public.[8]

In the RFC, NTIA asked for information concerning any issues of fact, law, or policy about the spectrum requirements of the energy, water, and railroad industries and for responses to six questions. Specifically, NTIA asked the following questions:[9]

1. How much spectrum is presently available for the energy, water and railroad industries?
2. In which spectrum bands and in which radio services do these industries operate radio communications equipment?
3. What kinds of spectrum-dependent telecommunications equipment are currently being used by the energy, water, and railroad industries?
4. Are there non-spectrum dependent alternative technologies or commercial services currently available?
5. What part of the spectrum do the energy, water, and railroad industries foresee for possible future use? What is the rationale for these additional spectrum requirements?
6. What non-spectrum dependent communications technologies or commercial alternatives will be available in the future for the energy, water and railroad industries?

REPORT OVERVIEW

Section 2 of this report provides information regarding industry certified frequency coordinators and federal regulatory agencies. Sections 3, 4, and 5 provide comprehensive

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[8] *Supra note 5.* Comments were due on or before June 8, 2001. All comments are available on the National Telecommunications and Information Administration's Web site at: http://www.ntia.doc.gov/osmhome/utilities/CommentPage.html. All federal agency responses are on file at NTIA. A list of responders to both the RFC and letter to the federal agencies, and the acronym used to refer to each responder in this report, is attached as Appendix D. The first reference to each comment and/or response will include the full name of the organization, its acronym, and the page number. Subsequent references will be cited as "[acronym] at [page]." NTIA received 19 written comments from the public, of which five are from industry trade organizations. The five trade organizations are: American Petroleum Institute, American Water Works Association, Association of American Railroads, National Rural Telecommunications Cooperative, and the United Telecom Council. The trade organizations are made up of members of each industries and, through their members, they represent the members and the industry.

[9] *Supra note 5.*

information extracted from the public comments and federal agency responses to the questions raised by NTIA for the energy, water, and railroad industries, respectively. Each section will provide a brief overview of the industry. Based on the responses received by NTIA, the current spectrum requirements of each industry are discussed in terms of wireless communications infrastructure and wireline and commercial services. Technical issues and trends are then addressed. Finally, the future spectrum requirements for each industry are discussed. Section 6 provides a summary of spectrum usage for the three industries in terms of current usage and possible future needs. Section 7 provides the findings reached from NTIA's investigation.

SECTION 2
CERTIFIED FREQUENCY COORDINATORS AND FEDERAL REGULATORY AGENCIES

BACKGROUND

This section describes the role and frequency assignment process of Certified Frequency Coordinators and federal regulatory agencies associated with the energy, water, and railroad industries, with whom NTIA consulted in the development of this report. A frequency coordinator is an entity or organization that has been certified by the FCC to recommend frequencies for use by licensees. Frequency coordinators provide a useful service as the link between the FCC and end user. They ensure that the spectrum is used efficiently.

CERTIFIED FREQUENCY COORDINATORS

In accordance with rules implemented in 1997, the FCC consolidated 20 previously exclusive Private Land Mobile Radio (PLMR) services[10] into two frequency pools - the Public Safety Pool and the Industrial/Business Pool.[11] The FCC promulgated these new rules to "provide for more efficient allocation of the increased capacity created by the introduction of more efficient technology."[12] Each of the 20 PLMR services has one designated certified frequency coordinator (see Table 2-1). Eligibility for the Public Safety Pool is restricted to local government, police, fire, highway maintenance, forestry-conservation, emergency medical and special emergency services.[13] Eligibility for the Industrial/Business Pool is available to any entity engaged in a commercial, educational, philanthropic, or ecclesiastical activity.[14] In general, an eligible applicant can request any frequency in the Industrial/Business Pool. However, applications for frequencies previously allocated solely to the railroad, power, and petroleum radio services must be submitted to the respective railroad, power, or petroleum certified frequency coordinator within the Industrial/Business Pool.[15] The FCC states in its *Second Report*

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[10] Formerly grouped into the Public Safety Radio Services, Special Emergency Radio Service, Industrial Radio Services and the Land Transportation Radio Services categories. The frequencies within the Industrial/Business Pool are specified in 47 CFR § 90.35(b)(3) of the FCC Rules.

[11] The Industrial/Business Pool includes the Industrial Radio Services (Power, Petroleum, Forest Products, Film & Video Production, Relay Press Special Industrial, Business, Manufactures, and Telephone Maintenance Radio Services) and Land Transportation Radio Services (Motor Carrier, Railroad, Taxicab, and Automobile Radio Services) categories.

[12] Part 90 Order at 14308.

[13] Part 90 Order at 14319.

[14] Part 90 Order at 14322.

[15] Part 90 Order at 14330.

& Order (PR Docket 92-235 dated March 12, 1997):

> ...we have identified three types of entities within the new Industrial/Business pool – railroad, power, and petroleum companies[16] – that routinely use PLMR frequencies for critical public safety-related communications. To ensure that the integrity of these communications is not impaired, we will require anyone who seeks to use the frequencies previously allocated specifically for these types of operations to go through the same frequency coordinators that have been responsible for coordinating these frequencies.[17]

Frequency coordinators are not required to maintain a common database.[18] However, they are required to "provide notification of all frequency recommendations within one business day of making such recommendations to every certified in-pool coordinator that is also certified to coordinate that frequency."[19] In addition, this notification must be made to all in-pool coordinators at approximately the same time.[20] This notification should include an applicant name, frequencies recommended, antenna height, antenna locations, type of emissions, effective radiated power, description of service area, and time of recommendation.[21] The in-pool coordinators are required to communicate at least once daily; even if no license applications are received.[22] Furthermore, applicants must wait ten business days before transmitting pursuant to temporary and conditional authorization.[23]

Comments to the RFC were received from 3 of 18 certified frequency coordinators (power, petroleum and railroad) within the Industrial/Business Pool. They did not provide additional data (e.g., types of systems used) regarding current use of the frequencies in the Industrial/Business Pool by providers of energy, water, and railroad services. NTIA was unable to determine the number of frequency applications that were submitted to other frequency coordinators within the Industrial/Business Pool (See Table 2-1 on page 2-4). However, it would

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[16] These frequencies are annotated with a Railroad, Power or Petroleum designator (LR, IW, or IP respectively).

[17] Part 90 Order at 14309.

[18] Part 90 Order at 14333.

[19] *Id.*

[20] *Id.*

[21] *Id.*

[22] *Id.*

[23] Part 90 Order at 14335.

not be surprising if the number of applications was significant considering the large number of frequencies not managed by the power, petroleum, or railroad frequency coordinators.[24]

The Energy Industry

The American Petroleum Institute (API) and the United Telecom Council (UTC) are the two certified frequency coordinators authorized by the FCC to process requests for channel assignments from energy providers eligible to hold frequency authorizations in the Industrial/Business Pool, as outlined by Part 90 of the FCC rules and regulations.[25] Furthermore, UTC and API were the only certified frequency coordinators for the Industrial/Business Pool to submit comments on behalf of the energy industry.

The API is designated as the "Petroleum Coordinator (IP)" for all energy providers of petroleum or petroleum-based energy products.[26] API manages over 34,100 licenses authorized for operations in frequency bands below 512 MHz. Over 5,000,000 mobile units and 43,000 base stations operate under these licenses.[27] API is also a national trade association representing various facets of the petroleum and natural gas industries, ranging from exploration and production to the transportation, refining, and marketing of those energy sources.[28] API is a forum for its 400 plus members of all sectors of the oil and natural gas industries to pursue common goals and to protect certain public policy objectives.[29]

The UTC is designated as the "Power Coordinator (IW)" for all non-petroleum energy providers and water utilities (both waste water and drinking water) seeking to hold frequency authorizations in the Industrial/Business Radio Pool. UTC has been the national representative on communications matters for the Nation's electric, gas, water and steam utilities, and natural gas pipelines since its formation in 1948.[30] UTC's members range in size from large combination electric-gas-water utilities that serve millions of customers, to smaller, rural electric cooperatives and water districts that serve only a few thousand customers each.[31]

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[24] *Supra note 16.*

[25] 47 CFR § 90.35.

[26] *Id.*

[27] American Petroleum Institute (API) at 1.

[28] *Id.*

[29] *Id.*

[30] United Telecom Council (UTC) at 3.

[31] *Id.*

Table 2-1
List of Radio Services and Corresponding Frequency Coordinators[32]

Radio Service	**Frequency Coordinator**
Local Government and Police	Association of Public-Safety Communications Officials-International, Inc. (APCO)
Fire and Emergency Medical	International Association of Fire Chiefs/International Municipal Signal Association (IAFC/IMSA)
Forestry-Conservation	Forestry Conservation Communications Association (FCCA)
Highway Maintenance	American Association of State Highway and Transportation Officials (AASHTO)
Special Emergency	Personal Communications Industry Association (PCIA) and IAFC/IMSA
Power	United Telecom Council (UTC)
Petroleum	American Petroleum Institute (API)
Forest Products	Forest Industries Telecommunications
Film and Video Production	Alliance of Motion Picture and Television Producers
Relay Press	Newspaper Association of America
Special Industrial	Industrial Telecommunications Association (ITA)
Business	PCIA
Manufacturers	Manufacturers Radio Frequency Advisory Committee
Telephone Maintenance	Telephone Maintenance Frequency Advisory Committee
Motor Carrier	American Trucking Association
Railroad	Association of American Railroads (AAR)
Taxicab	International Taxicab and Livery Association
Automobile Emergency	American Automobile Association (AAA)

[32] Part 90 Order at 14324-14325.

The Water Industry

The UTC is also designated as the FCC frequency coordinator for water utilities seeking to hold frequency authorizations in the Industrial/Business Radio Pool.[33] As noted before, UTC serves as the national representative on communications matters for the Nation's electric, gas, water and steam utilities, and natural gas pipelines since its formation in 1948. UTC's members range in size from large combination electric-gas-water utilities that serve millions of customers, to smaller, rural electric cooperatives and water districts that serve only a few thousand customers.[34] UTC was the only certified frequency coordinators for the Industrial/Business Pool to submit comments on behalf of the water industry.

The Railroad Industry

The Association of American Railroads (AAR) is a non-profit organization composed of railroad companies operating in the United States, Canada, and Mexico.[35] AAR members generate about 97 percent of the total revenues of all railroads in the United States.[36] The AAR is the FCC certified frequency coordinator for railroads seeking licenses for frequencies in the Industrial/Business Radio Pool.[37] AAR represents its members on routine federal regulatory issues in the railroad industry, communications matters, and subjects regarding access to RF spectrum.[38] AAR also participates in UTC's Critical Infrastructure Communications Coalition (CICC).[39] AAR was the only certified frequency coordinator for the Industrial/Business Pool to submit comments on behalf of the railroads.

FEDERAL REGULATORY AGENCIES

PL 106-553 requires NTIA to consult with federal departments and agencies responsible for regulating the core operation of entities that provide energy, water, and railroad services. The following paragraphs list the department and/or agencies who responded to NTIA's inquiry for each of the three industries at issue.

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[33] Water utilities is considered a power service, therefore, frequency coordination falls under UTC's penumbra.

[34] UTC at 3.

[35] Association of American Railroads (AAR) at 2.

[36] *Id.*

[37] *Supra note 25*. AAR is designated as a Railroad Coordinator or LR.

[38] AAR at 2.

[39] UTC at 3.

The Energy Industry

The Department of Energy's (DOE's) mission is to foster a secure and reliable energy system that is environmentally and economically sustainable.[40] DOE does not regulate the core operations of the energy industry because regulation of core operations is generally accomplished at the state level.[41] The Federal Energy Regulatory Commission (FERC) is an independent regulatory agency within DOE that regulates the transmission, sale and wholesale of natural gas, oil (by pipeline interstate commerce) and electricity. The FERC also licenses and inspects private, municipal, and state hydroelectric projects. Environmental matters related to the providers of energy are overseen by the FERC.[42]

Within the Department of Transportation (DOT), two entities have regulatory oversight of the energy industry. The Research and Special Programs Administration, Office of Pipeline Safety (OPS) is responsible for promulgating regulations governing the safety and environmental matters of pipelines carrying gas (natural gas, flammable gas, or gas which is toxic or corrosive) and hazardous liquids (petroleum, petroleum products, and anhydrous ammonia).[43] As part of its mission to "protect the public, the environment, and U.S. economic interests through the prevention and mitigation of maritime projects,"[44] the U.S. Coast Guard is responsible for promulgating safety regulations and inspecting petroleum transfer facilities (e.g., refineries, barges, etc.), and tanker ships that transport petroleum products.

The Water Industry

The Environmental Protection Agency (EPA), U.S. Army Corps of Engineers (USACE), and Department of Interior (DOI) share responsibility for management of the water industry. The EPA, as directed by the Clean Water Act, Safe Drinking Act and Sanitary Sewer Overflow Rule, has placed increasingly strict performance requirements on drinking water and wastewater treatment facilities to ". . . protect public health and the environment, requirements which demand frequent monitoring for both large and minimally-staffed smaller water and wastewater systems."[45] The EPA does not promulgate regulations concerning communications or spectrum

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[40] Department of Energy (DOE) at 1.

[41] *Id.*

[42] FERC homepage at <http://www.ferc.gov/about/about.html>.

[43] Department of Transportation hompage at <http://ops.dot.gov/toc.htm>.

[44] Marine Safety and Environmental Protection Directorate, U.S. Coast Guard, U.S. Dept. of Transportation, U.S. Coast Guard Marine Safety and Environmental Protection Business Plan FY 2001-2005 at I-2, (August 2000).

[45] Letter from Charles Fox, Assistant Administrator, U.S. Environmental Protection Agency, to William E. Kennard, Chairman, Federal Communications Commission (Dec. 20, 1999) at 5, [hereinafter Fox Letter].

related issues.[46] However, EPA believes that the water quality and drinking water programs pose substantial challenges to the regulated community in its compliance with federal and state requirements.[47] Thus, the EPA projects that "the wastewater and drinking water utilities will need the communications tools to successfully achieve and maintain compliance objectives."[48] EPA informed NTIA that they do not consult with the industry certified frequency coordinator regarding spectrum licensing.[49]

Since the first Flood Control Act was enacted by Congress in 1917, USACE has been the primary federal agency responsible for civil works programs throughout the U.S. Management of dams and locks at various U.S. locations is also part of the USACE's responsibilities.[50]

In addition, the Tennesee Valley Authority, Bureau of Land Management, U.S. Geological Service, Bureau of Reclamation, and International Boundaries and Water Commission, all within the Department of The Interior, share regulatory oversight of the water industry.

The Railroad Industry

The Federal Railroad Administration (FRA), is an agency within the Department of Transportation, is responsible for working with the railroad industry to ensure it complies with all federal safety and communications regulations. The FRA is required by law "to monitor railroad compliance with federally mandated safety standards."[51] The FRA employs 400 inspectors in 47 offices nationwide to manage a site-specific inspection program.[52]

According to information supplied by the various federal agencies with regulatory oversight over energy, water, and railroad industries, none of the federal departments or agencies are involved with or support the private sector's spectrum matters. Furthermore, these regulating departments or agencies do not promulgate specific rules concerning spectrum use. Private sector companies approach the appropriate certified frequency coordinators when the need for spectrum arises.

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[46] Environmental Protection Agency (EPA) at 1.

[47] EPA at 2.

[48] *Id.*

[49] *Id.*

[50] U.S. Army Corps of Engineers homepage at <http://www.usace.army.mil/who.html#Mission>.

[51] U.S. Department of Transportation hompage at <http://www.fra.dot.gov/o/safety/ers/esxecsu0.htm>.

[52] *Id.*

SECTION 3
THE ENERGY INDUSTRY

BACKGROUND

The UTC's Critical Infrastructure Communications Coalition (CICC)[53] contends its members' unique operational needs make consistent and immediate access to exclusive radio frequency spectrum imperative to continuity of operations of the energy, water, and railroad industries.[54] According to the CICC, disruptions to the communications infrastructures of these industries can threaten public safety.[55]

Furthermore, the 1996 Executive Order pertaining to critical infrastructure protection states:

> [c]ertain national infrastructures are so vital that their incapacity or destruction would have a debilitating impact on the defense or economic security of the United States. These critical infrastructures include telecommunications, electrical power systems, gas and oil storage and transportation, banking and finance, transportation, water supply systems, emergency services (including medical, police, fire, and rescue), and continuity of government. Threats to these critical infrastructures fall into two categories: physical threats to tangible property (physical threats), and threats of electronic, radio-frequency, or computer-based attacks on the information or communications components that control critical infrastructures (cyber threats).[56]

A 1997 report of the President's Commission on Critical Infrastructure Protection identifies oil and gas production and storage, the water supply and electrical power infrastructures as integral

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[53] Formed in December 1999, CICC represents industries that include representatives of the electric, gas, water, railroad, and petroleum industries. CICC's mission is to promote legislative and regulatory policies that protect the internal communications systems of these industries. Specific participants of CICC include the American Gas Association, American Petroleum Institute, American Public Power Association, American Water Works Association, Association of American Railroads, Association of Oil Pipe Lines, Edison Electric Institute, Interstate Natural Gas Association of America, National Association of Water Companies, and the United Telecom Council. UTC at 3.

[54] UTC at 3.

[55] *Id.*

[56] Exec. Order No. 13010, 61 Fed. Reg. 37347 (July 15, 1996).

components of "the critical infrastructures that constitute the life support systems of our Nation ... ."[57] Cinergy Corporation contends in supplemental comments that utilities play a critical role in the quality of life for the Nation, especially during a local or national crisis.[58]

The Bonneville Power Administration (BPA)[59] has stated that the loss of wireless applications would interfere with energy companies' compliance with environmental and industry standards and regulations pertaining to power distribution.[60] BPA emphasizes that wireless applications are crucial to real time operations and activities related to safety, maintenance, and construction.[61] "Removing wireless systems on power networks would be like removing the backbone and nervous system of an animal and then asking it to walk and talk."[62]

Many power transmission, energy supply, and distribution systems are located in sprawling rural service territories, underground, or in remote, isolated areas where placement of non-spectrum dependent facilities such as fiber optics or commercial wireless networks are not cost effective, practical, or feasible.[63] Urban areas are also becoming more dependent on wireless technologies because of the high demand for energy by rapidly growing population centers.

