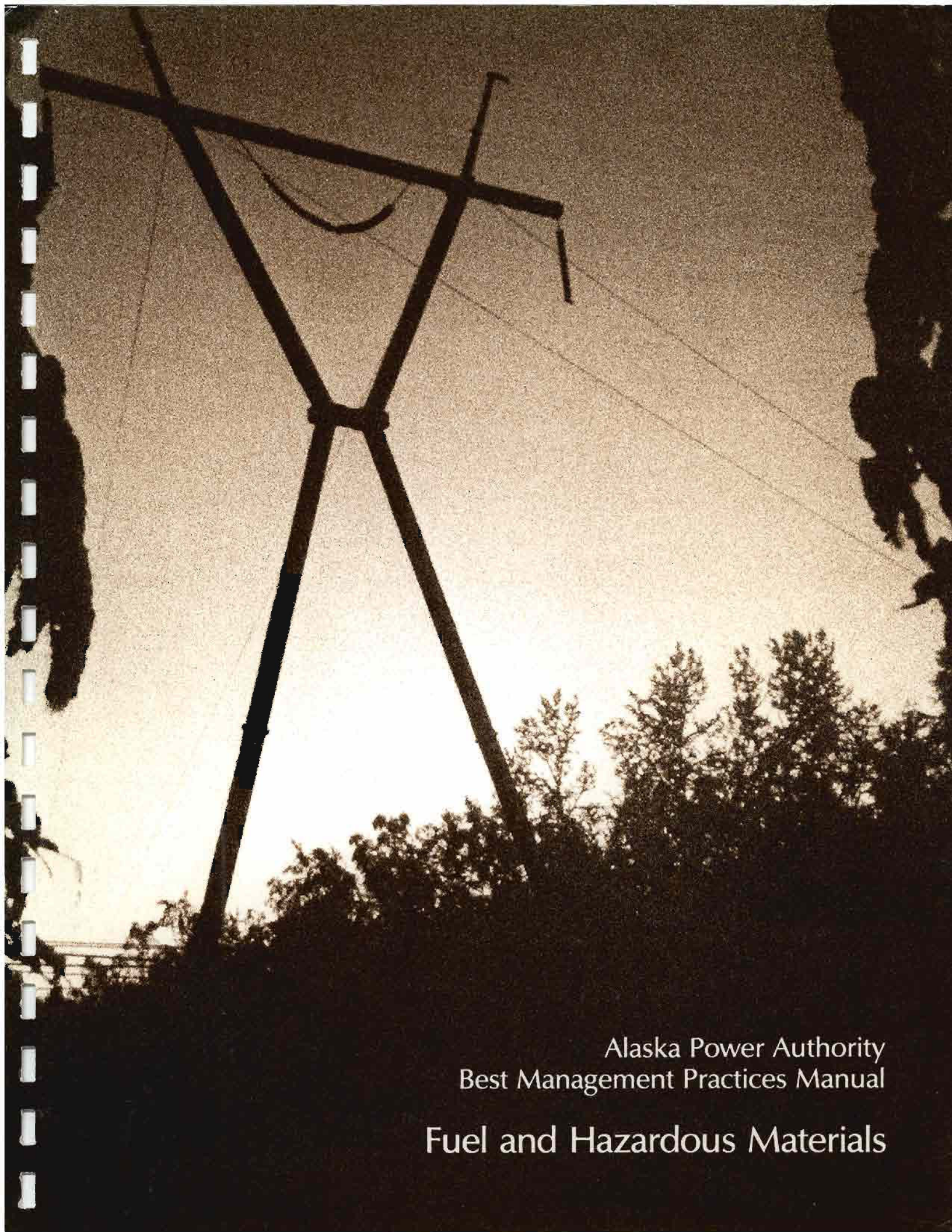

Alaska Power Authority
Best Management Practices Manual

Fuel and Hazardous Materials

ALASKA POWER AUTHORITY

BEST MANAGEMENT PRACTICES MANUAL

FUEL AND HAZARDOUS MATERIALS

February 1985

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under contract to Harza-Ebasco

Susitna Joint Venture

PREFACE

This manual is one of a series of "best management practices" manuals to be used in the design, construction, and maintenance of Alaska Power Authority projects. It presents a coordinated effort involving federal, state and local government agencies, and special interest groups.

The Alaska Power Authority intends that applicable guidelines and state-of-the-art techniques contained in the manuals will be incorporated where appropriate into the contractual documents for projects constructed, maintained, or operated by or under the direction of the Alaska Power Authority.

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CHAPTER 1 - INTRODUCTION

The Alaska Power Authority has prepared this best management practices (BMP) manual as one of a series of manuals to be used in design, construction, operation, and maintenance of Power Authority projects in Alaska. This BMP manual identifies some of the major elements that comprise on-site management of hazardous materials, and presents guidelines which reflect codes and regulations for accountability, storage, and disposal. Not all elements or guidelines will be appropriate for a particular site. In addition, federal, state and local laws may impose specific requirements on particular Power Authority projects or activities. This manual is not a substitute for case-by-case identification and compliance with all laws and regulations applicable to Power Authority projects.

The terms "hazardous materials" and "hazardous wastes" are used throughout this manual. For purposes of this manual, these are materials which have potential to cause substantial harm to humans or the environment. However, because each environmental law may define "hazardous materials" or "hazardous wastes" in a different manner, this manual cannot provide a definition of these terms that will be accurate in all contexts.

A substance or material is "hazardous" when it meets one of the defined characteristics in any one of several environmental laws and/or because it is actually found on a list of substances or materials which the law defines as hazardous. To constitute a "hazardous waste", the hazardous substance must first be a "waste". The laws regulating hazardous wastes provide very specific legal definitions for what constitutes a waste. These laws are discussed in Chapter 4.

Since hazardous materials and hazardous waste management are heavily regulated at the federal and state level, permitting requirements are important in project planning. Applicable regulations and permitting requirements may determine the kind of hazardous materials and waste management strategies used for individual projects. The following are important factors that should be an integral part of Power Authority project planning:

- Identify project goals and describe hazardous materials and waste generation necessary.

- Identify statutes, regulations and agencies which regulate either the proposed activity or its impacts. In particular, determine whether existing Power Authority permits control the activities or impacts involved.

- Compare burdens imposed by regulations and/or permits for proposed activities and alternatives (including costs associated with modifying activities to reduce or eliminate requirements).

- Develop and implement permitting strategy to obtain timely issuance of permits.

Chapter 2 of this manual discusses accountability and safety elements common to on-site management of hazardous materials. Chapter 3 addresses storage of hazardous materials with emphasis on the two types of products most common to construction projects in Alaska: 1) explosives, and 2) petroleum, oils and lubricants. Chapter 4 discusses the requirements for identification, treatment,

storage, and disposal of hazardous wastes. Regulatory authorities governing hazardous materials and hazardous wastes are listed in Chapter 5.

CHAPTER 2 - ACCOUNTABILITY AND SAFETY

All Power Authority projects will be required to develop and implement an accurate accounting and product information system for any fuel or hazardous materials from delivery to the site, through storage and use, to final disposal.

Training programs must also be designed and conducted to assure that fuel and hazardous materials will be appropriately handled to protect both human health and the environment.

2.1 FUEL AND HAZARDOUS MATERIALS TRACKING AND INFORMATION SYSTEM

A product tracking and information system must be developed to alert workers of proper procedures for handling hazardous materials and hazardous wastes and potential environmental and health dangers if mishandled. Equally important, the system must facilitate compliance with the "cradle-to-grave" reporting provisions of the Resource Conservation and Recovery Act (RCRA) and its implementing regulations discussed in Chapter 4.

The most immediate but least detailed form of product information is the manufacturer's direct labeling of containers. Proper labeling should contain a description of the product, recommended uses, recommended storage conditions, and safety precautions.

Individual data sheets available from the supplier for specific products provide the next level of information. Such sheets usually contain typical

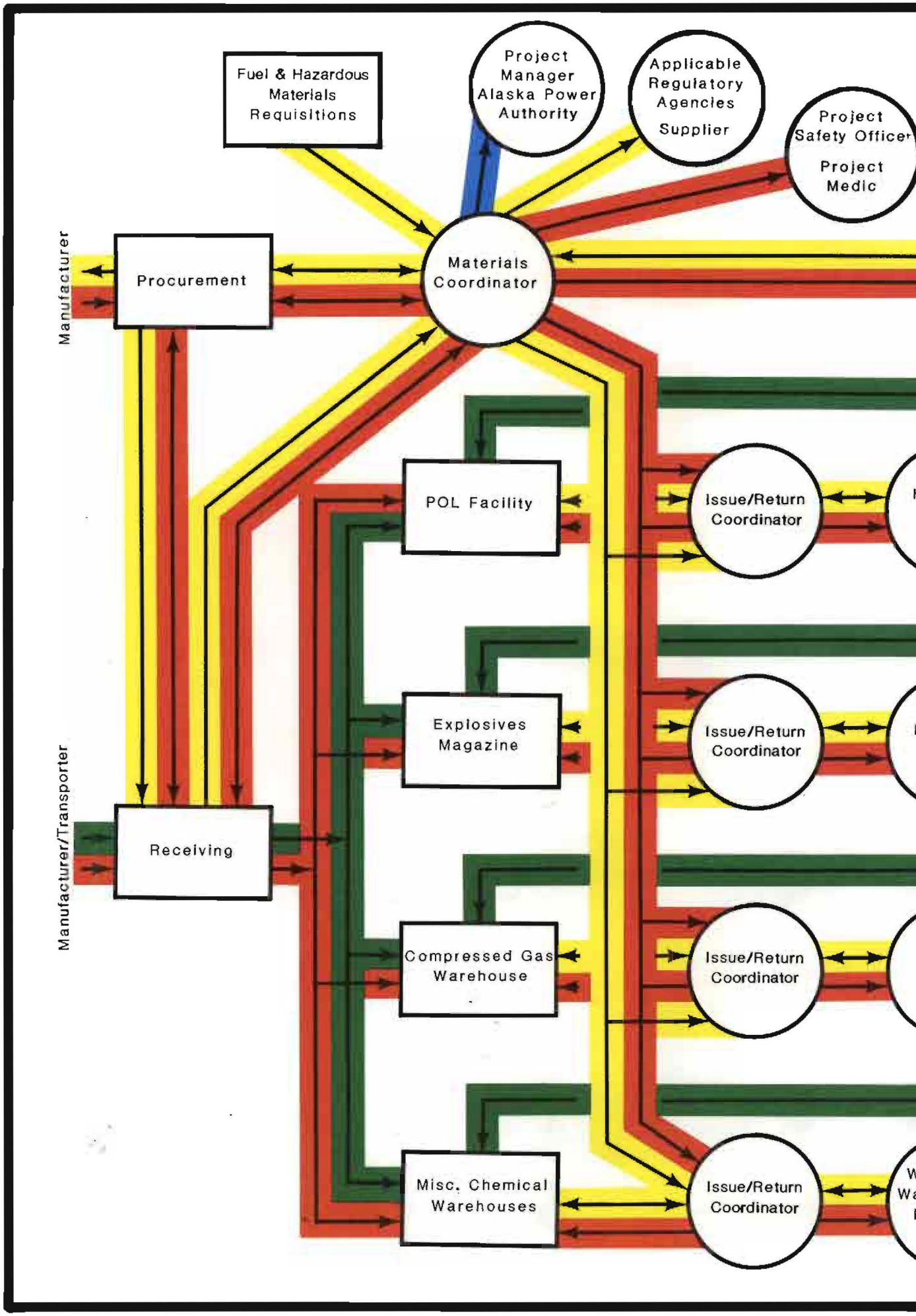
properties, recommended storage conditions, safety procedures, environmental considerations, and spill control procedures.