Energy providers are continuously adding power substations, transmission lines, and communications systems to control these facilities. DOE states that, as infrastructure is added, the expansion of Land Mobile Radio (LMR) voice and data communication systems must also grow to allow maintenance crews to operate in the expanded areas. This expansion in generation capacity also allows for increased sharing (energy resources) between utilities in areas where deregulation has been implemented.[64] These technologies feature advance power meters that provide reactive/apparent power, time of use data (i.e., in segregated time frames), and special

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[57] President's Commission on Critical Infrastructure Protection, Critical Foundations - Protecting America's Infrastructures, The Report of the President's Commission on Critical Infrastructure Protection (Oct. 13, 1997) at i.

[58] Cinergy letter dated November 29, 2001

[59] BPA is a U.S. Department of Energy (DOE) agency that markets and transmits electric energy from federally owned hydroelectric and transmission facilities. BPA is represented on the IRAC through the DOE.

[60] Letter from Howard Landon, Chief Information Officer, U.S. Department of Energy, to William T. Hatch, Associate Administrator, Office of Spectrum Management, National Telecommunications and Information Administration (Aug. 9, 2001), [hereinafter Landon Letter], BPA Attachment at 5.

[61] *Id.*

[62] *Id.*

[63] *Id.* at 7.

[64] *Id.* at 2.

communications features that operate via phone, radio, or power lines.[65] Energy producers, suppliers, and distributors utilize the radio frequency spectrum to implement operations in the PLMRS, SMR, MAS, and Fixed Microwave Service to provide a variety of critical services that utilize various voice and data communications systems and applications. These networks facilitate the control and monitoring of power grids and pipeline distribution systems, and the exploration for petroleum and natural gas.[66]

Energy providers use a combination of spectrum dependent technologies and wireline technologies to maintain a secure, reliable, and safe voice and data communications infrastructure to preclude disruption of service caused by natural disasters or equipment malfunctions. Wireless voice and data networks also enable energy producers, suppliers, and distributors to comply with existing state and federal safety and environmental requirements that in many instances have specific system restoration and emergency notification time requirements. The BPA states that:

> BPA's power reliability, control, maintenance, safety and peripheral devices for metering, alarms and reporting are dependent on wireless. In many real time line protection applications such as a transfer trip, a line disconnect operation must be completed within 8 [millisecond] (ms) for system protection. Another example is BPA's long distant Remedial Action Schemes that require completion of action within 50 ms for line isolation and power stability through its controllers. SCADA require 2.5 seconds for responses from queries. Safety of linemen, maintenance, construction crews [sic] and equipment are dependent on wireless technologies. Emergencies dealing with restoring the power grid because of environmental, or other contingencies must be met by supporting wireless technologies. In summary, the loss of real time control operations with regulations is crucial to our nation's [sic] critical infrastructure and would cease today's power operations immediately in most cases without wireless operation.[67]

Any system disruptions that are not quickly restored pose potential threats not only to public safety, but also to the nation's economic security. Just as the September 11, 2001, terrorist attacks on the World Trade Center and the Pentagon disrupted our economy, crippled the airline industry, and compromised our national security, a disruption in a power generating station's control computer or a petroleum pumping facility could be just as devastating.[68] The

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[65] J.D. Kuecek, B.J. Kirby, J. Eto, R.H. Stuanton, C. Murray, C.A. Martinez, C. Goldman, Oak Ridge National Laboratory, U.S. Department of Energy, Pub. No. ORNL/TM2001/97, LBNL-47983, Load As a Reliability Resource in Restructured Electricity Markets (June 1, 2001) at 3, [hereinafter Load Report].

[66] UTC at 7.

[67] Landon Letter, in BPA Attachment at 6.

[68] President's Commission on Critical Infrastructure Protection, Critical Foundations - Protecting America's Infrastructures, The Report of the President's Commission on Critical Infrastructure Protection (Oct. 13,

utility command and control infrastructures do not have exclusive radio frequency spectrum assigned or priority access to the available radio frequency spectrum. The Detroit Edison Company (DTE), an energy provider, emphasized in their comments that slivers of the radio spectrum are shared by the energy, water, and railroad industries along with public safety entities. These frequencies are fragments of the entire band as compared to the spectrum allocations for broadcast television.[69] North Atlantic Energy Service (NAES) - Seabrook Station contends that there is insufficient radio spectrum and that its work crews, dispatchers, and command centers have continually encountered interference from other users who operate in close proximity to the station.[70] Cinergy Corporation (Cinergy) states in supplemental comments for this report that energy providers operating in the 800 MHz band must compete with livestock breeders, concrete manufacturers, taxicabs, buses, lumberjacks, and film producers.[71] The FCC has determined that any commercial business is eligible to be assigned channels in the 800 MHz and 900 MHz Industrial /Land Transportation pools.[72]

INDUSTRY GROWTH

Consumer Demand and Industry Trends

The current power crisis in certain parts of the United States, where demand far exceeds supply, serves as an example of why real-time redundant wireless communications technologies are essential to meet growing consumer requirements.[73] Many energy suppliers and distributors are utilizing wireless technologies to match increasing load requirements with escalating consumer demand. For example, over a dozen utility companies in 17 states offer pilot programs with real time-of-day pricing for electricity. In some cases, consumers are charged different rates during the day instead of a fixed rate.[74] "More recently, utilities such as Florida Power & Light, Potomac Electric and Xcel Energy (formerly Northern States Power) have offered price breaks to customers who allow their utility to automatically shut down their air conditioners or hot-water

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1997) at x.

[69] DTE Energy (DTE) comments at 1.

[70] North Atlantic Energy Service Corp (NAES) at 3-4. NAES further asserts that users are being licensed within 30 miles of the station disregarding a 70-mile exclusion area guideline used by frequency coordination agencies.

[71] Cinergy Supplemental comments (Cinergy Supp.) at 6.

[72] *See* 47 CFR § 90.617 (c) and § 90.35.

[73] *See generally* Itron, The Critical Role of Advanced Metering Technology in Optimizing Energy Delivery and Efficiency, A Report to the U.S. Department of Energy (May 5, 2000), [hereinafter Itron Report].

[74] USA TODAY, Savings Seen In Hour of Energy Use, Section A (July, 16, 2001) at 3A.

heaters by radio control when demand for electricity is high."[75] These programs would not exist but for the use of "cellular meters that transmit how much electricity is used minute-to-minute, matching the power use to the real-time cost of electricity."[76]

As shown in Figures 3-1 and 3-2, on pages 3-6 and 3-7 respectively, consumer demand for energy has historically increased and it is projected that consumer demand and advances in technology will be significant factors affecting the growth of the energy supply and distribution industry during next ten years. American Petroleum Institute (API) anticipates an increased need for spectrum allocations based on petroleum and natural gas production and consumption forecasts through the year 2020. This increased production and consumption will require additional communications capabilities to sustain all stages of the exploration, production and distribution process.[77]

The wireless voice and data infrastructure required to keep pace with projected industry growth must be reliable and have the capability to provide real-time network command and control. Electricity, natural gas, and natural gas pipelines utilities have extensive telecommunications requirements. An expansive, sprawling infrastructure, whether it is transmission lines, water pumps, or electric substations, requires maintenance, remote control, and monitoring. These objectives can be met effectively through telecommunications services. One of the most critical components in a utility's telecommunications arsenal is its wireless network.[78] Florida Power & Light and GPU Energy have indicated in joint comments for this report that, "because of the rise in electrical consumption and power shortages that may arise as a result of increased demand, wireless control of circuits in real time mode is becoming more important in order to maintain the stability of the power distribution grid. For example, wireless home gateways at customer premises can be utilized to monitor loads during peak hours. Such systems can be used to curtail use (e.g., shut down electric hot water heaters or air conditioners) during peak usage or emergency conditions during hot summer days when the electrical network is maximally taxed."[79]

Deregulation

Deregulation is another reason why energy providers have had increasing difficulty keeping pace with growing consumer demand. Deregulation opens retail energy markets to

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[75] *Id.*

[76] *Id.*

[77] API at 23.

[78] Utilities Spectrum Assessment Taskforce Final Report (USATFR) at 1.

[79] Florida Power and Light Company and GPU Energy, Inc. (FPL & GPU) at 4.

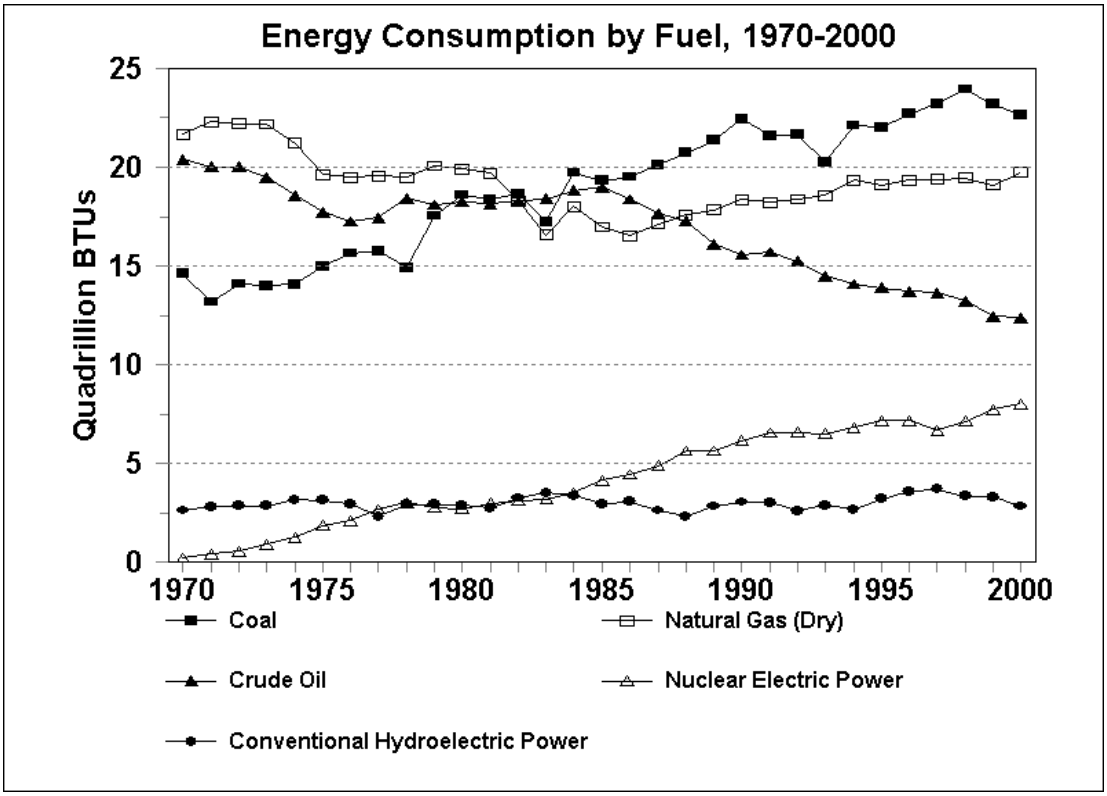

Figure 3-1[80]

competition and separates electric generation from the transmission and distribution of electricity. Previously, utilities maintained the entire end-to-end generation, transmission, and distribution of service. Now multiple companies are involved in various components of providing electric power.[81] UTC emphasizes that wireless systems will be increasingly important to critical infrastructures entities in the future because of deregulation, regulatory requirements, and system growth.[82] "Power outages and rolling blackouts in California are prime examples of what can occur when there is insufficient power system capacity, or proper control of the power system cannot be maintained. As new generation capacity is brought on line and new

[80] U.S. Department of Energy, Annual Energy Outlook 2001, DOE/EIA-0383 (Dec. 22, 2000) at 6.

[81] Central Maine Power (CMP) comments, page 4-5

[82] UTC at 2.

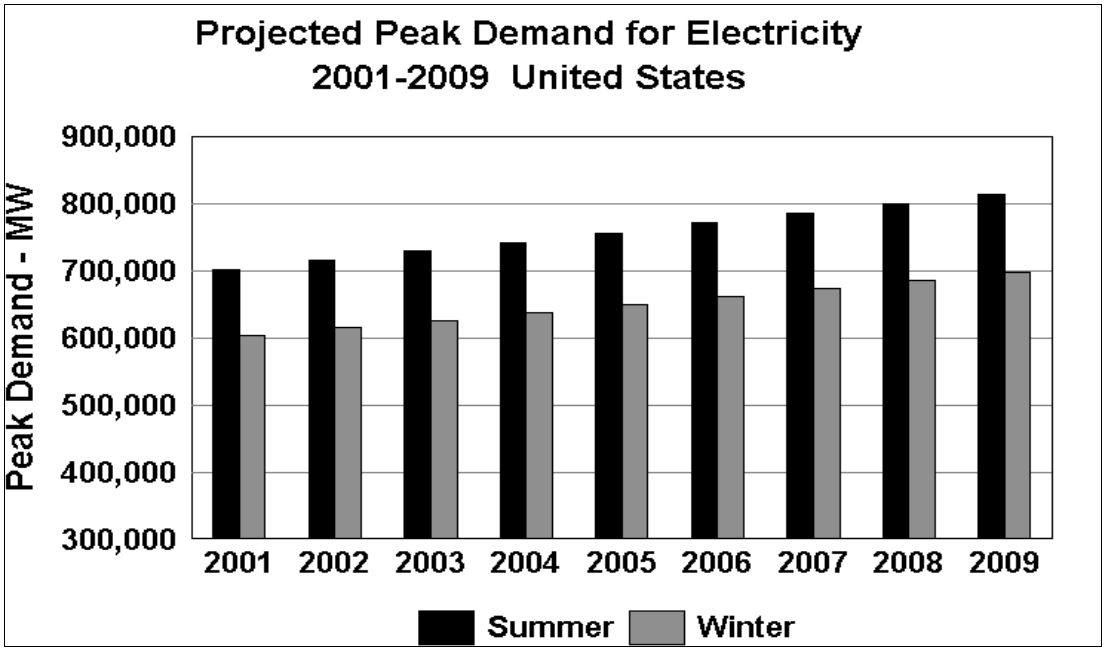

Figure 3-2[83]

transmission systems are installed in the power grid to allow sharing between utilities, spectrum requirements will increase for all electric utilities."[84]

WIRELESS COMMUNICATIONS INFRASTRUCTURE

The wireless telecommunications infrastructures of energy providers include applications that process both voice and data information. Energy providers utilize multiple frequency bands in the PLMRS, MAS, and the POFS. They operate SMR systems and maintain service with commercial wireless providers. Voice-related systems, such as land mobile, often use frequencies below 470 MHz for crew dispatch and emergency restoration efforts. Higher frequency bands used by microwave systems are being utilized for multiple address telemetry applications, point-to-point microwave for data and voice communications, and special applications such as control of electric power and natural gas SCADA networks.[85] This section will focus on "private and

[83] North American Reliability Council homepage at <http://www.nerc.org>.

[84] Landon Letter at 2.

[85] Niagara Mohawk Power Corporation (NMPC) at 2.

commercial"[86] voice and data applications commonly used by the energy industry in day-to-day operations and emergency response situations.

Voice Requirements

PLMR is used to coordinate daily activities of work crews and equipment for routine maintenance operations and restoration of service. Dispatchers and managers utilize systems in the PLMRS to communicate directly to mobile crews to safely restore power, to give operating orders, and to receive crew reports of job completions. Listed below are various modes of operations used for voice communications.[87]

Dispatcher to Crew/Crew to Crew/Group Dispatch.[88] This is a versatile mode of communications between managers, dispatchers and field personnel. Mobile voice is the primary mode of communication when coordinating the activities of work crews for routine maintenance. Service must be restored quickly when unexpected outages occur because of natural disasters, human error or intentional disruption of service (e.g., acts of terrorism, vandalism etc.). Group dispatch allows multiple parties to communicate on the same channel simultaneously.[89] Wireless voice calls enable work crews to maintain real-time communications with managers while working in remote or rural areas where wireline communications could be expensive and unreliable if available. Wireless land mobile operations maximize the reliability of real-time exchanges of information in various settings and conditions and are not tied to a specific location.[90] Omaha Public Power District states that real-time communications are crucial because they enable maintenance workers to communicate and coordinate their efforts for quick restoration of power.[91]

Emergency Calls/Mutual Aid/Interoperability. This mode of communication also allows for optimum use of safety procedures while maximizing the efficiency of operations in situations where serious injury has occurred or loss of life or property is imminent. Utility providers require reliable real-time communications with law enforcement, fire department, and emergency services in situations dictating emergency response. The utilities industry's transmission and distribution networks will become increasingly diversified with the onset of deregulation. Reliable communications with adjacent utilities is crucial if adjustments to energy transmission and

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[86] USATFR at 12, for industry definitions of private and commercial telecommunications systems.

[87] USATFR at 5.

[88] *Id.*

[89] Cinergy Supp. at 5.

[90] Omaha Public Power District (OPPD) at 4.

[91] *Id.*

distribution load requirements caused by growing consumer demand are to be made in a timely manner. DTE states that the mobile radio system is the only means of communications for overhead line crews attempting to render mutual assistance to other utilities during adverse weather situations such as hurricanes, tornados, or ice storms.[92]

Interconnect.[93] In nearly all field activities, utility personnel need to communicate with supervisors, engineers, contractors, consultants and others via land line telephones from the field (e.g., managers without access to LMR or SMR units). "Telephone interconnect" patches radio calls to land lines through command consoles. They provide real-time communications between various utilities work crews and managers.

Data Requirements

The primary goal of energy providers engaged in the exploration, production, distribution, and storage of energy is the efficient, reliable, and safe management of that resource. Producers, suppliers, and distributors of electricity, water, nuclear power, steam, and petroleum-based energy use various data collection and management systems to accurately align energy supply with consumer demand, which in turn lowers costs while enhancing reliability. These data collection and management systems also enable energy providers to comply with numerous state and federal regulations.[94] Energy providers depend on wireless data communications applications to monitor, control, and repair enormous production and distribution networks that extend between densely populated urban areas and rural, remote areas that are not easily accessed by repair personnel. The use of these systems (e.g., MAS and POFS systems) enable managers to dispatch field personnel more efficiently. Deregulation also necessitates the use of wireless data communications if energy suppliers and distributors in various sectors are to maintain reliable real-time communications in a competitive environment. Listed below are some of the major data collection and management systems used by the industry to efficiently monitor and manage energy resources.

Telemetry/Protective Relaying.[95] The energy utility industry uses wireless data telemetry systems to monitor and control electrical distribution systems and pipelines for natural gas, petroleum, steam, and water. Electrical distribution systems utilize these data links to trip circuit breakers when power faults or short circuits occur. They also utilize these systems to control the load level that generation facilities have to provide during peak demands. Suppliers are able to direct resources to consumers with much greater precision and efficiency by utilizing data collection and analysis, precision load forecasting, long-term power purchase contracts, pro-active

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[92] DTE at 2.

[93] USATFR at 5.

[94] UTC at 25.

[95] USATFR at 7.

load management and control, demand-side management programs and incentives, dynamic rate structures, and conservation programs.[96] The pipeline systems utilize similar techniques for the purposes of controlling valves to reroute or inhibit the flow of materials in the event of a failure of a section in a pipeline network.

SCADA. SCADA systems are generally computer-controlled radio communications links that allow a user to control and monitor power generation, storage and distribution systems without having to deploy staff where the equipment is located. These systems generally operate using MAS in the 900 MHz band, point-to-point microwave systems in the 2 GHz, 6 GHz, and 11 GHz bands, and unlicenced spread spectrum in the 2 GHz and 5 GHz bands. As modern utility systems have increased in complexity, SCADA systems have become critical components of their command and control infrastructure. These systems help to automate tasks like opening and closing circuit breakers, monitoring system stability, and monitoring alarms for overload conditions. Additionally, they are used for monitoring and controlling pumping stations and other critical components of water networks. Information supplied by DTE indicates that direct radio control of its remote substations, gas compressor stations, and pole top switches allows for prompt customer service and restoration of service.[97] The API indicates that petroleum, natural gas, and energy distribution industries have increasingly relied upon MAS assignments from the 900 MHz band for the operation of SCADA systems as their command and control infrastructures grow. These systems involve two-way traffic that requires paired channels, allowing a master station to monitor and control the status of a multitude of measurements and tolerance limits at wellheads, compressor stations, and valves, thereby eliminating requirements for constant manual surveillance. SCADA systems are deployed in production fields and along pipelines to monitor and adjust a variety of operating parameters, such as temperature, pressure level, and volume. These monitoring functions are crucial in satisfying safety and environmental objectives while also maintaining an acceptable level of production.[98]

AMR. All energy providers use some form of wireless technology to monitor and transmit usage data from utility meters to utility databases in real time. Accumulation of real time data gives a utility company the ability to develop a new portfolio of dynamic rate structures and incentive programs, real-time pricing packages, and interruptible rates that can be targeted to specific customers to significantly improve load management and reduce peak demand.[99] This is generally accomplished with a mobile system or a fixed network. The mobile system employs a handheld unit or a van-mounted unit, which polls consumer meters (typically with a licensed frequency) and "wakes" the meter unit. The remote meter unit then sends metering data back to the mobile unit (generally on an unlicensed frequency). This record of energy consumption is segregated into

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[96] Itron, Inc. (Itron) at 3.

[97] DTE at 2.

[98] API at 6.

[99] Itron at 1.

adjustable time frames (typically a month) and set to correspond to "on-peak" and "off-peak" prices.[100] The fixed networks generally use a pair of licensed frequencies. These systems operate in a manner similar to the mobile system except that there are numerous "mini-master" stations deployed to interrogate meters. Central Maine Power Company (CMP), an electric utility servicing central and southern Maine, states: "[u]tilities are also increasingly relying on wireless communications to obtain accurate customer profile information. Utilities now seek to read customer meters daily and to gather a wide range of information that ensures the efficient generation of electricity. Automated meter reading (AMR) and electronic meter reading (EMR) have flourished in recent years to meet this need. Collection and assimilation of these vast quantities of data are essential to the core functions of utility facilities."[101]

The energy industry considers AMR systems to be less expensive than wireline systems because they require only the initial investment for radio equipment that has a long life span.[102] Wireline systems require a dedicated land line for each AMR unit.[103] Furthermore, Itron attributed the following as beneficial use of AMR: automation of costly "off-cycle reads" associated with beginning-and-end-of-service transactions, a reduced number of erroneous readings, the ability of customers to monitor or make changes to their equipment from a remote location using wireless sensor devices, no degradation of service because of weather, the elimination of dangerous access situations, and automatic outage notification.[104]

Energy theft pertaining to metering and meter reading is another issue confronting energy providers, regulators, and consumers that can be addressed with AMR technology.[105] Industry groups and analysts estimate that energy theft in the United States is between 0.5 percent and 3.5 percent of annual gross revenues.[106] In the late 1990s, U.S. electricity revenues were

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[100] Load Report at 47.

[101] CMP at 5.

[102] National Rural Telecommunications Cooperative (NRTC) at 7. NRTC is a non-profit cooperative consisting of 705 rural electric cooperatives, 128 rural telephone cooperatives, and 189 independent rural telephone companies located throughout 48 states and its mission is to provide telecommunications technologies and services to rural America. NRTC at 2.

[103] *Id.*

[104] Itron at 6.

[105] Itron Report at 4.

[106] *Id.*

approximately $280 billion per year.[107] However, electricity theft was estimated to be between $1 billion to $10 billion annually, and that does not include theft of natural gas.[108]

Meter tampering is not only costly to consumers, but theft of electricity and natural gas service also causes significant public safety issues. For instance, a consumer tampering with a gas meter could cause a meter to leak, increasing the risk of an explosion. Tampering with an electric meter poses the risk of electrocution or other serious injury. Technology is currently available and in use that is capable of automatically detecting meter tampering. This could provide a crucial asset in efforts to improve public safety and deter energy theft.[109]

WIRE-BASED AND COMMERCIAL SERVICES

In most instances, wire-based services are leased from commercial providers because of the high cost of components (e.g., installation costs, maintenance and repair costs, etc.). Although some media, such as fiber optic cables, have shown a high capacity for relaying data, they also have distinct disadvantages when utilized by energy providers. Each wire-based or commercial medium and its feasibility is discussed below. For an overview of the advantages and disadvantages of wire-based and commercial services go to Table 3-1. This table was derived from comments in response to the RFC.

Fiber Optic

In some instances, fiber optic networks can be a robust alternative to the use of spectrum-dependent equipment, such as point-to-point microwave or MAS. "A single fiber can carry 2,400 megabits per second (Mb/s) of data (48 DS-3 Circuits[110]); the maximum capacity of a commercial microwave channel is 135 Mb/s (three DS-3 circuits)."[111] Fiber can be used instead of spectrum-dependent equipment to process voice and data information, such as land mobile voice, SCADA and AMR between meter devices and main offices.

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[107] *Id.*

[108] *Id.*

[109] Itron Report at 4.

[110] A DS-3 link is equivalent to one TV channel, 28 T1 circuits, 762 voice channels, or 45 Mb/s.

[111] U.S. Department of Commerce, National Telecommunications and Information Administration, Staff Study, U.S. National Spectrum Requirements/Projections and Trends (Mar. 1995) at 69.

Table 3-1
Summary of Commercial Services as Indicated by Commenters

Wire Based or Commercial Service	Disadvantages	Advantages
Fiber Optic	Limited coverage area in rural and remote areas Expensive components Difficult to install in remote, rural or inhospitable areas "Right-of-way" land rights must be obtained Very susceptible to damage No priority of service for public safety agencies & utilities	Channel capacity Beneficial for network redundancy
Power Line Carrier	Limited coverage area in rural and remote areas Susceptible to damage Interference Low channel capacity	Pre-existing network
Commercial Telephone	Limited coverage area in rural and remote areas Susceptible to damage Dependent on reliable power supply Low channel capacity Requires complicated design scheme No priority of service for public safety agencies & utilities	Pre-existing network
Commercial Wireless Telephone	Limited coverage area in rural and remote areas Complexity of dealing with multiple carriers Frequent network saturation Long restoration time when outages occur No priority of service for public safety agencies & utilities	Pre-existing network
Cellular Digital Packet Data	Limited coverage area in rural and remote areas Longer implementation time Complexity of dealing with multiple carriers Frequent network saturation Long restoration time when outages occur No priority of service for public safety agencies & utilities	Pre-existing network

To lay fiber, a utility needs to acquire the right-of-way to the land, which can be particularly difficult if the terrain is uninhabited or the fiber needs to traverse a waterway or ravine. As a result, it is often much more expensive to lay fiber for long distances than it is to use spectrum-dependent equipment such as a MAS.[112]

[112] OPPD at 9.

DFS states that there is also the problem of service interruptions. Like other land lines, fiber optic cables are susceptible to damage by careless construction workers, unaware homeowners and a multitude of natural events such as thunderstorms, ice storms, tornadoes, hurricanes and floods.[113] Baltimore Gas & Electric uses fiber optic routes in redundant configurations with microwave point-to-point systems.[114] It should be noted that fiber optic networks are also installed along various pipeline networks by the administrative and operational centers of the oil and gas industry to forward data received from remote locations to various field offices. However, the API stated in its comments:

> some pipeline companies have deployed private fiber optic networks along their rights-of-way. However, with some notable exceptions, most pipeline companies have been reluctant to deploy fiber optic networks because of operational concerns. The principle concern with such deployment is twofold: operating and maintaining fiber networks could interfere with "core business" pipeline operations; and, communications may be lost at the most inopportune time, such as when a high-pressure pipe bursts and destroys the fiber optic cable at the same time.[115]

Power Line Carrier (PLC)

PLCs send communications signals over pre-existing power line networks. This technology transmits information using broadband communications.[116] The UTC Power Line Telecommunications Forum[117] has identified technical hurdles that include signal-to-noise ratio, interference, bypasses of transformers, segmentation of the feeder and various safety and procedural considerations.[118] The primary advantage to using PLCs is the pre-existing communications network.[119] The BPA has indicated several disadvantages restricting the use of

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[113] Data Flow Systems, Inc. (DFS) at 12.

[114] UTC at 29.

[115] API at 22.

[116] A transmission facility providing greater than 45 Mbps (T3). Harry Newton, Newton's Telecom Dictionary, (1996) at 113.

[117] UTC's Power Line Telecommunications Forum was established in 1998 as a neutral platform where utilities, manufacturers, service providers, consultants and potential users of power line products and services can work together as equal partners to determine the scope, viability, and benefits for power line telecommunications services in the United States. The Forum consists of three committees: business applications, technical, and regulatory.

[118] UTC homepage at <http://www.utc.org/?v2_group=0&p=187>.

[119] Load Report at 50.

PLCs alternatives to wireless technologies:

> (1) [t]he communication channels travel on the same power line that it is to relay/switch out for protection and does not provide the required reliability. This decreases the power transmission system reliability for many applications. (2) The noise on the communication channels is high for many applications and does not provide the required reliability. (3) The amount of communication channels is restricted to low capacities. BPA requires larger amounts of channel capacity for its existing and future operation and does not provide the required reliability. (4) Future expansion is restricted in channel capacity and application requirements. (5) Future improvement of this technology is required for BPA's reliability.[120]

Commercial Telephone Lines

Commercial telephone has been used for many years by the energy industry. However, spectrum dependent communications are considered to be much more reliable. DTE states that disadvantages to use of commercial telephone lines include high leasing costs and circuit failure during adverse weather conditions.[121] BPA indicates that technical restrictions include the high noise volume on communication channels (which cause real time controls to be unreliable when outages occur), the complicated design schemes of substation environments, and restricted low channel capacity.[122]

Commercial Wireless Telephones

Energy providers are among more than 95 million users of cellular telephones on a routine basis. This number will continue to grow rapidly as cell phone carriers acquire more RF spectrum, increase their coverage area and implement new service such as PCS[123] which features wireless Internet access in addition to processing voice and data information.[124] However, energy providers contend that the major obstacles to increase use and reliance on this medium include unreliability due to limited coverage areas and frequent system saturation during peak hours and crisis situations. In supplemental comments for this report, Cinergy emphasizes that the events of the September 11, 2001, terrorist attacks illustrated how quickly a commercial wireless network could become completely saturated:

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[120] Landon Letter, in BPA Attachment at 7

[121] *Id.*

[122] BPA at 7.

[123] The basic forms of existing PCS include cordless telephone, one-way paging and various cellular services than enable customers maintain service between cell sites and the public switched telephone network.

[124] Load Report at 53.

> After the attacks occurred, Consolidated Edison ("Con Ed"), electric, gas and steam utility for lower Manhattan, had to respond quickly to the crisis. Fortunately, Con Ed was able to rely on its own private internal communications system because it otherwise would not have been able to rely on a commercial carrier. The commercial wireless providers were inundated with calls from their customers immediately after the attacks. Telephone and wireless traffic "surged by as much as 400 percent above normal levels." This resulted in commercial wireless systems being overwhelmed. This was particularly true in Manhattan where Verizon stated that close to 100% [sic] of its wireless calls in lower Manhattan were blocked and failed to get through. As a result of the congestion, wireless companies asked their customers to use the phones only if it was an emergency. Not only was wireless service in New York and Washington, DC affected by the events of September 11th, wireless users nationwide got busy signals for much of the day. Utilities cannot depend upon commercial wireless providers for their telecommunications needs because the commercial wireless provider cannot guarantee that a utility would have service during an emergency.[125]

CMP indicates that a major ice storm during the winter of 1998 accentuated the shortcomings of commercial cellular service in a crisis situation.[126] In the aftermath of the storm, CMP tried using public cellular networks to dispatch out-of-state crews working in Maine.[127] But other energy providers were also relying on cellular telephones to repair damage from the storm.[128] Both the wireline and cellular telephone networks were deluged and could not be relied upon to dispatch repair crews.[129] CMP further states that a lack of wireless communications capability in emergency situations is unacceptable; as a consequence, private internal wireless networks are needed for the provision of reliable, safe electric service.[130] There is no priority of service afforded to public safety agencies and energy providers when a commercial wireless network becomes saturated or a major service disruption occurs. Commercial service providers operate on a "first come, first serve basis." Neither are they subject to state and federal requirements for restoration of service as is frequently the case with energy providers.

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[125] Cinergy Supp. at 13.

[126] CMP at 4.

[127] *Id.*

[128] *Id.*

[129] *Id.*

[130] *Id.*

Cellular Digital Packet Data (CDPD)[131]

CDPD is a commercial wireless data service that uses the cellular network to provide packet data capabilities. It uses a data format similar to Internet communications while dividing data into packets that are transmitted over the cellular network. Data is processed utilizing 30 kHz voice channels in the 800 MHz cellular band, which are subordinate to voice transmissions. When a voice transmission is initiated, the data is rerouted to another channel.[132] CDPD is also subject to the same disadvantages attributed to commercial cellular voice service.

SUMMARY OF SPECTRUM AND SYSTEMS CURRENTLY USED

Reliable energy service is easily taken for granted. Whether we flip a switch or pump gasoline, the energy industry is able to provide these resources on demand in part due to the expansive nature of their infrastructure. Infrastructure that includes transmission lines, water pumps, railroads or electric substations, requires maintenance, remote control, monitoring, and repair.[133] Whether an entity is in the electric, natural gas, petroleum, nuclear, delivery, transmission, storage, or renewable energy business, the overriding similarity between these companies is their telecommunications requirements.[134]

In the first and second question of NTIA's RFC, NTIA asked how much spectrum is presently available and in which spectrum bands and radio services the energy industry operates radio communications equipment, respectively?[135] As a whole, the energy industry uses frequencies anywhere from 25 MHz to 25 GHz.[136] Within this range, companies use point-to-point microwave systems, shared Industrial/Business Pool, and systems in VHF and UHF. Table 3-2, on page 3-19, illustrates the frequency bands and applications the energy industry utilizes in their daily operations. These bands are used by systems that are needed to maintain radio communications

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[131] USATFR at 9.

[132] *Id.*

[133] UTC at 1.

[134] *Id.*

[135] *Supra note 5.*

[136] *See* API at 2 -7; CMP at 1-2; Cinergy Corporation (Cinergy) at 2; Delmarva Power & Light Company and Atlantic City Electric Company (DPLC &ACE) at 2; DTE at 1; Dominion Resources Services, Inc (Dominion) at 1-2; FPL & GPU at 1-3; NRTC at 4; NMPC at 2-3; NAES at 1; OPPD at 2-4; SCANA Corporation (SCANA) at 2-4; UTC at 8 and Williams Gas Pipeline (WGP) at 3.

throughout all stages of the exploration, production, distribution, maintenance, and restoration processes of energy companies.[137]

Specifically, one commenter, Cinergy, indicated that they used "spectrum-dependent equipment for two way radios, private paging, electric and gas distribution system control and data acquisition, generation control, generation scheduling and dispatch, electric system protective relaying, mobile data to field service trucks, electrical feeder lockout alarms, meter reading, phone service, and data network communications."[138] There was insufficient information from the commenters or coordinators to determine how much spectrum is available or used in the frequency bands in Table 3-2.