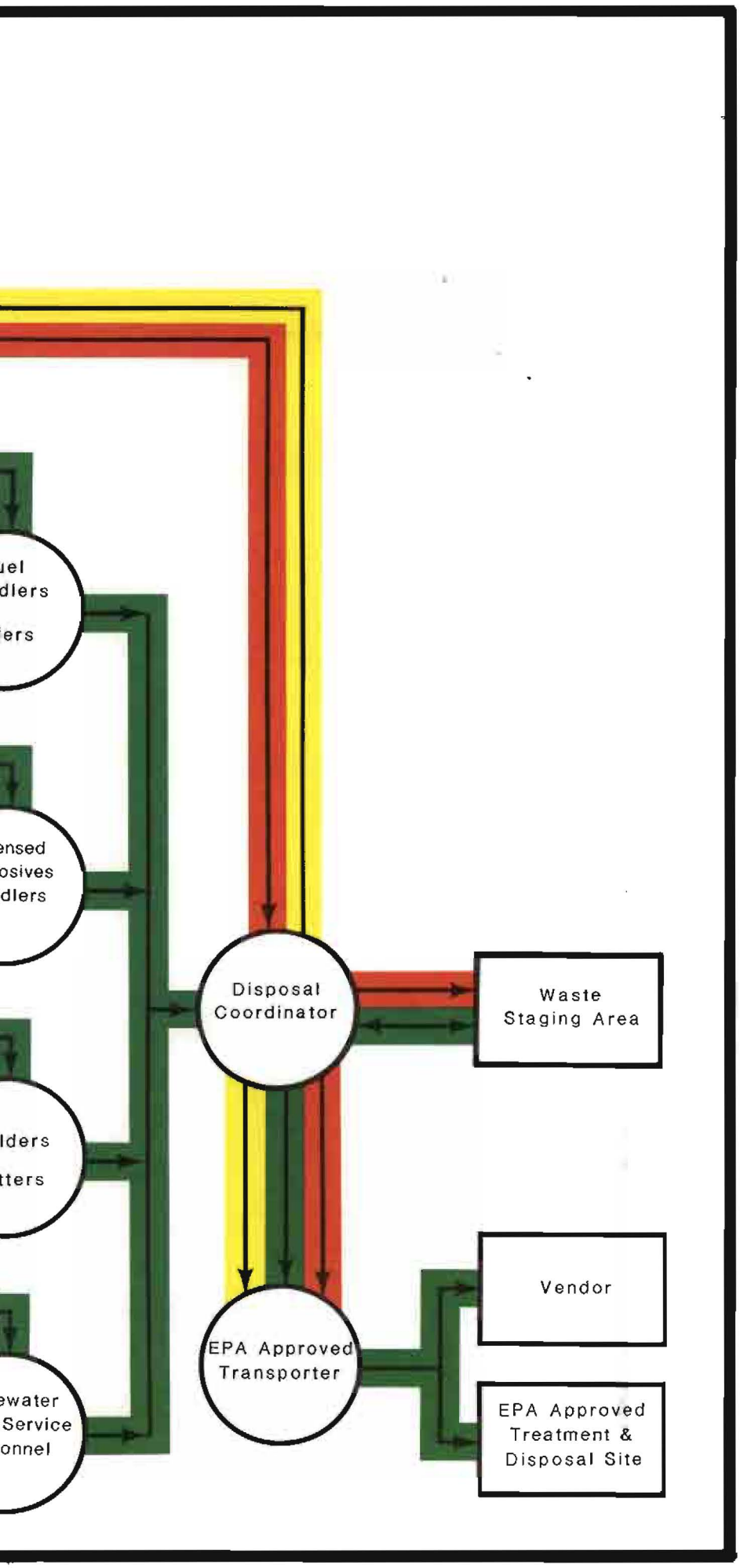
A third level of information involves the manufacturers' material safety data sheets (OSHA Form 20). Concise chemical and physical properties such as specific flammability, explosivity, chemical reactivity, or toxicity are reported. Also included are special protection or precautions required.

Figure 1 depicts an example of a product tracking and information system for a project whose hazardous wastes are transported offsite to an EPA-approved treatment or disposal site. The following sections discuss the functional relationships and components of the system and the three principal positions (for purposes of this example designated as "Materials Coordinator", "Issue/Return Coordinator[s]", and "Disposal Coordinator") responsible for implementation.

2.1.1 Procurement and Receipt (Figure 2)

Product tracking and information dissemination begins with a request for requisition of materials. These requisitions are reviewed by the Materials Coordinator, who is fully cognizant of applicable state and federal regulations governing hazardous materials, and who has access to product information provided from manufacturers or other sources. The requisitions are forwarded to the procurement office for purchasing and are accompanied by copies of product information data. Completed copies of purchasing documents along with the product information are sent to the receiving


Fuel & Hazardous Materials Requisitions
Project Manager Alaska Power Authority
Applicable Regulatory Agencies
Supplier
Project Safety Officer
Project Medic
Manufacturer
Procurement
Materials Coordinator
POL Facility
Issue/Return Coordinator
Explosives Magazine
Issue/Return Coordinator
Manufacturer/Transporter
Receiving
Compressed Gas Warehouse
Issue/Return Coordinator
Misc. Chemical Warehouses
Issue/Return Coordinator



MATERIAL

INVENTORY/RECORDS

PRODUCT
INFORMATION

COMMUNICATION

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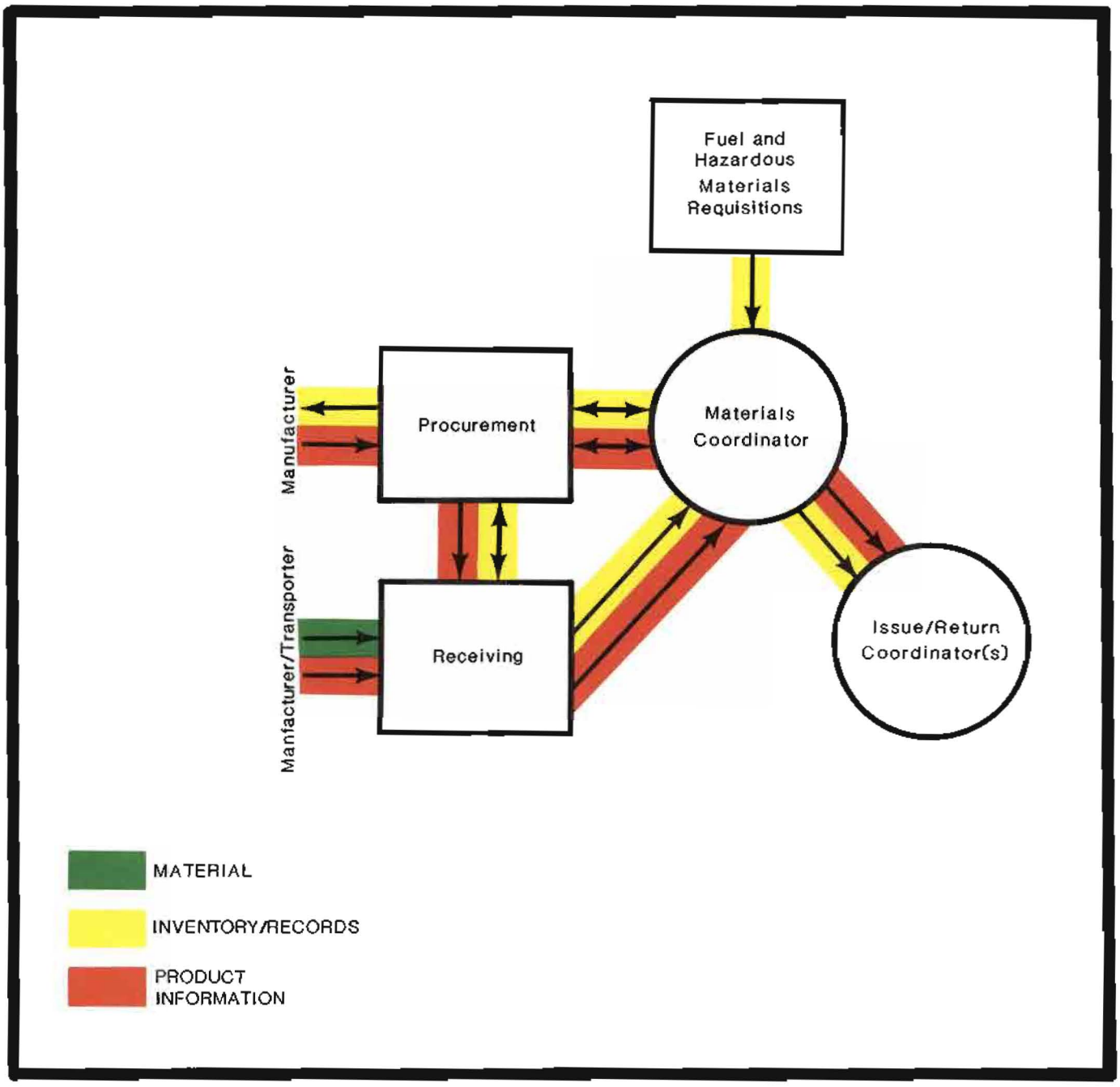
PRODUCT TRACKING & INFORMATION SYSTEM

FIGURE 1



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PROCUREMENT AND RECEIPT

FIGURE 2

office. Another copy of the purchasing document is sent to the Materials Coordinator who notifies the appropriate Issue/Return Coordinator(s) that the product(s) has been ordered and provides copies of product information.

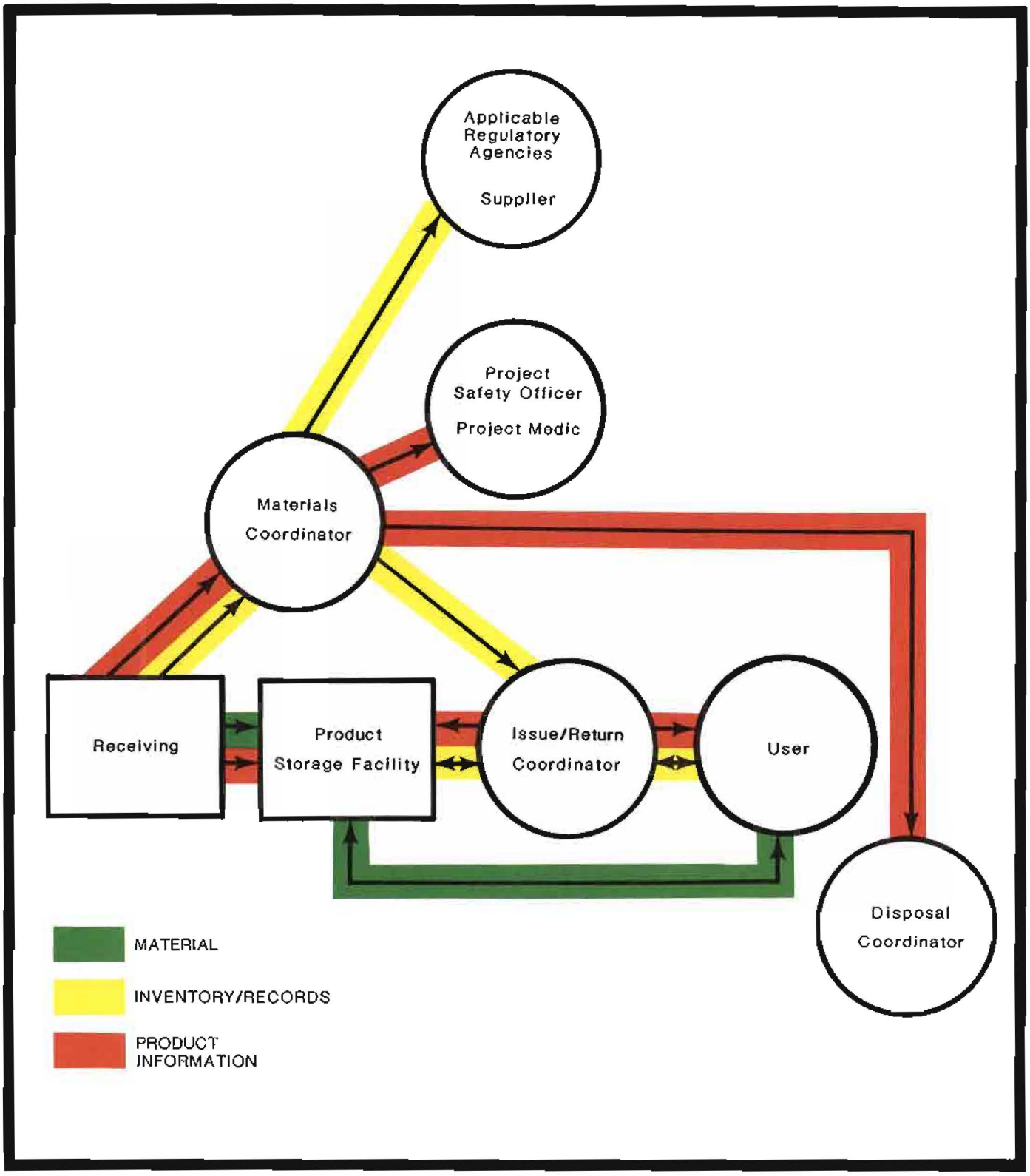
Fuel and hazardous materials arriving onsite at project receiving are checked for labels and must be accompanied by a manifest containing product information from the manufacturer. Incoming shipments are checked against the receiving office's copies of purchasing documents.

Copies of receipt documents are sent to the procurement office and the Materials Coordinator. A copy of the manifest accompanying the shipment is also forwarded to the Materials Coordinator.

2.1.2 Storage (Figure 3)

Once the material has been received onsite, the Materials Coordinator is responsible for distributing appropriate documentation to the product supplier, applicable regulatory agencies, and the Issue/Return Coordinator(s) in charge of recordkeeping at each product storage facility. The Materials Coordinator also sends product information data to the Disposal Coordinator, and to project safety and medical personnel.

The actual material, accompanied by a copy of the manifest, is delivered to the appropriate storage facility by the transporter where it is off-loaded and stored according to the instructions and warnings contained on the manifest, container labeling, and product information distributed at the time of purchasing.