According to industry comments, the pipeline companies have a growing need for these communication systems to be compliant with Federal Energy Regulatory Commission regulations that require companies to electronically disseminate an index of all their company transportation and storage customers under contract as of that date on the first business day of each calendar quarter.[139] API stated its use of radio systems is for its public safety support and emergency response roles, as well as for protection of the environment.[140]

The third question NTIA asked was what kinds of radio equipment were being used?[141] Commenters informed NTIA that various systems were used including Private Land Mobile Radio Service or two way radios, fixed microwave services, supervisory control and data acquisition (SCADA) systems, spread spectrum, data service and Multiple Address System (MAS).[142]

TECHNICAL ISSUES

Energy providers share RF spectrum with a broad range of users of spectrum in the Industrial/Business Pool of frequencies, as outlined by FCC regulations. They are afforded no specified separation rights or other interference protection. Some of these frequencies are used

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[137] *See generally* API at 3, CMP at 2, DPLC and ACE at 3, DTE at 2, FPL and GPU at 3, NMPC at 2-3, OPPD at 2, WGP at 4.

[138] Cinergy at 2.

[139] API at 5. *See also* 18 C.F.R. § 284.13(c)(1).

[140] API at 7, 10.

[141] *Supra note 5.*

[142] *See* API at 2-7, CMP at 2, Cinergy at 2, DPLC and ACE at 2, DTE at 2, Dominion at 2, FPL and GPU at 3, NRTC at 3-5, NMPC at 2-3, OPPD at 2, SCANA at 2-3, UTC at 11-17, and WGP at 3.

Table 3-2
Summary of Bands and Applications Currently Used by The Energy Industry Based on Input from Commenters

Frequency Bands	Applications	Frequency Bands	Applications
25-50 MHz	PLMRS	932-941 MHz	SCADA
48-50 MHz	Voice Dispatch, Alarms From Remote Stations	935-940 MHz	PLMRS
50 MHz	PLMRS, MAS	941-944 MHz	POFS
150-170 MHz	Voice Dispatch, Load Management Control	952/956/959 MHz	MAS
150-175 MHz	Alarms From Remote Substations, PLMRS	952-960 MHz	POFS
220 MHz	SCADA	956, 959 MHz	Mobile Meter
450-470 MHz	Voice Dispatch, Mobile Data, PLMRS	1.427-1.432 GHz	AMR
470-512 MHz	PLMRS	1.85-1.99 GHz	POFS
800 MHz	Voice Dispatch, Mobile Data Terminals, Trunked PLMRS	2 GHz	PLMRS, POFS, MAS, SCADA, Point-to-Point Microwave, Spread Spectrum
806-821 MHz	PLMRS	2.4 GHz	Point-to-Point MW
821-824 MHz	PLMRS	5 GHz	Spread Spectrum
851-866 MHz	PLMRS	5.8 GHz	Point-to-Point MW
866-899 MHz	PLMRS	5.9-6.4 GHz	Point-to-Point MW
896-901 MHz	PLMRS	6 GHz	Point-to-Point MW
900 MHz	MAS	6.5-6.8 GHz	Point-to-Point MW Microwave
902-928 MHz	SCADA	6.525-6.875 GHz	POFS
928-929 MHz	POFS	11 GHz	Point-to-PointMW
928/932/941 MHz	MAS	18-19 GHz	Point-to-Point MW
928-952 MHz	SCADA	21.2-23.6 GHz	POFS
929-930 MHz	PLMRS	24.25-25.25 GHz	POFS
932-935 MHz	POFS		

on a shared basis.[143] UTC specifically states, "[Private Land Mobile Radio] PLMR users continue to experience increasing levels of ambient noise on various frequency bands, as well as harmful interference."[144] UTC further states that notwithstanding the FCC's public safety radio services determination for critical infrastructure, ". . . adjacent channel interference remains a threat to the safe and reliable operation of utilities and pipelines."[145] In addition, UTC informed NTIA that, "[a]s private wireless spectrum grows more congested, there are increasing reports of harmful interference to energy activities, including critical power restoration."[146] Cinergy seconds this assertion by stating, "Interference also can occur even if the utility is allowed to operate on a frequency exclusively, and adjacent licensees and co-channel licensees are obeying all FCC regulations."[147] In addition, API states that:

> . . . [p]rimarily because of the lack of adequate licensed spectrum, oil and gas companies also currently operate private internal communications systems utilizing frequencies on an unlicensed basis in the 902-928 MHz band, the 2.4 GHz band (2400-2483.5 MHz) and the 5.8 GHz band (5725-5850 MHz). These systems are governed by certain technical and service requirements under Part 15 of the FCC's Rules and Regulations which, among other things, require users to accept any interference that may occur from other radio systems (licensed or unlicensed) or industrial, scientific or medical systems (including microwave ovens and microwave lighting systems). A growing problem for systems that operate in the unlicensed bands is the raising of the noise floor. That is, as more and more unlicensed systems are deployed within close geographical proximity to one another, the systems become less and less reliable because the aggregation of transmitted energy begins to reduce each system's ability to discriminate its desired signal from the noise. Notwithstanding the noise problem, however, such unlicensed systems are being used to provide high speed data transfer capabilities through direct sequence spread spectrum systems and lower speed data acquisition in frequency hopping, MAS-like, point-to-multipoint systems. Although unlicensed spectrum helps to meet the oil and gas industry's need for radio spectrum, the unlicensed bands cannot be relied upon to meet the system integrity and communications reliability requirements demanded by the public safety aspects of oil and gas pipeline operations.[148]

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[143] *Supra note 25.*

[144] UTC at 18.

[145] *Id.*

[146] *Id.*

[147] Cinergy at 12.

[148] API at 6.

TECHNOLOGY TRENDS

Trunked Radio Systems

In addition to being allowed in the 800 MHz, 900 MHz and 220 MHz bands, centralized trunked operation is now permitted in the 150-174 MHz, 450-470 MHz and 470-512 MHz bands.[149] Trunked operation enhances spectral efficiency through dynamic allocation and sharing of a small number of communications channels among a large number of users. In a centralized trunked system (as defined by the FCC), a user in a previously established talk group generates a channel request on a control channel that is continuously monitored.[150] A computer then searches for an available frequency pair and assigns it to the party requesting it.[151] Call requests are placed in a queue to wait for a vacant channel.[152] Trunking systems can also be programmed to include specific features and options such as talk groups, encryption, emergency operation and telephone access.[153] This eliminates scenarios in which users are forced to wait for an particular channel while other channels remain idle, as in conventional systems.[154]

Wideband Data Technology

Wideband data and wideband video are two developing technologies that could have increasing roles in the control and monitoring of an energy provider's operational infrastructure. These rapidly emerging technologies could enhance the efficiency of an energy provider's daily operations and its ability to deal with emergency conditions where it is important to communicate the complex and often dynamically changing details of an emergency situation to others in the command or worker/supervisory chain. Video systems are invaluable tools to public service entities responding to catastrophic events, such as train derailments, tornadoes, hurricanes, and terrorist attacks.

The ice storm that hit upstate New York in the mid-1990s provides a good example of how this technology can be utilized in emergency situations. With thousands of lines down, the transmission of video images of the disaster areas from the field to the storm coordination centers

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[149] Part 90 Order at 14338.

[150] Public Safety Wireless Network, Comparisons of Conventional Trunked Systems, (May 10, 1999).

[151] *Id.*

[152] *Id.*

[153] *Id.*

[154] Part 90 Order at 14338.

could have been invaluable to command centers. Utilities provided with real-time video feedback could have been able to make accurate damage assessments and deployed repair crews accordingly.[155] Furthermore, the utilities in a final report stated:

> [t]he basic requirement for video/imagery is immediate, clear wireless transfer of video/imagery for all utility personnel upon all demands, major and minor, created by utility-related field situations and emergencies. Video/imagery capture and display systems must be capable of transceiving specific replications and should accommodate video and imagery from multiple sources including privately owned and utility controlled. For example, automatic aid agreements with public safety agencies could often require quality video/imagery of incident scenes for utility command personnel, either directly or through retransmission.[156]

Wireless LAN/WAN Connectivity

The USAT Final Report found that "[t]he wireless LAN operates in the unlicensed 2400–2500 MHz band and infrared regions of the electromagnetic spectrum. Only a transceiver and antenna are required with an interface that attaches to a personal computer and allows it to connect with a LAN without having to run cable to it."[157] API anticipates an increased use of wireless Internet services as commercial providers make them available. However, API emphasizes that commercial wireless services will not completely replace private wireless systems.[158]

Geographic Position and Automatic Location Data

Commenters provided no information or data on the viability of commercial geographic position and automatic location data systems (e.g., LoJACK and Global Positioning Systems). However, energy providers would like to be able to transmit location data that is determined by geographic position technology or other means, automatically or on demand, to other locations. Examples of this requirement include continuous updating of vehicle positions and of individual worker locations. This is particularly useful when the worker is outside of her/his vehicle. This technology also gives the company the ability to trigger position transmitting devices on stolen construction or other heavy equipment.[159]

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[155] USATFR at 10.

[156] *Id.*

[157] USATFR at 8.

[158] API at 22.

[159] *See supra note 118.*

In addition, the Utilities Spectrum Assessment Taskforce Final Report stated:

> A need exists for automatic communication of location information generated to report accurate location of vehicles and personnel into a synthesized computer command and control system. This system should also accommodate associated data, such as emergency situation alert function, personnel vitals and equipment status and needs such as fuel and water. Automatic location information will accomplish several goals in the mission of life and property protection; emergency responders dispatched with regard to actual incident proximity will trim precious life and property saving response times; incident supervisors will accurately assign and monitor units/personnel to accomplish strategic efficiency; and emergency field personnel will report emergency situation location by the push of a button, speeding help their way and reducing the likelihood of injury or death. Location systems provide a means to track crews and equipment for the purposes of effective response to disruption of service as well as for efficient day to day fleet management. When a catastrophic event does occur, the Utility entities rely on access to databases which contain information concerning the availability of repair and restoration materials and equipment.[160]

SUMMARY OF NON-SPECTRUM DEPENDENT ALTERNATIVES AND COMMERCIAL SERVICES

NTIA inquired about the use of non-spectrum dependent alternative technologies or commercial services that are currently available.[161] For the most part, commenters stated that commercial wireless services did not adequately service their needs due to issues of compatibility, reliability, cost-effectiveness, and whether commercial services would meet the specific needs of energy companies.[162] As one commenter stated, "[c]ommercial service providers cannot meet the unique and varied needs of [these] entities."[163]

Many commenters also discussed the use of fiber optic and/or wireline networks. A few commenters said they currently use fiber optics and other wireline networks.[164] However, even with practical applications of fiber optic and/or wireline networks, some commenters stated these

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[160] *Id.*

[161] *Supra note 5.*

[162] API at 19-21, CMP at 4, Cinergy Supp at 12-13, DPLC and ACE at 8-9, DTE at 2, Dominion at 2-3, FPL and GPU at 3, NMPC at 3, OPPD at 7-9, and SCANA at 9-10.

[163] UTC at 20.

[164] API at 21 and NAES at 2.

alternatives do "not provide the mobility that spectrum dependent equipment does"[165] and they are not as cost effective as radio-based systems.[166]

POSSIBLE FUTURE SPECTRUM REQUIREMENTS

After asking for the current spectrum dependent and independent usage of telecommunications devices, NTIA asked "[w]hat part of the spectrum do the energy, water and railroad industries foresee for possible future use?"[167] As a follow-up, NTIA then asked commenters to give the rationale for any additional spectrum requirements.[168]

Of the 19 commenters, seven stated that energy providers need additional spectrum, specifically for exclusive use.[169] Out of these seven, four stated that the FCC should allocate more spectrum in the 450 MHz, 800 MHz, and 900 MHz bands because the majority of the current spectrum used by energy companies is located in these bands.[170] Another commenter, NAES, suggested that the 450 MHz band should be considered for allocation. NAES recently installed a new 450 MHz Narrowband Digital Trunked Radio System and intends to pursue expansion of this system.[171]

DTE stated that one or more unused television channels should be reallocated for utilities' use on a low powered, non-interfering basis.[172] DTE also informed NTIA that "[o]ther preferred spectrum would be between 1 GHz and 12 GHz."[173] Another commenter, who provides electric and gas services, simply stated that they have a "glaring need" for more spectrum in the two-way mobile radio and Mobile Data Dispatch system.[174] On the other hand, Niagra Mohawk Power Corporation (NMPC) stated that "high frequencies are likely to be the target for future wireless

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[165] DPLC and ACE at 10.

[166] Cinergy at 10, OPPD at 9 and SCANA at 11.

[167] *Supra note 5.*

[168] *Id.*

[169] API at 25-29, CMP at 5, Cinergy 10-12, DPLC & ACE at 10-12, FPL & GPU at 4, OPPD at 10-12, and SCANA at 11-13.

[170] Cinergy at 15-16, DPLC & ACE at 15-16, OPPD at 15 and SCANA 16-17.

[171] NAES at 2.

[172] DTE at 3.

[173] *Id.*

[174] Dominion at 3.

needs"[175] because traditional frequency bands under 450 MHz have been saturated by other users.[176] Another commenter, National Rural Telecommunications Cooperative (NRTC), felt that its members need access to spectrum in lower bands such as the 220 MHz band they are currently using.

Two other commenters, WGP and UTC, both stated that adequate spectrum is required for continued operation of energy companies.[177] Despite various recommendations for possible future spectrum use, all commenters cited the lack of current spectrum due to interference from overcrowding and the lack of spectrum licensed to the energy industry on an exclusive basis.

Lastly, NTIA received a comment from a manufacturer of equipment the utilities use in their daily operation. Itron, Inc. (Itron), is a provider of equipment that collects, analyzes, and applies electric, gas, and water usage data. As a manufacturer of this equipment, Itron believes that "utility telemetry services make efficient use of the 1427-1432 MHz band" and that the FCC should preserve this band for current use.[178] Itron stated that AMR systems successfully operate in this band and it has made significant investment in AMR equipment to make its use more efficient and reliable.[179] More importantly, Itron feels the Nation's critical infrastructure may be impaired if adequate spectrum is not provided for AMR use.[180]

POSSIBLE FUTURE ALTERNATIVE TECHNOLOGIES

Finally, NTIA asked about emerging non-spectrum dependent technologies or commercial services.[181] NTIA asked this question to investigate the emerging technology in the energy industry and to help inspire innovations, whether the new technology is spectrum dependent or spectrum independent.

One commenter, API, noted that future technology will likely remain in the private wireless area due to the historical reliance on and the reliability of these "mission-critical mobile wireless systems."[182] API believes future wireless networks will employ digital modulation as the

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[175] NMPC at 3.

[176] *Id.*

[177] WGP at 7 and UTC at 26-27.

[178] Itron at 12.

[179] Itron at 6.

[180] *Id.*

[181] *Supra note 5.*

[182] API at 24.

telecommunications industry as a whole converges on digital standards.[183] Another commenter, NAES, stated that it "will pursue commercially available and non-spectrum dependent communications technologies as alternates[,] provided [these systems meet] the requirement on protecting the health and safety of the public and employees in a manner consistent with systems currently in place."[184]

One technology that was often mentioned is fiber optics. One company, Dominion Resources Services, Inc. (Dominion), discussed the use of fiber optic technology as an application for a fixed point-to-point and point-to-multipoint network,[185] as did DTE.[186] Another commenter, NMPC, informed NTIA that, in its view, utilities will continue to expand the use of fiber optic technology.[187] NMPC goes on to state that fiber optic networks are useful for certain functions that rely on information moving from point to point, much like the system discussed by Dominion.[188]

Another emerging technology NMPC mentioned is power line carrier systems where existing electrical lines are used for transmitting and receiving data.[189] However, NMPC did assert limitations of both fiber optic and power line carrier systems.[190] Nevertheless, the potential use of such technologies appears to be limited! As noted by Dominion, "there appears to be no alternative for mobile communications other than use of the radio frequency spectrum."[191]

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[183] API at 24-25.

[184] NAES at 2.

[185] Dominion at 3.

[186] DTE at 3.

[187] NMPC at 4.

[188] *Id.*

[189] *Id.*

[190] *Id.*

[191] Dominion at 3.

SECTION 4
THE WATER INDUSTRY

BACKGROUND

Water is a vital component of the Nation's critical infrastructure. Perhaps one of the main reasons water tends to be overlooked when one examines various components of the Nation's critical infrastructure is that the consistency and high quality of service is literally taken for granted by the consumer. The September 11, 2001, terrorist attacks on the World Trade Center and the Pentagon serve as a vivid reminder that components of our critical infrastructure are vulnerable and should not be taken for granted.

Wireless voice and data technologies are crucial in the management of wastewater and drinking water. Wireless communications ensure compliance with numerous state and federal regulations governing environmental and public health protection. The EPA states, "[w]e project that the wastewater and drinking water utilities will need the communications tools to successfully achieve and maintain compliance objective."[192] The EPA further states that any loss of spectrum allocations or underestimation of wastewater and drinking water wireless communication requirements will have dire consequences on operations within the water industry.[193] The obvious impact will be higher consumer costs and noncompliance with safety and environmental requirements.[194] The American Water Works Association (AWWA) emphasizes that real-time command and control of drinking water treatment operations is crucial to avoiding disruption by vandalism or terrorist assaults on the water industry's infrastructure.[195]

Energy generation (i.e., hydroelectric power) is another area where water resources are sometimes taken for granted. The U.S. Army Corps of Engineers (USACE) is one of several federal agencies[196] that utilizes wireless communications technologies to manage dams and locks throughout the country. It should be noted that the USACE manages several of the largest hydropower dams in the Nation. Wireless technologies used to manage dams and locks are the primary means of flood control and land irrigation.

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[192] EPA at 2.

[193] EPA at 4.