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STORAGE

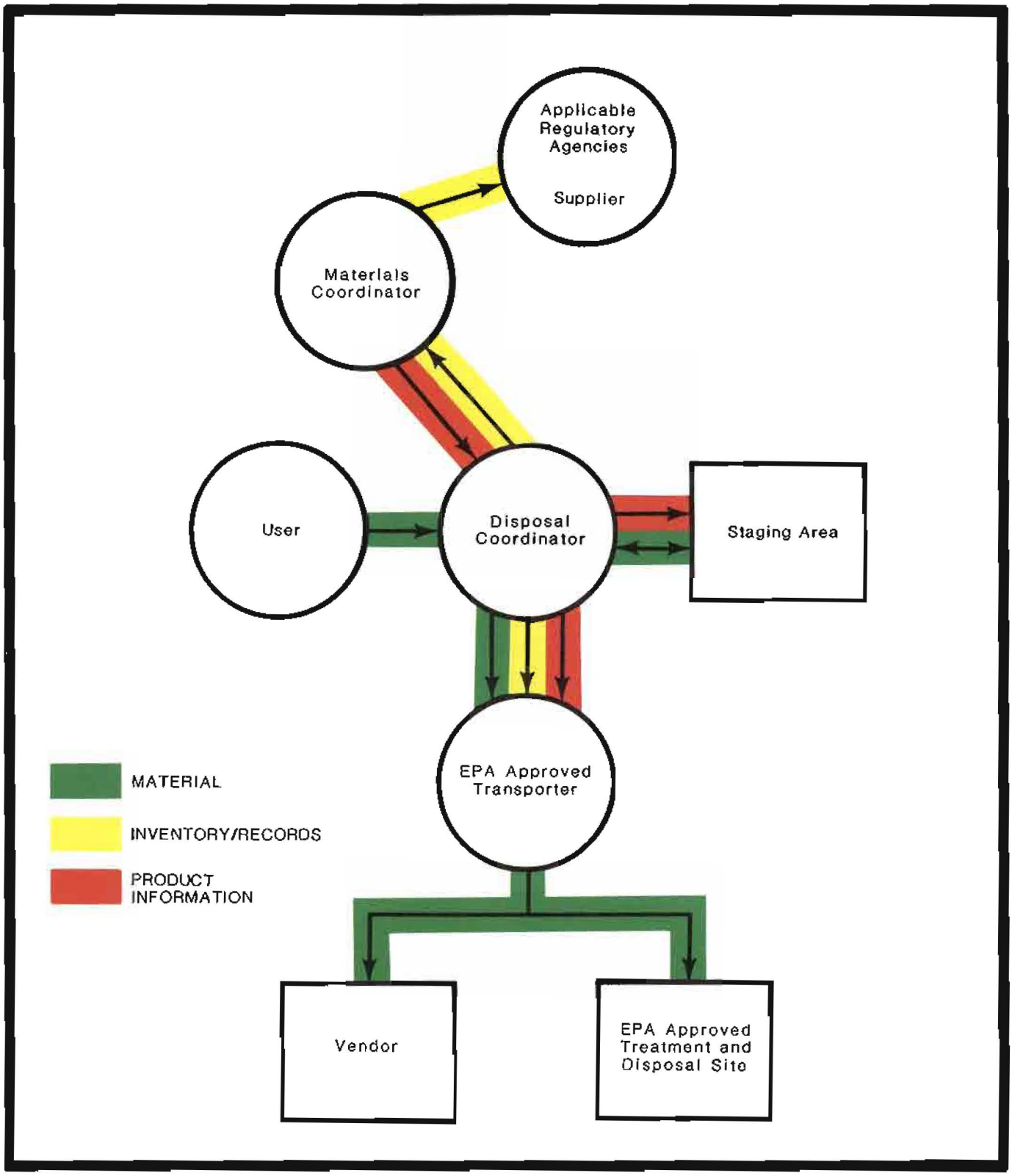
FIGURE 3

All requests from users for products stored at the site are documented through the Issue/Return Coordinator responsible for the product. This coordinator is also responsible for informing users of potential hazards associated with the product. Products returned to the storage facility (i.e. unused explosives to be returned to the magazine) are also documented through the Issue/Return Coordinator.

2.1.3 Disposal (Figure 4)

Wastes generated from project activities or defective products are delivered by the users to the Disposal Coordinator who documents their arrival at the waste staging area at each project site. Copies of records of incoming materials to the waste staging area are sent to the Materials Coordinator.

The Disposal Coordinator is responsible for identifying and segregating hazardous wastes from nonhazardous wastes in compliance with the RCRA regulations for hazardous waste determination (40 CFR 262.11), identification, and characterization (40 CFR 261). The Disposal Coordinator shall arrange for transport and disposal of hazardous wastes or defective products through an EPA-approved transporter to either the vendor of the defective product or an EPA-approved treatment and disposal site, as appropriate. Offsite shipments are packaged and labelled according to federal Department of Transportation regulations and are accompanied by an approved uniform manifest that is completed by the Disposal Coordinator (40 CFR 262, Subpart B; see 49 CFR 172, 173, 178 and 179). A copy of the manifest is sent to the Materials Coordinator who is responsible for fulfilling reporting requirements to applicable regulatory agencies and the



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DISPOSAL

FIGURE 4

original supplier of the material and for compliance with the ongoing RCRA recordkeeping and reporting requirements set out at 40 CFR 262, Subpart D.

2.2 PERSONNEL TRAINING AND SAFETY PROGRAM

Personnel assigned to handling hazardous materials or hazardous wastes must complete a training course to ensure that they are aware of hazardous materials management procedures and safety measures. Training for personnel handling or using hazardous materials must include at least the following elements (8 AAC 15):

- Methods and observations that may be used to detect the presence or release of a hazardous substance in the work area (monitoring programs, odors, etc.)
- Potential health hazards (definitions and product identification as presented on Material Safety Data Sheet or equivalent) in the work area
- Personal protection equipment
- Appropriate handling procedures
- Recordkeeping and inventory procedures
- Preventive maintenance

- Emergency procedures and equipment

- Explanations on how to obtain and use material safety information.

Training programs required for personnel handling hazardous wastes are detailed in the RCRA regulations at 40 CFR 265.16. The training program must comply with RCRA training requirements and should be designed to allow facility personnel to respond effectively to emergencies.

CHAPTER 3 - STORAGE OF HAZARDOUS MATERIALS

This chapter is directed principally at facility designers responsible for the design of hazardous materials storage areas. The guidelines presented are not intended to be all-inclusive and are based on codes and regulations current at the time of publication. Applicable federal, state, and local regulations must be determined and complied with on a case-by-case basis. Storage regulations for hazardous wastes are discussed in Chapter 4.

3.1 GENERAL STORAGE GUIDELINES

Storage facilities for hazardous materials must be designed to segregate materials which may react upon contact with one another. Minimum distances between storage areas and residential facilities, wells, public roads, property boundaries, and natural resource features (such as waterbodies) are specified for storage of many products. In addition, the facilities must be designed and constructed to protect the materials from wildlife intrusion, weather, and any other changes which could affect composition or sensitivity. Showers, eye-wash stations, and fire protection equipment should be incorporated into the design.

3.1.1 Above/Underground Bulk Fuel Storage

In general, above-ground storage of bulk liquids, particularly combustible liquids, must be in containers meeting certain specifications. Additionally, the bulk storage facility is generally required to have a containing berm constructed around it and to be of sufficient size to hold and retain

all of the contents of the largest on-site storage container. Underground storage of bulk liquids also requires tanks meeting certain specifications, as well as cathodic protection for metal tanks. Underground tanks exceeding a certain size must have monitoring devices to detect leakage. More specific guidelines for bulk fuel storage are presented in Section 3.2.

3.1.2 Explosives

Explosives are stored in either permanent or portable magazines that are designed for the types of explosives that may be stored in them. Specific guidelines for storage of explosives are contained in Section 3.3.

3.1.3 Indoor Storage of Flammable/Combustible Liquids

According to 29 CFR 1926/1910, the amount of flammable/combustible liquid that may be stored in a building depends upon the building's fire resistance rating and the presence or absence of an automatic fire extinguishing system. For instance, facilities of less than 150 square feet with a 1-hour fire resistance rating and an automatic fire extinguishing system may store up to 750 gallons. The same facility without an automatic fire extinguishing system is limited to a storage capacity of 300 gallons. Containers holding more than 30 gallons may not be stacked.

Ground floor storage is preferred for flammable/combustible liquids. At least one outside wall is required for connected flammable storage rooms. Other structural characteristics include the following:

- Blow-out panels (recommended)
- Impermeable wall and floor joints
- Self-closing fire doors
- At least one exterior door (preferred)
- A drain and diking system at least 4 inches high in front of all openings; drains must connect to a safe outside collection area
- Unobstructed 3-foot wide aisles
- Secure shelving and racks

Mechanical and electrical provisions to be included in the design of storage facilities for flammable/combustible liquids include the following:

- An alarm system
- Ventilation with at least a ten times per hour air turnover
- Exhausts from the floor, ceiling, and all possible dead-air spaces
- Flame arrestors in vents

- o Air intake directly from the outside within 1 foot of the floor level; with proper dampers, air may come from inside a connected building.

- o Temperature and humidity control

- o Adequate lighting; switches should be installed on the outside of the room or building.

- o Adequate grounding of all racks, scuppers and other conducting elements

3.1.4 Corrosives

Corrosives must be stored in a dry, cool, ventilated (at least 6 times per hour air turnover) area and must not be directly exposed to sunlight. Sprinkler systems should be installed. All corrosives must be stored in containers recommended by the manufacturer. Temperature and humidity control must be provided. Fans must be direct drive, non-sparking and corrosion resistant.

3.1.5 Reactive Chemicals

Reactive chemicals (including oxidizing and reduction agents, complexers, etc.) must be provided with storage space in a cool, dry, well-ventilated area away from direct sunlight. The storage area must be fireproof and protected from extreme and rapid temperature changes. As these materials

may be water-sensitive, it is advisable that no water service be provided to the building. The use of wood for shelving, flooring, etc. is not recommended since oxidizing and reactive chemicals may react with organic materials.

3.1.6 Compressed Gases

Cylinders used for the storage of fuel gas or oxygen should be stored in well-ventilated areas. If the area is used for other purposes, storage of gas is limited to 2000 cubic feet of acetylene or non-liquified flammable gas. The cylinders must be separated at least 20 feet from flammable and combustible materials. The storage area should be located where cylinders will not be knocked over or damaged by passing or falling objects. For outside storage, provisions must be made for ease of access and handling during all seasons and for protection against wildlife intrusion. Outside storage areas should be located well away from traffic lanes and be designed with an adequate cover which will withstand projected snow loads and winds.

3.2 PETROLEUM, OILS AND LUBRICANTS (POL)

Typical POL products that will be stored and used at Power Authority project sites are diesel oil, gasoline, aviation fuels, hydraulic fluids, anti-freeze, lubricants, solvents, and rust inhibitors. Most POL products are flammable in different degrees varying from explosive in nature to merely flammable (classifications of combustible and flammable liquids are shown on Table 1), are classified as caustics and irritants to human and

TABLE 1

CLASSIFICATIONS OF COMBUSTIBLE AND FLAMMABLE LIQUIDS

Combustible Liquid. A liquid having a flash point at or above 100°F (37.8°C).

Combustible liquids shall be subdivided as follows:

Class II liquids shall include those having flash points at or above 100°F (37.8°C) and below 140°F (60°C).

Class IIIA liquids shall include those having flash points at or above 140°F (60°C) and below 200°F (93.4°C).

Class IIIB liquids shall include those having flash points at or above 200°F (93.4°C).

Flammable Liquid. A liquid having a flash point below 100°F (37.8°C) and having a vapor pressure not exceeding 40 pounds per square inch (absolute) at 100°F (37.8°C) shall be know as a Class I liquid.

Class I liquids shall be subdivided as follows:

Class IA shall include those having flash points below 73°F (22.8°C) and having a boiling point below 100°F (37.8°C).

Class IB shall include those having flash points below 73°F (22.8°C) and having a boiling point at or above 100°F (37.8°C).

Class IC shall include those having flash points at or above 73°F (22.8°C) and below 100°F (37.8°C).

Source: National Fire Codes (NFPA 30)

animal flesh, and can be carcinogenic. All POL products are considered potential pollutants.

3.2.1 Storage Containers

The National Fire Protection Association standards (NFPA 395) are applicable to the storage of flammable and combustible liquids (i.e. POL products) at rural construction projects where it is customary to obtain fuels in bulk and dispense or transfer under control of the owner or contractor. (The standards do not apply to storage of 25 gallons or less of flammable and combustible liquids in containers not exceeding 5-gallon capacity, or to fuel oil tanks and containers connected with oil burning equipment as covered in NFPA 31.)

Individual containers constructed of metal or other materials approved by the U.S. Department of Transportation may be used to store 60 gallons or less of flammable and combustible liquids. These individual containers must not be interconnected. Drumruns, if stored horizontally, should not exceed two drums wide and three drums high with a minimum of 5 feet between runs. All drumruns should be placed on 4x4-foot dunnage and be chocked at both ends. Outside storage for containers of Class I flammable liquids must be at least 10 feet from any building and well away from traffic lanes; inside storage may be in a building used exclusively for storage of flammable and combustible liquids that is located at least 10 feet from any other building. Buildings used for storage of Class I flammable liquids must have at least two 64-square-inch vents placed at floor level for cross-ventilation.

Flammable and combustible liquids of 61 to 1,100 gallons may be stored outside of buildings in tanks constructed of at least 14-gauge steel. The tanks must be of single-compartment design. Joints must be riveted and caulked, riveted and welded, or welded. Tank heads over 6 feet in diameter must be dished, stayed, braced, or reinforced. Each tank must have a free opening vent of the following minimum nominal pipe size to relieve vacuum or pressure:

Tank Capacity (gallons)	Vent Diameter (inches)
up to 275	1½
276-660	2
661-900	2½
901-1100	3

These tanks and any transfer operation must then be at least 40 feet from any building and 100 feet from any well or water supply source. Stationary tanks must be mounted on timbers or blocks approximately 6 inches in height to protect the bottom of the tank from corrosion.

The largest quantities (perhaps exceeding 50,000 gallons at any one on-site facility) of POL products stored at Power Authority project sites will consist of diesel oil, gasoline, and aviation fuels. These bulk products will be stored in either double-walled steel tanks or hypalon bladders designed and constructed according to NFPA 30 standards. Above-ground tanks and bladders of the types most likely to be used to store these products must be located at least the minimum distances shown on Table 2 from property lines, public ways, and buildings, and at least 1,500 feet from waterbodies. In addition, each above-ground tank or bladder must be separated from another according to the minimum distances shown on Table 3.