[194] *Id.*

[195] American Water Works Association (AWWA) at 12. AWWA is an international, non-profit, scientific, and educational society dedicated to the improvement of drinking water quality and supply. AWWA has 57,000 plus members and includes approximately 4,200 water systems that supply water to roughly 80 percent of the people in the United States.

[196] All federal agencies submit requests for frequency assignments through their respective IRAC representative.

Water utilities also play a significant role in public safety. In many instances, water utilities work in concert with public safety entities when situations requiring emergency response arise. For example, the AWWA emphasizes that "[w]ater distribution systems are critical to fire fighting, and in order to sustain water service, radio-based real-time control systems are used to maintain adequate supply and pressure in the delivery system. The inability of water systems to sustain supply and pressure would disarm the [firefighters]."[197] AWWA further states that spectral efficiency is maximized when police, fire, water, and other agencies share a common communications system under the auspices of local government.[198] An example of these types of mutually beneficial linkages is any instance in which fire departments require real-time communications with water departments beyond their normal operating area.[199]

INDUSTRY GROWTH

Data Flow Systems (DFS), a manufacturer of SCADA systems for the water utility industry, projects the population of the United States will increase by about 54 million residents during the next 25 years (roughly 28 million residents by 2015 and 25 million residents by 2025). These figures are based on a national population growth rate of approximately 13.1 percent during the past 10 years. The Nation's daily freshwater consumption is projected to increase by 8 billion gallons per day over current consumption levels by the year 2025. Wastewater effluent will increase at a commensurate rate. This growth will necessitate significant expansion of the Nation's fresh and wastewater supply sources and their wireless communications infrastructures.[200] Table 4-1 illustrates projected population growth in the United States, as a whole, in addition to California, Texas, and Florida (the Nation's first, second, and fifth most populous states).

If water resources are not managed efficiently, these population and water usage projections will cause sharp increases in water utility service rates. One of the most significant forces causing these increases in water utility rates is the cost of expanding and modernizing operational infrastructures. In addition, it should also be emphasized that increased use of the components within water utility infrastructures (brought on by expansion) creates a need for replacement due to over use.[201]

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[197] AWWA at 2.

[198] AWWA at 17.

[199] *Id.*

[200] DFS at 2.

[201] AWWA at 11.

Table 4-1
Projected Population Growth[202]

	Population 2015 (Projected)	Population % Change 2000-2015 (Projected)	Population 2025 (Projected)	Population % Change 2000-2025 (Projected)
USA	310,133,000	10.2%	335,048,000	19.1%
California	41,373,000	22.1%	49,285,000	45.5%
Florida	18,497,000	15.7%	20,710,000	29.6%
Texas	24,280,000	16.4%	27,183,000	30.4%

AWWA states that wireless SCADA and telemetry systems free of disruptions and interference will be one of the most efficient ways to manage and monitor the pumps, valves and storage facilities in a water distribution system.[203] AWWA further argues that:

> [a]s the length of time that capital facilities are in place without replacement increases, so does associated failures. The rate of failure increases even more rapidly when older facilities are subjected to increased usage associated with growing demand for water as populations grow and business uses of water increase. In drinking water facilities, failure events are most evident to customers as water main breaks. Each time such a break occurs, it represents a potential for cross-contamination of the potable water supply, low water pressure and potentially a water outage for customers, and loss of a valuable resource to the environment. Drinking water systems with aging distribution systems rely in part on faster SCADA systems with more frequent, even continuous monitoring, of remote nodes for pressure loss to identify main break events.[204]

WIRELESS TELECOMMUNICATIONS INFRASTRUCTURE

Water utilities use their wireless telecommunications infrastructures to process both voice and data information. Water providers utilize multiple frequency bands in the Private Land Mobile Radio Service (PLMRS), MAS, and the Private Operational-Fixed Microwave Service (POFS). They operate SMR systems and maintain service with commercial wireless providers.

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[202] *Id.*

[203] *Id.*

[204] *Id.*

Voice Requirements

Voice-related systems, such as land mobile, primarily use frequencies below 470 MHz for crew dispatch and emergency restoration efforts. Section 3, The Energy Industry, Wireless Telecommunications Infrastructure, provides more detailed information pertaining to the use of voice systems and applications by the water industry. Many systems used by one industry tend to be used by another as these systems are used for similar purposes.

Data Requirements

SCADA systems employ radio telemetry to monitor and control remote facilities and are critical for the efficient management of drinking water and wastewater treatment facilities.[205] In a letter to the FCC emphasizing the need for additional 900 MHz MAS frequency licenses for the internal SCADA systems of drinking water and waste water industries, the EPA emphasizes:

> SCADA systems offer these utilities improved, real-time monitoring and control of their systems while minimizing cost and staffing. It is essential to cost-effective protection of public health and the environment that utilities have access to the spectrum bandwidths they need for SCADA systems, and that, in recognition of the public safety function these system serve, these bandwidths be available outside of any auction process designed to allocate spectrum to "commercial" users.[206]

According to AWWA, the water industry uses SCADA systems to remotely manage treatment and distribution facilities in all phases of operations. SCADA systems are used to:

- control and monitor water quality;
- optimize pumping operations;
- maintain water levels in storage reservoirs to meet fire flow demands and requirements;
- monitor and control distribution systems pressures; and
- ensure physical and cyber security of facilities.[207]

SCADA also plays a critical role in the control of microbial and chemical contaminants in drinking water supplies. Data collected from remote points in the water treatment and distribution systems using SCADA systems includes:

- pressure levels to prevent ground and surface water from infiltrating into

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[205] AWWA at 3.

[206] Fox Letter at 1.

[207] AWWA at 3.

distribution facilities providing a 24-hour check on system integrity;
- monitoring of water chemistry at water intake facilities to ensure that treatment plant operation is optimized;
- provide water quality information on a continuous 24-hour cycle;
- providing pressure and flow information; and
- monitoring intrusion to prevent vandalism or sabotage.[208]

The EPA and AWWA both contend that SCADA systems are critical to compliance with the performance of the current drinking water regulations: (1) Clean Water Act Amendment; (2) Safe Drinking Water Act; and (3) Sanitary Sewer Overflow Rule.[209]

WIRE-BASED AND COMMERCIAL SERVICES

DFS and AWWA have expressed concerns similar to those received from energy and railroad providers regarding the use of commercial telephone lines. Again, the most prominent issues are reliability, costs, and service interruptions.[210] However, AWWA has indicated that commercial carrier telephone service is adequate for routine business communications and internal SCADA applications, over which the utility can control events that might disrupt operations.[211]

SUMMARY OF SPECTRUM AND SYSTEMS CURRENTLY USED

In the first and second question of NTIA's RFC, NTIA asked how much spectrum is presently available and in which spectrum bands and radio services does the water industry operate radio communications equipment, respectively?[212] NTIA was informed that the water industry utilizes SCADA systems via radio telemetry to monitor and control remote facilities to manage water quality and quantity.[213] SCADA systems are radio-based real-time control systems.[214] Specifically, SCADA systems are used to efficiently operate pumps, control water pressure, monitor water chemistry, and provide security to remote facilities.[215]

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[208] AWWA at 4.

[209] Fox Letter at 1.

[210] DFS at 12.

[211] AWWA at 19.

[212] *Supra note 5.*

[213] AWWA at 2.

[214] AWWA at 3.

[215] AWWA at 4.

In addition, the water industry is regulated by federal and state agencies for various water quality requirements.[216] AWWA informs NTIA that water utilities operate systems within the PLMRS bands,[217] but, these utilities are experiencing interference on their private land mobile channels and incidents of interference is on the rise.[218] On the other hand, water utilities also maintain multiple layers of communication systems, including private radio, commercial services, land-line providers, and dedicated land line links.[219] These services have their limitations however, and the AWWA noted that these alternative systems are not as reliable as exclusive use of spectrum because of the lack of control.[220]

Another entity in the water industry who responded to NTIA's RFC is East Bay Municipal Utility District (EBMUD). EBMUD is a publicly owned water utility whose service area encompasses 35 jurisdictions in Northern California.[221] EBMUD operates many microwave facilities, forming a network, which aids in the management of its water production, treatment, and distribution system.[222] The network consists of a MAS system operating at 25 kHz bandwidth and other systems using the 2 GHz, 6 GHz and 23 GHz bands.[223] Unfortunately, even though this network was installed in the mid-1980s, EBMUD's systems are currently operating at or near full capacity.[224] Table 4-2 provides an overview of the frequency bands used by the water industry and applications each band supports. However, there was insufficient information from the commenters or coordinators to determine how much spectrum is available or used in these frequency bands.

TECHNICAL ISSUES

The concerns expressed by water providers regarding band sharing and channel interference coincide with those indicated by energy providers, see Technology Trends section below. AWWA further attributes a marked increase in incidents of interference in private land mobile channels at 512 MHz, or below, to the frequency coordination process and recent FCC

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[216] *See generally* AWWA at 4-6.

[217] AWWA at 13.

[218] AWWA at 14.

[219] AWWA at 18.

[220] *Id.*

[221] East Bay Municipal Utility District (EBMUD) at 1.

[222] EBMUD at 5.

[223] *See generally*, EBMUD at 5-6.

[224] EBMUD at 6.

Table 4-2
Summary of Bands and Applications Currently Used by The Water Industry Based on Input from Commenters

Frequency Bands	Applications
900 MHz	MAS, SCADA
928 MHz	MAS
952 MHz	MAS
956 MHz	MAS
2 GHz	Water Operations Network
6 GHz	Water Operations Network
23 GHz	Water Operations Network

rule changes pertaining to frequency allocation.[225] AWWA specifically states for voice communications that:

> [i]n a number of these cases, interference from non-public safety-related radio users put at risk the lives and safety of critical infrastructure utility and pipeline maintenance and emergency response crews and hampered the efforts of police and fire crews to protect people's lives and property.[226]

TECHNOLOGY TRENDS

Water utilities are among the largest energy users in the United States, and their intense interest in the application of AMR technology will grow as the technology continues to develop.[227] AMR is used by drinking water utilities to bill customers for water usage.[228] The water industry considers AMR to be one of the most promising tools that optimize personnel

[225] AWWA at 14.

[226] *Id.*

[227] AWWA at 20.

[228] *Id.*

safety measures.[229] AWWA further states that assaults on meter reading personnel, as well as injuries from falls on customer property, have made location-based meter reading a dangerous occupation.[230] AWWA contends that AMR minimizes those dangers and improves operating efficiency.[231]

AWWA contends that additional band efficiency could be realized by assigning specific frequencies for AMR systems and sharing these frequencies with some sort of polling protocol.[232] "Through these types of efficiency measures, it may be possible to meet response channels, depending on the band choice. As AMR applications develop comparable to electric utilities, the demand for channels would clearly increase."[233]

Although trunked radio systems are recognized for their efficient use of limited spectrum, many water utilities are only able to procure trunked radio systems through joint purchases with other providers or municipalities.[234] Refer to Section 4 of this report for information on the following technologies used by the entire utilities industry: (1) wireless Local Area Network (LAN)/Wide Area Network (WAN) Connectivity; (2) Geographic Position and Automatic Location Data; and (3) wideband.

SUMMARY OF NON-SPECTRUM DEPENDENT ALTERNATIVES AND COMMERCIAL SERVICES

NTIA also inquired about the use of non-spectrum dependent alternative technologies or commercial services that are currently available to the water industry.[235] AWWA informed NTIA that "critical infrastructure entities will not rely on a single spectrum or non-spectrum dependent communication solution for either voice or data transmission."[236] These utilities will review these systems and make their selections based on requirement evaluations.[237] These

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[229] *Id.*

[230] *Id.*

[231] *Id.*

[232] Many water utility AMR systems now operate on unlicensed frequencies.

[233] AWWA at 20.

[234] AWWA at 21.

[235] *Supra note 5.*

[236] *Id.*

[237] *Id.*

evaluations will also consist of advanced technologies like AMR, computer automated design (CAD), geographic information systems (GIS), spread spectrum applications, and trunking.[238]

AMR systems operate on unlicensed frequencies employing short range transmitters. AMR systems are used by both the electric and water utilities for collecting customer usage, demand/supply management, and billing customers.[239]

CAD and GIS applications are used in conjunction with hand-held personal computers by field personnel.[240] These applications are used to assist field crews when responding to emergencies, customer complaints and water quality management.[241] Unlicensed spread spectrum radio systems have been used as an alternative to licensed spectrum. However, AWWA stated that "interference and, with general increases in the use of spread-spectrum, the reliability of spread-spectrum solutions are increasingly in question."[242]

Finally, AWWA said that trunking of radio systems has been effectively used by water companies.[243] However, AWWA also informed NTIA that:

> [t]runking is one instance where economies can be realized in both spectrum utilization and in implementation costs when public service, public safety, and critical infrastructure entities are able to jointly participate in the same trunked radio system. However, this degree of economy is not available to many drinking water utilities. Impediments to utilities associated with municipal or regional government entities that operate such trunked systems should be limited to the technical issues associated with that radio system and coordination of that group of users.[244]

POSSIBLE FUTURE SPECTRUM REQUIREMENTS

After asking for the current spectrum dependent and independent usage of telecommunications devices, NTIA asked "[w]hat part of the spectrum do the energy, water and

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[238] AWWA at 21.

[239] AWWA at 20.

[240] *Id.*

[241] *Id.*

[242] AWWA at 21.

[243] *Id.*

[244] *Id.*

railroad industries foresee for possible future use?"[245] NTIA also asked commenters to give a rationalization for any additional spectrum requirements.[246]

The AWWA believes that the USAT spectrum requirement projection is underestimated, based on industry trends and the current pace of telecommunications technology development and implementation.[247] The EBMUD is in the midst of upgrading its communications system because the current system has reached its capacity.[248] In this regard, EBMUD is considering migrating into the 6 GHz and 11 GHz bands while also expanding operations in the 23 GHz band for its new system.[249] DFS recommended "that the 216-220 MHz band be set aside and dedicated to water utility telemetry uses nationwide."[250] The reasons DFS gave for this recommendation are the prevalence of utility licensees in this band, favorable band characteristics, and the unattractiveness of this band to other industries.[251]

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[245] *Supra note 5.*

[246] *Id.*

[247] AWWA at 22.

[248] EBMUD at 6.

[249] *Id.*

[250] DFS at 14.

[251] DFS at 15.

SECTION 5
THE RAILROAD INDUSTRY

BACKGROUND

The railroad industry has been a heavy user of spectrum for more than 60 years.[252] Use of private and commercial wireless telecommunications systems assist railroad entities to comply with numerous safety and communications requirements.[253] The strong emphasis on safety within the railroad industry has resulted in very specific communications requirements promulgated by the FCC and the Federal Railroad Administration (FRA).[254] The Rail Safety Enforcement Act, enacted by Congress in 1992, gives the Department of Transportation statutory authority to promulgate regulations governing the use of radio to enhance safety practices within the rail industry. For example, 49 Code of Federal Regulations (CFR) Section (§) 220 stipulates that all locomotives must have radio communications capability, including communications redundancy.[255] Other communications requirements (49 CFR § 232.19-232.25) outline stipulations "governing the design, installation and operation of one-way and two-way end-of-train (EOT) devices equipped with radio transmission capability."[256] This regulation is even more significant when one examines the makeup of a standard train crew. In years past, these crews consisted of up to five members (an engineer, conductor, head brakeman, rear brakeman, and flagman). Real-time wireless voice communications has enabled dispatchers to have immediate contact with crews. Crews working in the field now rely on voice radio instead of hand or lantern signals between crew members to control train movement (i.e., train crews are smaller in number). This technology replaces the caboose and crew members on the rear end of each train with an EOT device and also eliminates the need for trainmen to pass signals from the moving rail cars.[257]

An emerging command and control initiative that could highlight the future importance of wireless telecommunications systems for the railroad industry is Positive Train Control (PTC). PTC is a general term referring to a set of safety objectives within the railroad industry.[258] The core features of PTC will include positive train separation (i.e., prevention of train-to-train

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[252] AAR at 5.

[253] AAR at 4.

[254] The FRA is an agency within the DOT that regulates all aspects of the railroad industry.

[255] AAR at 5.

[256] *Id.*

[257] Railroad Communications and Train Control, Report to Congress, Federal Railroad Administration, Office of Safety, U.S. Department of Transportation (July 8, 1994) at 24.

[258] *Id.* at 36.

collisions), enforced speed restrictions, and roadway worker (and equipment) protection.[259] The Accident Review Team of the Railroad Safety Advisory Committee's PTC Working Group estimates approximately 40 to 60 main line collisions and derailments could be prevented annually by using the PTC system.[260] This estimate is expected to increase along with the inevitable increase in train densities and service.[261]

Since safety of passenger, personnel, and equipment is an important priority for the railroad industry, it is customary for every single railroad employee to have access to a portable two-way radio. This allows for real-time communications among dispatchers, yard crews, switch crews, signal technicians, and mechanical and engineering crews.[262] In addition to maintaining internal mobile operations, the railroad radio voice system also has national interoperability. This enables train crews to maintain real-time communications even when using another company's track or equipment.[263] The U.S. railroad industry has track and frequency sharing agreements with several of its counterparts in Canada.[264] Since they use the same frequency pairs in the PTC system, they now have real-time command and control with seamless cross-border coverage.

Telemetry systems also play crucial roles in the railroad industry. Automated wayside detector systems monitor the temperatures of axle bearings (i.e., hot box detectors) on passing rail cars. Crews receive automatic voice alerts via two-way radio to stop the train when overheated bearings are detected to avoid derailments.[265] The Association of American Railroads (AAR) discussed EOT devices from a safety perspective in comments for this report, emphasizing the importance of radio telemetry links to assess the adequacy of the braking system. FRA has adopted regulations requiring two-way EOT devices by which the locomotive crew can initiate via radio frequency an emergency brake application at the rear of the train.[266]

The railroad entities contend that several characteristics of the industry highlight their

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[259] *Id.*

[260] Report of the Railroad Safety Advisory Committee to the Federal Railroad Administrator, Implementation of Positive Train Control Systems (Sept. 8, 1999) at viii [hereinafter PTC Report].

[261] AAR at 6.

[262] *Id.*

[263] Many railroad companies have agreements to share facilities.

[264] In the Matter of, Petition of AAR for Modification of Licenses For Use In Advanced Train Control Systems and Positive Train Control Systems, *Petition for Modification of Licenses* (Mar. 24, 2000) at 3.

[265] AAR at 11.

[266] AAR at 12.

dependence on enhanced wireless technologies:

- the destructive (size and weight) potential of rail equipment,
- long stopping distances required for trains,
- increased train speeds,
- natural disasters,
- vast operating areas spanning from remote rural areas to densely populated urban areas,
- reduced number of railway employees, and
- increase in track density due to plant downsizing and increase demand for rail service.[267]

AAR states that technological advances (e.g., radio telemetry devices now performing the functions of caboose personnel), increased safety, and redundancy requirements necessitate expanded use of wireless technologies by the railroad industry.[268]

INDUSTRY GROWTH

As a vital transportation component of the nation's critical infrastructure, the railroad industry is unique in that it transports people, heavy equipment, and freight at high speeds over vast operating areas. In comments submitted in response to the RFC, AAR quantifies the importance of the railroad industry to the nation's economy:

- America's freight railroads carry over 40 percent of all intercity freight;
- 70 percent of all vehicles produced by domestic manufacturers;
- 64 percent of the Nation's coal, which generates 36 percent of the Nation's electricity;
- 40 percent of the Nation's grain;
- freight railroads move just about everything, from lumber to vegetables, coal to orange juice, grain to automobiles, chemicals to scrap iron; and
- they interconnect domestic and global markets.[269]

The FRA expects the rail freight industry to grow at a rate of approximately 2 percent annually between the years 2000 and 2025.[270] The equivalent of that growth rate in rail ton-miles

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[267] PTC Report at 40.

[268] AAR at 8.

[269] AAR at 2.

[270] U.S. Department of Transportation, Bureau of Transportation Statistics, The Changing Face of Transportation, BTS00-07 (2000) at 2-44.

is 1.46 trillion in 2000 to 2.4 trillion in 2025.[271] As a result, the operational infrastructure of the railroad industry will also experience rapid expansion and could strain existing resources. This means the wireless communications systems used to relay voice and data information will need to process more information. Moreover, FRA informed NTIA that "[t]he use of the railroad network for high speed passenger transportation is also growing. The Secretary of Transportation is authorized by 23 U.S.C. 104 (d) [sic] to designate developing high speed rail corridors where speeds are expected to reach 90 mph or higher. Thirty-two states and the District of Columbia now have trackage included in such designated corridors or in the high-speed development area of the Northeast Corridor. Successful deployment of high-speed passenger rail operations will not only increase routine spectrum use, but will require deployment of advanced train control systems (such as PTC) wherever train speeds will exceed 80 mph."[272]

WIRELESS COMMUNICATIONS INFRASTRUCTURE

Historically, railroad radio operations have entailed two major areas: train movement authorities and intracrew activities. Train movement authorities utilize private communications systems to transmit train movement authorizations between dispatchers and locomotive crews. Intracrew activities such as switching operations that traditionally involved the use of electric hand lamps or lanterns are now accomplished with portable radios.[273] The AAR states in its comments that:

> . . . the railroads have used land mobile frequencies for traditional functions such as onboard and wayside point-to-train communications. Mobile radio units with dedicated radio channels permit communications among dispatchers, yard crews, switch crews, signal technicians, mechanical and engineering crews, and other personnel. Virtually all railroad employees involved in operations carry a portable radio assigned for their use, in addition to using mobile radios installed in the railroad's vehicular fleet.[274]

Voice Requirements

The railroad industry operates more than 16,000 base stations, 45,000 mobile radios (locomotives and other track vehicles), 125,000 portable radios and 5,500 radios associated with

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[271] *Id.*

[272] Letter from Mark Yachmetz, Associate Administrator for Railroad Development, U.S. Dept. of Transportation, to William T. Hatch, Associate Administrator, Office of Spectrum Management, National Telecommunications and Information Administration (Nov. 21, 2001) at 7.

[273] *Id.*

[274] AAR at 6.

"defect detectors."[275] A map showing the locations of the base stations is provided in Appendix E. Today's railroad mobile radio systems operate on 91 channels between 160.215 - 161.565 MHz utilizing analog frequency modulation (FM) equipment. These radios operate on overlapped channels with 25 kilohertz (kHz) bandwidth separated by 15 kHz from center to center.[276] The railroad industry's Wireless Communications Task Force developed, with FCC approval, a plan to improve spectrum utilization by splitting each of these channels while maintaining maximum compatibility with existing systems and creating opportunities for use of trunking technology.

Data Requirements

The 450-460 MHz band is used by the railroad industry for one-way and two-way EOT devices. One-way devices contain a telemetry link between the end of the train and the locomotive crew that relays train status information (e.g., motion detector, brake pressure monitor).[277] Two-way EOT telemetry links enable locomotive crews to initiate braking action starting at the end of the train.[278] These frequency pairs in the 450-460 MHz bands are also used in SCADA systems to distribute power between locomotives on the same train.[279]

Furthermore, the railroad industry also uses six channel pairs at 896/936 MHz[280] for the Advanced Train Control System/Positive Train Control (ATCS/PTC) systems.[281] In addition, the industry operates 1,000 base stations in the United States using an FCC-authorized geographic license whose boundaries extend 70 miles on either side of a track equipped with ATCS/PTC.[282] The data volume associated with PTC will expand greatly if these systems are widely deployed, as is highly likely to support high speed passenger rail operations now being proposed and implemented under state sponsorship in many areas of the Nation.

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[275] A defect detector is an electronic monitoring device that reports defective train equipment and hazardous track conditions. They are also referred to as "wayside detectors."

[276] AAR at 15.

[277] AAR at 18

[278] *Id.*

[279] Some trains are so long that locomotives are placed in the middle for added power.

[280] The six channel pairs are specifically located in the following frequencies: 896.8875 MHz/935.8875 MHz; 896.9375 MHz/935.9375 MHz; 896.9875 MHz/935.9875 MHz; 877.8875 MHz/936.8875 MHz; 897.9375 MHz/936.9375 MHz; and 897.9875 MHz/936.9875 MHz.

[281] *See infra* Technology Trends in this section.

[282] AAR at 19.

In addition, an industry-wide standard that uses the Automatic Equipment Identification (AEI) system information (fixed and varying) is placed on electromagnetic tags attached to railcars, locomotives, and containers.[283] This system uses frequencies in the 902-928 MHz band, which were designated by the FCC for the Location and Monitoring Service (LMS) in 1995.[284] Tags are read automatically using a reader system consisting of a reader, an RF module and antenna. Information is extracted from the tag and relayed to other fixed facilities. There are two types of tags: (1) static tags - containing fixed data such as the permanent identifying code and (2) dynamic tags - programmed to transmit limited amounts of data. There are also 5,000 licensed tag readers in use.[285]

AAR states in its comments that Multiple Address System (MAS) frequencies in the 928 MHz, 952 MHz and 956 MHz bands are also used by the railroad industry for Supervisory Control and Data Acquisition (SCADA) operations involving the remote control of switches and signals along the rail right-of-way.[286]

Finally, fixed point-to-point communications systems in the 2 GHz, 6 GHz, 11 GHz and 18 GHz bands are used by the railroads to link various mobile radio systems such as very high frequency (VHF) systems and ATCS/PTC. Various other uses include: (1) relay of information regarding train signals, the routing of trains and the remote switching of tracks; (2) relay of trackside telemetry data; (3) relay of information regarding damaged tracks, equipment or hazards (e.g., rock slides); and (4) links dispatchers in distant locations.

WIRE-BASED AND COMMERCIAL SERVICES

In its comments for this report, AAR states that alternative technologies such as fiber optic links are not feasible in a mobile environment. Spectrum-dependent radios provide the best communications platform for the railroad industry. However, wire-based technologies, such as long-distance telephone providers and local phone companies, are used by the railroad industry for conventional communications requirements.[287]

The railroad industry frequently uses cellular systems to communicate with contractors and customers. However, AAR states that the railroad industry considers cellular service unreliable for en route train operations due to lack of commercial service in remote operating

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[283] Approximately 1.4 million rail cars, locomotives, and containers are equipped with AEI tags.

[284] 47 CFR, Part 90, 90.353

[285] *Id.*

[286] *Id.*

[287] AAR at 23.

areas.[288] AAR specifically states, "coverage requirements dictate that communications be available where the trains are, and railroad rights-of-way in many parts of the nation are in remote areas, far from any commercial communications infrastructure."[289] Table 3-1 also identifies disadvantages associated with the use of commercial services.

In addition, "[r]ailroads also depend upon reliable communications during emergencies and natural disasters. When earthquakes, floods, and hurricanes occur, the circuits of the telephone companies are busy or simply do not work. In such circumstances, the railroads must rely on their own communications networks."[290]

SUMMARY OF SPECTRUM AND SYSTEMS CURRENTLY USED

In the first and second question of NTIA's RFC, NTIA asked how much spectrum is presently available and in which spectrum bands and radio services does the railroad industry operate radio communications equipment, respectively?[291] AAR's response is that the railroad industry has been making extensive use of the RF spectrum for over 60 years.[292] In addition, railroad's use of radio continues to grow as advanced specialized radio applications continue to expand.[293] More importantly, railroad mobile radio operations are inherently nationwide as trains travel from coast to coast.[294] The Location and Monitor Service (LMS), Multiple Address System (MAS) and fixed microwave systems are shared with other business and industrial frequency users.[295] Table 5-1, on the next page, provides an overview of the frequency bands used by the railroad industry and the applications each band supports. However, there was insufficient information from the commenters and coordinators to determine how much spectrum is available or used in these frequency bands.

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[288] AAR at 23-24.

[289] *Id.*

[290] *Id.*

[291] *Supra note 5.*

[292] AAR at 5.

[293] AAR at 8.

[294] *Id.*

[295] *Supra note 25.*

Table 5-1
Summary of Bands and Applications Currently Used by The Railroad Industry Based on Input from Commenters

Frequency Bands	Applications
160.215-161.565 MHz	FM Equipment
450-460 MHz	End of Train Devices
896 MHz	ATCS/PTC
902-928 MHz	LMS
928 MHz	MAS
936 MHz	ATCS/PTC
952 MHz	MAS
956 MHz	MAS
2 GHz	Point-to-Point Microwave
6 GHz	Point-to-Point Microwave
11 GHz	Point-to-Point Microwave
18 GHz	Point-to-Point Microwave

TECHNICAL ISSUES

AAR states that the railroad industry is experiencing heavy congestion in the 160.215-161.565 MHz band, 450-460 MHz band, and the six channel pairs at 896/923 MHz. This is especially true in the major urban centers where rail lines converge and large terminals are located. AAR does not anticipate a lessening of congestion even with implementation of digital trunked systems in the VHF band (i.e., Project 25).[296] According to AAR, widespread deployment of high speed passenger rail service and the associated train control systems will increase demand in all areas. In order to make more efficient use of licensed spectrum in the 160 MHz band, the railroad industry has chosen the Association of Public Safety Communications Officials (APCO) Project 25[297] protocol to develop a rechannelization plan for its 160 MHz

[296] AAR at 25.

[297] APCO developed a series of standards for radio equipment and systems known as APCO Project 25 or P25. The new equipment is narrowband, with digital trunking, supports trunking, encryption, private calls, group call, voice plus data, and talk group precedence and is backward compatible with analog FM equipment allowing for a phased migration to new equipment and systems.

radios.[298] The rechannelization plan is backward compatible with FM analog equipment and systems.[299] It employs eighty trunked duplex voice channel-pairs, with five non-trunked channel-pairs, plus 11 simplex channels.[300] This channel plan is now being demonstrated as a pilot project in the Pacific Northwest.[301] The channel-pairs will be co-located at base stations and both the transmit and receive channel will be at the repeater sites while transmitting and receiving simultaneously.[302]

TECHNOLOGY TRENDS

The emerging PTC systems are integrated command, control, communications, and information systems for controlling train movements with safety, precision, and efficiency.[303] The components of PTC systems include digital data link communications networks, positioning systems (such as Nationwide Differential Global Positioning System), on-board computers on locomotives, maintenance-of-way equipment, in-cab displays, throttle-brake interfaces on locomotives, wayside interface units at switches, wayside detectors, and control center computers and displays.[304] PTC systems also interface with traffic planners, work order reporting systems, and locomotive health reporting systems.[305] They are used to: issue movement authorities to train and maintenance-of-way crews; track locations of trains and maintenance-of-way vehicles; intervene to prevent violations of the movement authorities; and update operating data systems with information on the location of trains, locomotives, cars, and crews.[306] PTC systems also enable a railroad to run scheduled operations and provide improved running time, greater running time reliability, higher asset utilization, and greater track capacity.[307] They will assist railroads in measuring and managing costs and in improving energy efficiency.[308]

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[298] PTC Report at 100

[299] *Id.*

[300] AAR at 17

[301] *Id.*

[302] *Id.*

[303] Steven R. Dittmeyer, Federal Railroad Administration, U.S. Department of Transportation, A Vision for the Future: Intelligent Railroad Systems, (May 16, 2001) at 2.

[304] *Id.*

[305] *Id.*

[306] *Id.*

[307] *Id.*

[308] *Id.*

SUMMARY OF NON-SPECTRUM DEPENDENT ALTERNATIVES AND COMMERCIAL SERVICES

NTIA inquired about the use of non-spectrum dependent alternative technologies or commercial services that are currently available.[309] AAR informed NTIA that "spectrum-dependent (i.e., wireless) technologies are absolutely essential, and the rail industry is not aware of any non-spectrum-dependent and commercial technologies suitable for meeting the railroads' mobile communications needs."[310] As for commercial technologies, the railroad industry relies heavily on interlata and intralata providers for conventional communications requirements and wireless (i.e., cellular, personal communications service (PCS) and special mobilized radio (SMR)) carriers to meet their mobile communications requirements.[311] However, due to the geographical coverage of railroad operations and the "ribbon"[312] nature of their coverage, railway companies would have to subscribe to numerous commercial radio providers. AAR informs NTIA that this would render the arrangement "unwieldy, inefficient and costly."[313]

POSSIBLE FUTURE SPECTRUM REQUIREMENTS

NTIA then inquired about the Railroad industry's future spectrum requirements. According to AAR, possible bands for future expansion could be the 700 MHz "guard band," which was recently auctioned by the FCC, and the Land Mobile Communications Service spectrum at 1.4 GHz that is currently part of the reallocation proceedings at the FCC.[314]

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[309] *Supra note 5.*

[310] AAR at 23.

[311] *Id.*

[312] AAR at 24.

[313] *Id.*

[314] AAR at 25.

SECTION 6
SUMMARY OF CURRENT SPECTRUM USE AND FUTURE REQUIREMENTS

Below is a summary of information gathered by NTIA about the current and future spectrum requirements of providers of railroad, water and energy services.

CURRENT SPECTRUM USED

The energy, water, and railroad industries all use spectrum anywhere between 20 MHz and 25 GHz. Below is a summary of the spectrum that is currently used by the energy, water, and railroad industries. This is reflected in more detail in Table 6-1, on the next page.

According the energy industry commenters, the use of these frequencies range from voice to data applications. In addition, the energy industry commenters indicated that the industry is experiencing problems with interference.

The water industry makes use of the 900 MHz, 928 MHz, 952 MHz, 956 MHz, 2 GHz, 6 GHz, and 23 GHz bands. Besides operating in the PLMRS, water utilities use commercial services, land-line providers, and dedicated land-line link systems as compliments to its wireless system. However, water industry commenters indicated that industry users are near the limits of capacity and experiencing increased interference problems.

The railroad industry uses the 160-161 MHz, 450-460 MHz, 902-928 MHz, 952 MHz and 956 MHz bands and the 2 GHz, 6 GHz, 11 GHz, and 18 GHz bands. It also uses six channel pairs at 896/936 MHz for the Advanced Train Control/Positive Train Controls (ATCS/PTC) test systems (See Data Requirements section).

FUTURE SPECTRUM REQUIREMENTS

Although there is a consensus among industry commenters that more spectrum is needed by providers of railroad, water, and energy services, there is no consensus as to where the spectrum should be located. Below is a summary of the responses NTIA received when industry was asked to provide comments on future spectrum requirements. Table 6-2, page 6-3, illustrates the bands that could be used to satisfy commenters' stated future spectrum requirements.

The future spectrum suggestions received by NTIA from the energy industry were mixed. Four commenters stated that the FCC should allocate more spectrum in the 450 MHz, 800 MHz and 900 MHz bands. Another commenter mentioned obtaining spectrum from the unused television channels, along with spectrum between 1 GHz and 12 GHz bands. However, the NRTC wants more access to the lower spectrum bands, such as the 220 MHz band. Itron mentioned using the 1427 - 1432 MHz bands. Thus, while the energy industry is in agreement that more spectrum is needed, it has not reached any consensus on where the "ideal" location of such spectrum would be.