TABLE 2

MINIMUM DISTANCES RELATIVE TO PROPERTY LINES, PUBLIC WAYS, BUILDINGS

Tank Capacity (gallons)	Minimum Distance (feet) from Property Line Which Is or Can Be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance (feet) from Nearest Side of Any Public Way or from Nearest Important Building on the Same Property
275 or less	10	5
276 to 750	20	5
751 to 12,000	30	5
12,001 to 30,000	40	5
30,001 to 50,000	60	10
50,001 to 100,000	100	15
100,001 to 500,000	160	25
500,001 to 1,000,000	200	35
1,000,001 to 2,000,000	270	45
2,000,001 to 3,000,000	330	55
3,000,001 or more	350	60

Source: National Fire Codes (NFPA 30)

TABLE 3

MINIMUM TANK SPACING (SHELL-TO-SHELL)

		Fixed Roof Tanks	
	Floating Roof Tanks	Class I or II Liquids	Class IIIA Liquids
All tanks not over 150 feet diameter	1/6 sum of adjacent tank diameters but not less than 3 feet	1/6 sum of adjacent tank diameters but not less than 3 feet	1/6 sum of adjacent tank diameters but not less than 3 feet
Tanks larger than 150 feet diameter			
Remote Impounding	1/6 sum of adjacent tank diameters	1/4 sum of adjacent tank diameters	1/6 sum of adjacent tank diameters
Impounding Around Tanks	1/4 sum of adjacent tank diameters	1/3 sum of adjacent tank diameters	1/4 sum of adjacent tank diameters

Source: National Fire Codes (NFPA 30)

3.2.2 Storage Area Design

POL storage areas should be built in accordance with American Society of Petroleum Engineers standards and must be contained to protect adjoining property or waterbodies from possible spills. The accepted practice for containment is an impermeable diked area around individual tanks/bladders or around a group of tanks/bladders. The volumetric capacity of a diked area around an individual tank/bladder must be at least 100 percent of the capacity of the tank plus sufficient freeboard to allow for precipitation (greatest amount of rainfall that may reasonably be expected to occur in a storm and/or seasonal snow accumulation with melt). The volumetric capacity of a diked area for a group of tanks/bladders must be at least 100 percent of the capacity of the largest tank/bladder plus freeboard for precipitation. A slope of at least 1 percent from a tank/bladder must be provided for at least 50 feet or to the dike base, whichever is less, to facilitate pumping of precipitation accumulations by either a sump pump or a below-grade, explosion-proof pumping system, as appropriate. The outside base of the dike at ground level must be no closer than 10 feet to any property line.

High-liquid-level alarms with audible and visual signal, high-level pump cutoff devices, a visual system for determining liquid levels, and other safety devices must be provided. Bladder storage areas must be fenced. Lighting should be provided for POL facilities used as project service stations during periods of darkness. Storage facilities must be protected against electrical spark or static discharge and, when practical, should also be fitted with lightning arrestors. Fire protection measures should

include alarm systems, halon systems (where practical), and non-freezing extinguishers readily available for Class A, B and C fires.

Transfer stations must be sized to accommodate the numbers of project vehicles and construction equipment for each specific project. All dispensing facilities must include anti-static devices and bonding wire to facilitate proper grounding. For those sites where petroleum products are delivered by marine tank vessels with a capacity of 10,500 gallons or more, the equipment requirements administered by the U.S. Coast Guard (33 CFR 154) must be incorporated into the design.

3.3 EXPLOSIVES

Explosives likely to be required for power projects include, but are not limited to:

Dynamite and other high explosives	Detonating cord
Pellet powder	Igniter cord
Initiating explosives	Igniters
Detonators	Primers
Fuses	Smokeless propellants
Cartridges for propellant activated power devices	Squibs

Explosives are classified according to the degree of hazard they present. Class A explosives present a detonating or otherwise maximum hazard and include such substances as dynamite, nitroglycerin, picric acid, lead

oxide, fulminate of mercury, blasting caps, and detonating primers. Class B explosives, such as propellants, present a flammable hazard. Class C explosives, which present a minimum hazard, include certain types of manufactured articles containing Class A or Class B explosives, or both, as components, but in restricted quantities. The final classification, oxidizing material, is a substance that yields oxygen readily to stimulate the combustion of organic matter.

3.3.1 Storage of Explosives and Blasting Agents

Explosives are stored in either permanent or portable magazines that are designed for the types of explosives that may be stored in them. Magazine classifications are as follows:

Type 1 Magazine--A permanent magazine for the storage of explosive materials that are bullet sensitive such as dynamite and detonators which will mass explode.

Type 2 Magazine--A portable or mobile magazine for outdoor or indoor storage of explosive materials that are bullet sensitive such as dynamite and detonators which will mass explode.

Type 3 Magazine--A portable magazine for the temporary storage of explosive materials while attended. An example is a "day box" at the site of blasting operations.

Type 4 Magazine--A permanent, portable, or mobile magazine for the storage of low explosives, explosive materials that are not bullet sensitive, or explosive materials that will not mass explode.

Type 5 Magazine--A permanent, portable or mobile magazine for the storage of explosive materials that are not bullet sensitive. Type 5 magazines include tanks, tank trailers, tank trucks, semi-trailers, bulk trailers, bulk trucks and bins.

Ammonium nitrate, which is a common blasting agent, should not be accepted for storage when the temperature of the product exceeds 130°F. If stored indoors, ammonium nitrate should be stored in a separate building or be separated by approved firewalls of not less than 1-hour fire-resistance rating from organic chemicals, acids, other corrosive materials, materials that may require blasting, compressed flammable gases, and flammable and combustible materials. Sulphur and finely divided materials should not be stored in the same building with ammonium nitrate.

Unless constructed of non-combustible material or unless adequate facilities for fighting a roof fire are available, bulk storage structures for ammonium nitrate should not be over one story in height. Not more than 2,500 tons of bagged ammonium nitrate should be stored in a structure not equipped with an automatic sprinkler system. Bags of ammonium nitrate should not be stored within 30 inches of building walls and partitions. The height of the piles should not exceed 20 feet and no closer than 36 inches below the roof or overhead supporting and spreader beams. The width of the piles should not exceed 20 feet. Unless the building is of non-

combustible construction or protected by automatic sprinklers, piles should not exceed 50 feet in length. Aisles, at least 3 feet wide, should separate piles and at least one 4-foot wide service or main aisle should be provided.

Due to the corrosive and reactive properties of ammonium nitrate, bins used to store the product should not be constructed of galvanized iron, copper, lead, or zinc. Aluminum bins and wooden bins protected against impregnation by ammonium nitrate are permissible. Piles or bins should be sized and arranged so that material is moved out periodically to minimize possible caking.