Table 6-1
Summary of Bands and Applications Currently Used as Indicated by Commenters

	Energy Industry	Water Industry	Railroad Industry
20 MHz	25-50 MHz: PLMRS		
40 MHz	48-50 MHz: Voice Dispatch, Alarms From Remote		
50 MHz	50 MHz Band: PLMRS, MAS		
100 MHz	150-170 MHz: Voice Dispatch, Load Management Control 150-175 MHz: Alarms From Remote Substations, PLMRS		160.215-161.565 MHz: FM Equipment
200 MHz	220 MHz: SCADA		
400 MHz	450-470 MHz: Voice Dispatch, Mobile Data, PLMRS 470-512 MHz: PLMRS		450-460 MHz: End of Train Devices
800 MHz	800 MHz Band: Voice Dispatch, Mobile Data Terminals, Trunked PLMRS 806-821 MHz: PLMRS; 821-824 MHz: PLMRS 851-866 MHz: PLMRS; 866-896 MHz: PLMRS 896-901 MHz: PLMRS		896 MHz: ATCS/PTC
900 MHz	900 MHz Band: MAS 902-928 MHz: SCADA 928-929 MHz: POFS 928/932/941 MHz: MAS; 952/956/959 MHz: MAS 928-952 MHz: SCADA; 929-930 MHz: PLMRS, 932-935 MHz, 932-941 MHz, SCADA, 935-940 MHz, PLMRS, 941-944 MHz, 952-960 MHz, POFS, 956 MHz, Mobile Meter Reading	900 MHz Band: MAS, SCADA 928 MHz: MAS 952 MHz: MAS 956 MHz: MAS	902-928 MHz: LMS 928 MHz: MAS 936 MHz: ATCS/PTC 952 MHz, 956 MHz, MAS
1 GHz	1.427-1.432 GHz, AMR, 1.85-1.99 GHz, POFS		
2 GHz	2 GHz Band, PLMRS, POFS, MAS, SCADA, Point-to-Point 2.4 GHz Band, Point-to-Point Microwave	2 GHz Band,[1] Water Operations Network	2 GHz Band,[2] Point-to-Point Microwave
5 GHz	5 GHz Band, Spread Spectrum 5.8 GHz, 5.9-6.4 GHz, Point-to-Point Microwave		
6 GHz	6 GHz Band, Point-to-Point Microwave 6.5-6.8 GHz, Point-to-Point Microwave 6.525-6.875 GHz, POFS	6 GHz Band,[3] Water Operations Network	6 GHz Band,[4] Point-to-Point Microwave
11 GHz	11 GHz Band,[5] Point-to-Point Microwave		11 GHz Band,[6] Point-to-Point Microwave
18 GHz	18-19 GHz, Point-to-Point Microwave		18 GHz Band,[7] Point-to-Point Microwave
21 GHz	21.2-23.6 GHz, POFS		
23 GHz		23 GHz Band,[8] Water Operations Network	
24 GHz	24.25-25.25 GHz, POFS		

1) 2.11-2.2 GHz, 2.45-2.5 GHz and 2.65-2.69 GHz. 47 CFR § 101.147(a).
2) *Id.*
3) 5.925-6.875 GHz. 47 CFR § 101.147(a).
4) *Id.*
5) 10.7-12.2 GHz. 47 CFR § 101.147(a).
6) *Id.*
7) 18-19 GHz. 47 CFR § 101.147(a).
8) 23-23.6 GHz. 47 CFR § 101.147(a).

Table 6-2
Summary of Frequency Bands That Could Be Used as Indicated by Commenters

Energy Industry	Water Industry	Railroad Industry
220 MHz Band	216-220 MHz Band	700 MHz Band[1]
450 MHz Band	6 GHz Band	1.4 GHz Band
800 MHz Band	11 GHz Band	
900 MHz Band	23 GHz Band	
1427-1432 MHz Band		
1-12 GHz Band		

1) Although the AAR mentioned the 700 MHz Guard Band, this spectrum will also be available to the energy and water industries by leasing spectrum from the "Guard Band Managers."

The DOE and FERC both agree with the industry assessments of their future spectrum requirements even though FERC does not consult with certified frequency coordinators for the energy industry.

The AWWA, on behalf of the water industry, cites the USAT's spectrum requirement of 1.0 MHz additional bandwidth by the year 2000, 1.9 MHz additional bandwidth by the year 2004, and 6.3 MHz of additional bandwidth by the year 2010. AWWA believes that this projection is underestimated. One industry commenter, EBMUD, is considering migrating into the 6 GHz, 11 GHz and 23 GHz bands. DFS recommends that the 216-220 MHz band be used for future spectrum requirements.

AAR, on behalf of the railroad industry, suggests that the 700 MHz "guard band" and the 1.4 GHz Land Mobile Communications Service bands be used as possible new spectrum in the future.

AVAILABILITY OF 700 MHz GUARD BAND SPECTRUM

In 1998, the FCC adopted service rules for the 24 MHz of spectrum in the 764-776/794-806 MHz frequency bands (collectively, the 700 MHz band). At the direction of Congress, this spectrum was reallocated from television broadcast services to public safety communications services. Spectrum located in 746-747/776-777 MHz and 762-764/792-794 MHz bands was auctioned to Guard Band Managers through competitive bidding. Three bidders won 8 licenses in these guard bands.

The Guard Band Manager is a new class of commercial licensee engaged solely in the business of leasing spectrum to third parties on a for-profit basis. The Guard Band Manager may

subdivide its spectrum in any manner it chooses to make it available to system operators, or directly to end users for fixed or mobile communications. The Guard Band Manager will be required to adhere to strict frequency coordination and interference rules, and control use of the spectrum so as to facilitate protection for public safety. Energy, water, and railroad entities are eligible to use this spectrum.

SECTION 7
SUMMARY AND CONCLUSION

INTRODUCTION

Public Law 106-553, The Departments of Commerce, Justice, and State, the Judiciary, and Related Agencies Appropriations Act of 2001, requires the NTIA Administrator, after consultation with federal agencies and departments responsible for regulating the core operations of entities engaged in the provision of energy, water, and railroad services, to submit to Congress a study of current and future use of spectrum by these entities to protect and maintain the nation's critical infrastructure. To compile the information necessary to complete the report, NTIA solicited private sector entities engaged in energy, water, and railroad services for their current and future spectrum needs. This was conducted through a "Request for Comments" (RFC) procedure, which was published in the *Federal Register*. To comply with the language contained in PL 106-553, a letter of inquiry was also sent to those regulatory federal agencies that have oversight of these industries.

SUMMARY

Based upon the comments and information received in response to either the RFC or the federal letter, NTIA provides the following general observations:

- Energy, water, and railroad services are considered vital components of the nation's critical infrastructure. These computer-based services utilize wireless networks to process voice and data information, and also to comply with existing safety, operational, environmental, and regulatory requirements. Wireless communications technology is also a reliable means of maintaining command and control during situations requiring emergency or demand-side response. Providers of energy, water, and railroad services assert they would be unable to address major service interruptions due to natural disasters or equipment malfunctions without adequate spectrum.

- Energy, water, and railroad services utilize portions of the radio spectrum from 20 MHz to 25 GHz for a variety of services. For example, wireless telecommunications are frequently used by energy producers, suppliers, and distributors to provide two-way voice communications; to monitor power transmission lines and oil or natural gas pipeline functions; and to send commands to various remote control switches. These companies rely on wireless communications to coordinate the daily activities of various work crews and to obtain meter data automatically from consumers. The railroad industry relies heavily on wireless technologies to conduct inspections of approximately 230,000 miles of track. Wireless technologies are also crucial in managing a soon-to-be implemented Positive Train Control (PTC) system, a U.S. and Canada coordinated system that controls train movement, train separation, and route alignment. Water utilities depend on wireless telecommunications technologies while engaged in activities such as flood control,

wastewater management, the processing of drinking water, and farmland irrigation.

- Many commenters were not specific with regards to the frequency bands they use. For instance, a general designation (e.g., 23 GHz band) was used instead of a specific frequency(ies) range, or portion of the spectrum within or around the band. Therefore, NTIA could not quantify spectrum use or amounts thereof.

- Commenters generally noted that wireless commercial services cannot replace existing private wireless infrastructure. They noted that limited coverage areas, no priority of services when outages occur, and cost are a few of the reasons why commercial services would not be able to replace their private network. However, commenters noted that commercial services are used to a great extent for administrative communications.

- Commenters also noted that wireline systems cannot replace the wireless infrastructure that these entities heavily rely on because wireless systems are mobile, less expensive, more reliable, and easier to maintain than fiber or wire-based systems.

- Commenters stated that growth in the services that energy, water, and railroad entities provide is increasing. They stated that growth within these industries caused by increasing consumer demand and deregulation make the use of wireless networks one of the most practical and efficient ways to supervise, control, and monitor these essential services on a daily basis.

- Commenters did not specify the amount of additional spectrum that would be required in the future, with one exception, AWWA. AWWA, citing to the Utilities Spectrum Assessment Taskforce Final Report, noted the need for as much as 9.2 MHz of additional bandwidth through the year 2010. Commenters did, however, suggest specific bands as sources for additional spectrum needs, such as the 220 MHz, 700 MHz (Guard Bands), 800 MHz, 900 MHz, and 1400 MHz bands.

- One common issue identified by the commenters is the congestion that they are experiencing in the land mobile bands. Since many applications by these entities are highly mobile, they make use of land mobile allocations and are considered part of the LMR services. The majority of commenters stated that problems of interference from overcrowding in the LMR bands was a primary concern. They indicated that exclusive spectrum would help to alleviate the problem.

- NTIA did not receive any supporting data from commenters pertaining to license applications for frequencies in the Industrial/Business pool. This data would have been useful in identifying and quantifying specific areas of congestion and interference. Thus, NTIA can only note without comment the commenters concern about exclusive spectrum because of interference from adjacent channels and channel congestion.

CONCLUSIONS

The commenters raised concerns and issues regarding the current and future use of spectrum for the energy, water, and railroad industries. Furthermore, federal agencies who regulate these industries generally concur with the comments NTIA received. Specifically, the federal agencies noted that spectrum usage is an important part of these industries' core operations, ranging from routine maintenance to emergency response.

One issue raised by the commenters that may require further consideration by the FCC is the issue of congestion in the land mobile bands used by these entities. Commenters contend that congestion leads to problems of interference, further leading to erosion of core communications functions. This issue was raised by 13 of the 19 comments received by NTIA.

Since this report is based predominately on comments received from the industry and public, and information from federal agencies with oversight or regulatory authority over these industries, NTIA is unable to independently validate specific industry requirements. However, NTIA suggests some of these issues (i.e., congestion and interference) may be addressed or mitigated with the use of advanced communications technology or newly allocated frequency bands, such as the 700 MHz guard bands.

Appendix A

Public Law 106-553
Departments of Commerce, Justice, and State, the Judiciary, and Related Agencies Appropriations Act, 2001

from prior years), $24,055,000 is for Program Development and Management; $55,096,000 is for Data Content and Products; $122,000,000 is for Field Data Collection and Support Systems; $1,500,000 is for Address List Development; $115,038,000 is for Automated Data Processing and Telecommunications Support; $55,000,000 is for Testing and Evaluation; $5,512,000 is for activities related to Puerto Rico, the Virgin Islands and Pacific Areas; $9,197,000 is for Marketing, Communications and Partnership activities; and $3,500,000 is for the Census Monitoring Board, as authorized by section 210 of Public Law 105–119.

In addition, for expenses to collect and publish statistics for other periodic censuses and programs provided for by law, $145,508,000, to remain available until expended: *Provided*, That regarding engineering and design of a facility at the Suitland Federal Center, quarterly reports regarding the expenditure of funds and project planning, design and cost decisions shall be provided by the Bureau, in cooperation with the General Services Administration, to the Committees on Appropriations of the Senate and the House of Representatives: *Provided further*, That none of the funds provided in this Act or any other Act under the heading "Bureau of the Census, Periodic Censuses and Programs" shall be used to fund the construction and tenant build-out costs of a facility at the Suitland Federal Center.

National Telecommunications and Information Administration

SALARIES AND EXPENSES

For necessary expenses, as provided for by law, of the National Telecommunications and Information Administration (NTIA), $11,437,000, to remain available until expended: *Provided*, That, notwithstanding 31 U.S.C. 1535(d), the Secretary of Commerce shall charge Federal agencies for costs incurred in spectrum management, analysis, and operations, and related services and such fees shall be retained and used as offsetting collections for costs of such spectrum services, to remain available until expended: *Provided further*, That hereafter, notwithstanding any other provision of law, NTIA shall not authorize spectrum use or provide any spectrum functions pursuant to the National Telecommunications and Information Administration Organization Act, 47 U.S.C. 902–903, to any Federal entity without reimbursement as required by NTIA for such spectrum management costs, and Federal entities withholding payment of such cost shall not use spectrum: *Provided further*, That the Secretary of Commerce is authorized to retain and use as offsetting collections all funds transferred, or previously transferred, from other Government agencies for all costs incurred in telecommunications research, engineering, and related activities by the Institute for Telecommunication Sciences of NTIA, in furtherance of its assigned functions under this paragraph, and such funds received from other Government agencies shall remain available until expended.

PUBLIC TELECOMMUNICATIONS FACILITIES, PLANNING AND CONSTRUCTION

For grants authorized by section 392 of the Communications Act of 1934, as amended, $43,500,000, to remain available until

expended as authorized by section 391 of the Act, as amended: *Provided*, That not to exceed $1,800,000 shall be available for program administration as authorized by section 391 of the Act: *Provided further*, That notwithstanding the provisions of section 391 of the Act, the prior year unobligated balances may be made available for grants for projects for which applications have been submitted and approved during any fiscal year.

INFORMATION INFRASTRUCTURE GRANTS

For grants authorized by section 392 of the Communications Act of 1934, as amended, $45,500,000, to remain available until expended as authorized by section 391 of the Act, as amended: *Provided*, That not to exceed $3,000,000 shall be available for program administration and other support activities as authorized by section 391: *Provided further*, That, of the funds appropriated herein, not to exceed 5 percent may be available for telecommunications research activities for projects related directly to the development of a national information infrastructure: *Provided further*, That, notwithstanding the requirements of sections 392(a) and 392(c) of the Act, these funds may be used for the planning and construction of telecommunications networks for the provision of educational, cultural, health care, public information, public safety, or other social services: *Provided further*, That notwithstanding any other provision of law, no entity that receives telecommunications services at preferential rates under section 254(h) of the Act (47 U.S.C. 254(h)) or receives assistance under the regional information sharing systems grant program of the Department of Justice under part M of title I of the Omnibus Crime Control and Safe Streets Act of 1968 (42 U.S.C. 3796h) may use funds under a grant under this heading to cover any costs of the entity that would otherwise be covered by such preferential rates or such assistance, as the case may be: *Provided further*, That the Administrator shall, after consultation with other federal departments and agencies responsible for regulating the core operations of entities engaged in the provision of energy, water and railroad services, complete and submit to Congress, not later than twelve months after date of enactment of this subsection, a study of the current and future use of spectrum by these entities to protect and maintain the nation's critical infrastructure: *Provided further*, That within six months after the release of this study, the Chairman of the Federal Communications Commission shall submit a report to Congress on the actions that could be taken by the Commission to address any needs identified in the Administrator's study.

PATENT AND TRADEMARK OFFICE

SALARIES AND EXPENSES

For necessary expenses of the Patent and Trademark Office provided for by law, including defense of suits instituted against the Commissioner of Patents and Trademarks, $783,843,000, to remain available until expended: *Provided*, That of this amount, $783,843,000 shall be derived from offsetting collections assessed and collected pursuant to 15 U.S.C. 1113 and 35 U.S.C. 41 and 376, and shall be retained and used for necessary expenses in this appropriation: *Provided further*, That the sum herein appropriated from the general fund shall be reduced as such offsetting

Appendix B

NTIA Request for Comments published in the Federal Register.

Permits and Modified Permits Issued

Permit 1237

Notice was published on February 16, 2000 (65 FR 7855) that the Corps applied for an enhancement permit (1237). Permit 1237 was issued to the Corps on March 22, 2001. Permit 1237 authorizes the Corps annual takes of ESA-listed juvenile salmon and steelhead associated with transporting juvenile anadromous fish around the dams and past the reservoirs on the mainstem lower Snake and Columbia Rivers in the Pacific Northwest. The purpose of the Corps' Juvenile Fish Transportation Program is to increase juvenile fish survival over the alternative of in-river passage, given current in-river migratory conditions. The collection and transportation of juvenile salmonids is projected to occur approximately March 25 through October 31 each year at Lower Granite, Little Goose, and Lower Monumental Dams on the lower Snake River, and approximately early to mid-June through December 15 each year at McNary Dam on the lower Columbia River. The Corps will load the juvenile fish into aerated trucks and barges for transportation to below Bonneville Dam on the Columbia River. Further handling of the fish does not occur, except for loading via raceways or when the fish are handled for monitoring purposes by Corps personnel or for scientific research purposes by individuals holding separate take authorizations. Annual takes of ESA-listed adult fish associated with handling fallbacks at the juvenile fish transportation facilities are also authorized. Permit 1237 expires on December 31, 2005.

Permit 1273

Notice was published on December 7, 2000 (65 FR 76612) that Mr. Chris Ivers, of NCAD applied for an enhancement permit (1273). NCAD proposes to continue to maintain 17 endangered shortnose sturgeon for the purposes of public education through species enhancement as identified in the Final Recovery Plan for Shortnose Sturgeon. Permit 1273 was issued on March 24, 2001, authorizing take of listed species. Permit 1273 expires March 1, 2006.

Dated: April 3, 2001.

Phil Williams,

Acting Chief, Endangered Species Division, Office of Protected Resources, National Marine Fisheries Service.

[FR Doc. 01–8656 Filed 4–6–01; 8:45 am]

BILLING CODE 3510–22–S

DEPARTMENT OF COMMERCE

National Telecommunications and Information Administration

[Docket No. 010327080–1080–01]

RIN 0660–XX12

Request for Comment on Energy, Water and Railroad Service Providers' Spectrum Use Study

AGENCY: National Telecommunications and Information Administration, Commerce.

ACTION: Notice, request for comments.

SUMMARY: Public Law 106–553, making appropriated funds available to the Departments of Commerce, Justice, and State, the Judiciary, and related agencies for fiscal year 2001, contained a provision directing the National Telecommunications and Information Administration (NTIA) to submit to Congress a study of the current and future use of spectrum by providers of energy, water and railroad services to protect and maintain the nation's critical infrastructure.[1] Therefore, NTIA is conducting an investigation of current and future use of radio frequency spectrum in the United States by providers of energy, water and railroad services, and how current and emerging technology trends affect use of the radio spectrum. By this notice and request for comments, NTIA is soliciting the views of the industry and the public on these issues.

DATES: Comments must be received on or before June 8, 2001.

ADDRESSES: The Department invites the public to submit written comments in paper or electronic form. Comments may be mailed to Jeng Mao, Public Safety Program, National Telecommunications and Information Administration, U.S. Department of Commerce, Room 4624, 14th and Constitution Avenue, NW., Washington, DC 20230. Paper submissions should include an electronic version on diskette in ASCII, WordPerfect (please specify version) or Microsoft Word (please specify version) format.

In the alternative, comments may be submitted in electronic form to the following electronic mail address: <utilities@ntia.doc.gov>.

FOR FURTHER INFORMATION CONTACT: Jeng Mao, (202) 501–0342, jmao@ntia.doc.gov, or Marshall Ross, (202) 482–1222, mross@ntia.doc.gov, Public Safety Program, NTIA.

SUPPLEMENTARY INFORMATION:

Background

Energy, water and railroad services are primary components of the nation's critical infrastructure. Processing voice and data information via wireless radio systems is an efficient way to supervise, control and monitor these utilities on a daily basis. It is also an efficient means of communications during situations requiring emergency response. Without adequate radio spectrum, providers of energy, water and railroad services would be unable to address major service interruptions due to natural disaster, equipment malfunctions or in some cases, terrorist activities. Wireless telecommunications are frequently used by utilities to monitor power transmission lines, water pumps and also to send commands to various remote control switches. In addition, some utilities must comply with State statutes requiring them to respond to service interruptions within a specified time period. Interruption of these services could disrupt emergency response efforts and impede law enforcement activities. Furthermore, lack of interoperability can be a major hindrance to mission-critical public safety communications. Multi-jurisdictional coordination between Federal and non-federal entities during crisis situations can be severely impacted because of inadequate radio spectrum.

NTIA is the President's principal adviser on telecommunications and information policy and manages the Federal Government's use of radio spectrum.[2] The Federal Communications Commission (FCC), an independent agency established by the Communications Act of 1934, manages the use of radio spectrum by state and local governments and the private sector, including the energy, water and railroad industries.[3] Public Law 106–553, making appropriated funds available to the Departments of Commerce, Justice, and State, the Judiciary, and related agencies for fiscal year 2001, contained a provision directing the National Telecommunications and Information Administration (NTIA) to submit to Congress a study of the current and future use of spectrum by providers of

[1] See Federal Funding, Fiscal Year 2001, Public Law 106–553, 114 Stat. 2762, 2762A–174 (2000).

[2] 47 U.S.C. 902 (2000).

[3] For example, see the FCC's proceeding to address the requirements of the private land mobile radio community, including the energy, water and railroad industries, for more efficient use of the radio spectrum below 800 MHz, commonly called the "Refarming Proceeding." Documents related to the Refarming Proceeding are available on the FCC's web site at <http://www.fcc.gov/wtb/plmrs/refarmdocs.html>.

energy, water and railroad services to protect and maintain the nation's critical infrastructure.[4] The statute also requires the FCC Chairman to submit a subsequent report to Congress addressing any needs identified in NTIA's study. The statute specifically provides:

[T]he [NTIA] Administrator shall, after consultation with other federal departments and agencies responsible for regulating the core operations of entities engaged in the provision of energy, water and railroad services, complete and submit to Congress, not later than twelve months after date of enactment of this subsection, a study of the current and future use of spectrum by these entities to protect and maintain that nation's critical infrastructure: Provide further, That within six months after the release of this study, the Chairman of the Federal Communications Commission shall submit a report to Congress on the actions that could be taken by the Commission to address any needs identified in the Administrator's study.[5]

Questions for Public Comment

In order to obtain information necessary for NTIA to conduct an assessment of current and future spectrum requirements of providers of energy, water, and railroad services to protect and maintain the nation's critical infrastructure, NTIA seeks public comment on any issue of fact, law, or policy that may inform the agency about spectrum requirements of these industries taking into account growth, new technology, and future applications. Specifically, comments are requested on the questions below.

These questions are designed to assist the public and should not be construed as a limitation on the issues on which public comments may be submitted. Comments should cite the number of the question(s) being addressed. Please provide copies of any studies, research and other empirical data referenced in the comments.

1. How much spectrum is presently available for the energy, water and railroad industries?

2. In which spectrum bands and in which radio services do these industries operate radio communications equipment?

3. What kinds of spectrum-dependent telecommunications equipment are currently being used by the energy, water and railroad industries?

4. Are there non-spectrum dependent alternative technologies or commercial services currently available?

5. What part of the spectrum do the energy, water and railroad industries foresee for possible future use? What is the rationale for these additional spectrum requirements?

6. What non-spectrum dependent communications technologies or commercial alternatives will be available in the future for the energy, water and railroad industries?

Kathy Smith,

Chief Counsel.

[FR Doc. 01–8672 Filed 4–6–01; 8:45 am]

BILLING CODE 3510–60–P

[4] Supra, n. 1.

[5] Id at 2762A–174 to 2762A–175. NTIA is required to submit its report to Congress no later than December 21, 2001.

COMMITTEE FOR THE IMPLEMENTATION OF TEXTILE AGREEMENTS

Denying Entry to Textiles and Textile Products Allegedly Produced in Certain Companies in Taiwan

April 3. 2001.

AGENCY: Committee for the Implementation of Textile Agreements (CITA).

ACTION: Issuing a directive to the Commissioner of Customs directing Customs to deny entry to shipments allegedly manufactured in certain companies in Taiwan.

EFFECTIVE DATE: April 9, 2001.

FOR FURTHER INFORMATION CONTACT: Janet Heinzen, International Trade Specialist, Office of Textiles and Apparel, U.S. Department of Commerce, (202) 482-3400.

SUPPLEMENTARY INFORMATION:

Authority: Section 204 of the Agricultural Act of 1956, as amended (7 U.S.C. 1854); Executive Order 12475 of May 9, 1984, as amended.

The U.S. Customs Service has conducted on-site verification of textile and textile product production in a number of foreign countries. Based on information obtained through on-site verifications and from other sources, U.S. Customs has informed CITA that certain companies were illegally transshipping, were closed, or were unable to produce records to verify production. The Chairman of CITA has directed the U.S. Customs Service to issue regulations regarding the denial of entry of shipments from such companies (see **Federal Register** notice 64 FR 41395, published on July 30, 1999). In order to secure compliance with U.S. law, including Section 204 and U.S. customs law, to carry out textile and textile product agreements, and to avoid circumvention of textile agreements, the Chairman of CITA is directing the U.S. Customs Service to deny entry to textiles and textile products allegedly manufactured by Hong Win Trading Company, City Art Printing, Hsu Chun Mei, and Spring Information Industry Co., Ltd. for two years. Customs has informed CITA that these companies were found to have been illegally transshipping, closed, or unable to produce records to verify production.

Should CITA determine that this decision should be amended, such amendment will be published in the Federal Register.

D. Michael Hutchinson,

Acting Chairman, Committee for the Implementation of Textile Agreements.

Committee for the Implementation of Textile Agreements

April 3, 2001.

Commissioner of Customs,
Department of the Treasury, Washington, DC 20229.

Dear Commissioner: The U.S. Customs Service has conducted on- site verification of textile and textile product production in a number of foreign countries. Based on information obtained through on-site verifications and from other sources, U.S. Customs has informed CITA that certain companies were illegally transshipping, were closed, or were unable to produce records to verify production. The Chairman of CITA has directed the U.S. Customs Service to issue regulations regarding the denial of entry of shipments from such companies (see directive dated July 27, 1999 (64 FR 41395), published on July 30, 1999). In order to secure compliance with U.S. law, including Section 204 and U.S. customs law, to carry out textile and textile product agreements, and to avoid circumvention of textile agreements, the Chairman of CITA directs the U.S. Customs Service, effective for goods exported on and after April 9, 2001 and extending through April 8, 2003, to deny entry to textiles and textile products allegedly manufactured by the Taiwanese companies Hong Win Trading Company, City Art Printing, Hsu Chun Mei, and Spring Information Industry Co., Ltd. Customs has informed CITA that these companies were found to have been illegally transshipping, closed, or unable to produce records to verify production.

The Committee for the Implementation of Textile Agreements has determined that this action falls within the foreign affairs exception to the rulemaking provisions of 5 U.S.C. 553(a)(1).

Sincerely,

D. Michael Hutchinson,

Acting Chairman, Committee for the Implementation of Textile Agreements.

[FR Doc.01–8615 Filed 4–6–01; 8:45 am]

BILLING CODE 3510–DR–F

Appendix C

Copy of Letter Sent to Federal Agencies

Dear _____:

Public Law 106-553, making appropriated funds available to the Departments of Commerce, Justice, and State, the Judiciary, and related agencies for fiscal year 2001, directed the National Telecommunications and Information Administration (NTIA) to report to Congress on the current spectrum allocations and possible future spectrum requirements by entities engaged in the provision of energy, water and railroad services. The statute also required NTIA to develop the study in consultation with other federal departments and agencies responsible for regulating the core operations of entities engaged in the provision of energy, water and railroad services. The study is due in December of 2001. I am therefore requesting input from your agencies for use in the report on the following issues

1. Please provide a brief description of your agency's mission, including the extent to which it provides regulatory oversight for any of the energy, water or railroad industry. Please indicate the aspects of the industry that your agency regulates, e.g., safety, industry standards, market supply, distribution, transport, disposals, pricing, and provide citations to your regulations.
2. Does your agency also promulgate regulations concerning communications or spectrum related issues? Please provide the citation to these regulations and summarize your agency's regulation(s) regarding current spectrum requirements and usage by the industry.
3. Will the industry your agency regulates require additional spectrum allocations in the future? If so, please provide details.
4. Are wireless technologies crucial to compliance of these regulation(s)? Are they crucial to maintaining the nation's critical infrastructure? What alternatives to wireless technologies can be utilized?
5. Do you consult with the industry certified frequency coordinator regarding spectrum allocations? If so, please provide contact information.

For your information, NTIA has already sought public and industry comment on these issues through a Federal Register notice published in April of 2001. The notice and the public comments are available through NTIA's website at http://www.ntia.doc.gov/osmhome/osmhome.html.

NTIA staff have also had informal discussions with _____ of your agency. Please provide us with your agency's input by August 6, 2001. NTIA will circulate the draft report to all of the federal agencies with which it consults before transmitting the final report to

Congress. If you have any questions, you may contact Marshall Ross at (202)482-1222, email mross@ntia.doc.gov, or Jeng Mao at (202)482-0342, email jmao@ntia.doc.gov, with NTIA's Office of Spectrum Management, Public Safety Program.
I look forward to your comments and thank you for your time and cooperation.

Sincerely,

William T. Hatch
Associate Administrator
Office of Spectrum Management____

Appendix D

Public Comment Respondents

American Petroleum Institute (API)
American Water Works Association (AWWA)
Association of American Railroads (AAR)
Central Maine Power Company (CMP)
Cinergy Corporation (Cinergy)
Data Flow Systems, Inc. (DFS)
Delmarva Power & Light Company and Atlantic City Electric Company (DPLC & ACE)
The Detriot Edison Company (DTE)
Dominion Resources Services, Inc. (Dominion)
East Bay Municipal Utility District (EBMUD)
Florida Power & Light Company and GPU Energy, Inc. (FPL & GPU)
Itron, Inc. (Itron)
National Rural Telecommunications Cooperative (NRTC)
Niagara Mohawk Power Corporation (NMPC)
North Atlantic Energy Service Corporation (NAES)
Omaha Public Power District (OPPD)
SCANA Corporation (SCANA)
United Telecom Council (UTC)
Williams Gas Pipeline (WGP)

Federal Agency Respondents

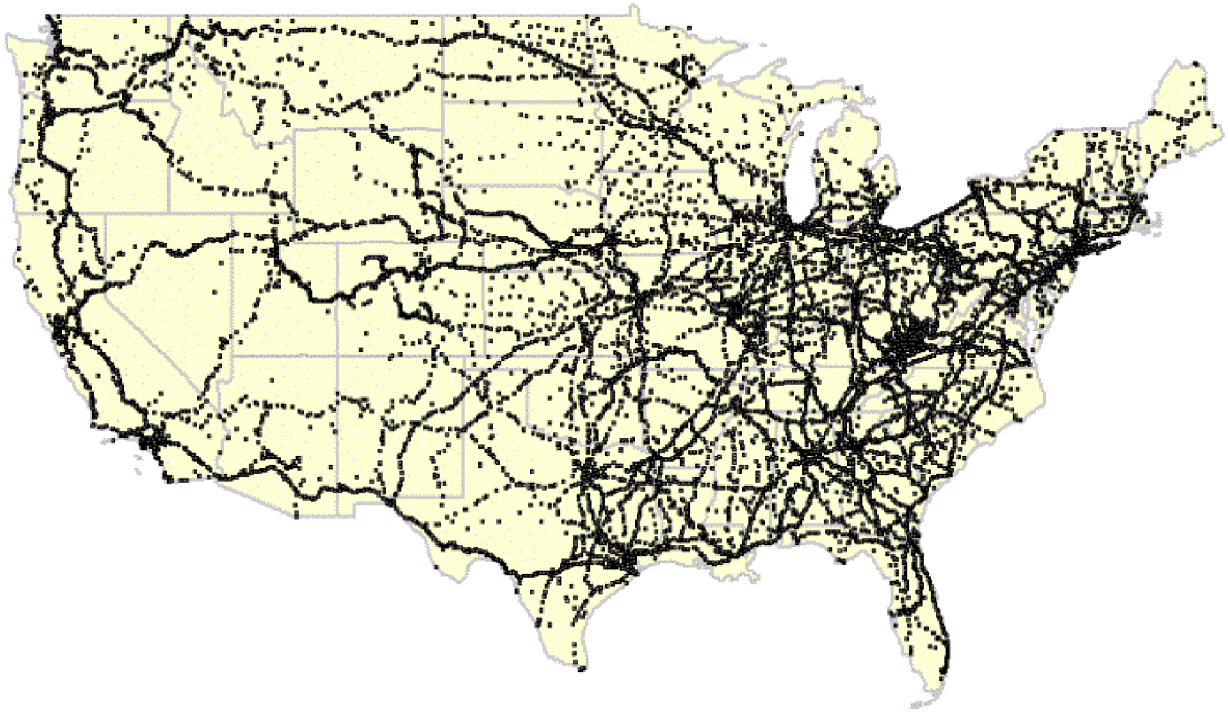
Department of Energy, IRAC Representative (DOE)
- DOE, Bonneville Power Administration (DOE/BPA)
- DOE, Chief Information Officer (DOE/CIO)
- DOE, Pittsburgh Naval Reactors (DOE/PNR)
- DOE, Savannah River Site (DOE/SRS)
- DOE, Western Area Power Administration (DOE/Western)

Environmental Protection Agency (EPA)
Federal Energy Regulatory Commission (FERC)

Appendix E

Map of Railroad's VHF Base Station Map

There are 16,000 base stations operating in mobile radio systems on 91 channels between 160.215 - 161.565 MHz, using analog FM equipment with 25 kHz bandwidth operating on overlapped channels separated by 15 kHz from center to center.



Appendix F

Executive Summary from the USAT Final Report

1. Executive Summary

Electric, gas and water utilities and gas pipelines have extensive telecommunications requirements. Expansive, sprawling infrastructure, whether it is transmission lines, water pumps, or electric substations, requires maintenance, remote control and monitoring. These objectives can be met effectively only through telecommunications -- and one of the most critical components of a utility's telecommunications arsenal is its wireless network.

In addition to needing access to wireless communications, utilities have a separate requirement: control over the communications system. This control can be satisfied only through the use of *private* radio spectrum. The transmission and distribution of Gas and Electricity pose unique problems. The two commodities are inherently hazardous and require "real-time" control to effectively administer them. While commercial systems can meet *some* of a utility's communications needs, the need for controlled, internal private systems will remain necessary.

During heavy storms and other serious weather events, commercial systems become saturated with traffic and, as a result, experience outage. Additionally, because commercial systems provide indiscriminate service to the general public, there is no priority access to the system. Consequently, utilities have no greater likelihood of gaining access to a channel than the average subscriber. It is precisely during these natural weather events that utilities require unencumbered, clear radio channels to address downed lines and other power outage problems. Further complicating matters is the fact that most commercial systems depend upon reliable power to keep their systems running. If power is interrupted, these communications systems will be interupted also, further impeding progress on power restoration. Private communications networks ensure that utility systems are brought back on line in the most timely manner possible.

The purpose of this report is to develop an estimate of private electromagnetic spectrum that will be required by utilities in the first decade of the twenty-first century. The report is the result of the findings of UTC's Utilities Spectrum Assessment Taskforce (USAT). The highlights of the report are listed below.

- The total "new spectrum" required (broken into three benchmark dates) is as follows:

Year	2000	2004	2010
Additional Bandwidth Required	1.0 MHz	1.9 MHz	6.3 MHz

- There is considerable interest within the utility to community to implement wireless video and wideband data in the future. As technology improves and cost of terminals decrease, it will become increasingly common for the utility to deploy these technologies.
- The total new spectrum requirements were generated by projecting future applications and growth and then subtracting the spectrum that is currently accessible by utilities. The number used as total current spectrum is 2.24 MHz.
- The focus of this report is on the mobile services generally associated with Part 90 of the FCC rules and regulations. Fixed microwave spectrum (that is, spectrum above 1000 MHz) was not considered.