3.3.2 Magazine Construction Guidelines

Magazines must be located prescribed distances from inhabited buildings, passenger railways, public highways, and other magazines. Distances for all explosives are listed on Table 4.

Tables 5 through 11 summarize construction and housekeeping guidelines for magazines. Table 5 lists those requirements that are common to all types of magazines. Table 6 lists the minimum construction alternatives for magazines that will store bullet-sensitive materials (Types 1, 2 [outdoor], 3). Restrictions specific to each of the five types of magazines are shown on Tables 7 through 11.

TABLE 4

DISTANCE FOR STORAGE OF EXPLOSIVE MATERIALS

Explosives		Distance in feet when storage is barricaded[1]			
Pounds over	Pounds not over	Inhabited buildings	Passenger railways	Public highways	Separation of magazines
2	5	70	30	30	6
5	10	90	35	35	8
10	20	110	45	45	10
20	30	125	50	50	11
30	40	140	55	55	12
40	50	150	60	60	14
50	75	170	70	70	15
75	100	190	75	75	16
100	125	200	80	80	18
125	150	215	85	85	19
150	200	235	95	95	21
200	250	255	105	105	23
250	300	270	110	110	24
300	400	295	120	120	27
400	500	320	130	130	29
500	600	340	135	135	31
600	700	355	145	145	32
700	800	375	150	150	33
800	900	390	155	155	35
900	1,000	400	160	160	36
1,000	1,200	425	170	165	39
1,200	1,400	450	180	170	41
1,400	1,600	470	190	175	43
1,600	1,800	490	195	180	44
1,800	2,000	505	205	185	45
2,000	2,500	545	220	190	49
2,500	3,000	580	235	195	52
3,000	4,000	635	255	210	58
4,000	5,000	685	275	225	61
5,000	6,000	730	295	235	65
6,000	7,000	770	310	245	68
7,000	8,000	800	320	250	72
8,000	9,000	835	335	255	75
9,000	10,000	865	345	260	78
10,000	12,000	875	370	270	82
12,000	14,000	885	390	275	87
14,000	16,000	900	405	280	90
16,000	18,000	940	420	285	94
18,000	20,000	975	435	290	98
20,000	25,000	1,055	470	315	105
25,000	30,000	1,130	500	340	112
30,000	35,000	1,205	525	360	119
35,000	40,000	1,275	550	380	124
40,000	45,000	1,340	570	400	129
45,000	50,000	1,400	590	420	135
50,000	55,000	1,460	610	440	140
55,000	60,000	1,515	630	455	145
60,000	65,000	1,565	645	470	150
65,000	70,000	1,610	660	485	155
70,000	75,000	1,655	675	500	160
75,000	80,000	1,695	690	510	165
80,000	85,000	1,730	705	520	170
85,000	90,000	1,760	720	530	175
90,000	95,000	1,790	730	540	180
95,000	100,000	1,815	745	545	185
100,000	110,000	1,835	770	550	195
110,000	120,000	1,855	790	555	205
120,000	130,000	1,875	810	560	215
130,000	140,000	1,890	835	565	225
140,000	150,000	1,900	850	570	235
150,000	160,000	1,935	870	580	245
160,000	170,000	1,965	890	590	255
170,000	180,000	1,990	905	600	265
180,000	190,000	2,010	920	605	275
190,000	200,000	2,030	935	610	285
200,000	210,000	2,055	955	620	295
210,000	230,000	2,100	980	635	315
230,000	250,000	2,155	1,010	650	335
250,000	275,000	2,215	1,040	670	360
275,000	300,000	2,275	1,075	690	385

[1] When storage is not barricaded, distances must be doubled.

Source: Alaska Occupational Safety and Health Standards, Subchapter 09.

TABLE 5

CONSTRUCTION REQUIREMENTS COMMON TO
ALL TYPES OF MAGAZINES

ITEM	REQUIREMENT
Hinges and Hasps	Shall be attached to doors by welding, or riveting, or bolting (nuts on inside of door).
Locks	Each door shall be equipped with 2 mortise locks, or 2 padlocks fastened in separate hasps and staples, or a combination of a mortise lock and a padlock, or a mortise lock requiring 2 keys to open, or a three-point lock. Locks shall be five-tumbler proof. Padlocks shall be protected with ¼" steel caps constructed to prevent sawing or lever action on locks or hasps. NOTE: Outdoor-mobile storage facilities with one steel, case-hardened, five-tumbler padlock, having at least a 7/16" shackle diameter, have been determined to meet necessary requirements.
Lighting	In general, battery-activated safety lights or lanterns should be used for magazine types 1, 2, 3 or 4. Electrical illumination may be used when explosive-proof fixtures and wiring in rigid conduit are used inside and all electric switches are located outside the magazine.
Heating	Magazines requiring heat shall be heated by either hot water radiant heating connection within the magazine building or air directed into the magazine building over either hot water or low pressure steam (15 psig or less) coils located outside the magazine building. Radiant heating coils within buildings shall be installed so that the explosive materials or their containers cannot contact the coils and air is free to circulate between the coils and the explosive materials or their containers. Hot air discharged from heating ducts must not be directed against the explosive materials or their containers. The heating device shall have controls which prevent the ambient building temperature from exceed 120°F. Electric fans or pumps shall be mounted outside and separate from the wall of the magazine and shall be grounded. Electric fan motors and controls for electrical heating devices shall have overloads and disconnects. All electrical switching devices shall be located outside and separate from the walls of the magazine and shall be grounded. The heating source for water or steam shall be separated from the magazine by a distance of at least 25 feet when electrical and 50 feet when fuel-fired. The area between the heating unit and the magazine shall be kept clear of all combustible materials.

Source: 27 CFR 181

TABLE 6

ALTERNATIVE MINIMUM
SPECIFICATIONS FOR BULLET-RESISTANT MAGAZINES[1)]

- Exterior of 5/8-inch steel lined on the interior with any type non-sparking material.
- Exterior of 1/2-inch steel lined on the interior with not less than 3/8-inch plywood.
- Exterior of 3/8-inch steel lined on the interior with 2 inches of hardwood.
- Exterior of 3/8-inch steel lined on the interior with 3 inches of softwood or 2 1/4 inches of plywood.
- Exterior of 1/4-inch steel lined on the interior with 3 inches of hardwood.
- Exterior of 1/4-inch steel lined on the interior with 5 inches of softwood or 5¼ inches of plywood.
- Exterior of 1/4-inch steel lined with an intermediate layer of 2 inches of hardwood and an interior lining of 1 1/2 inches of plywwod.
- Exterior of 3/16-inch steel with an interior lining of 4 inches of hardwood.
- Exterior of 3/16-inch steel with an interior lining of 7 inches of softwood or 6 3/4 inches of plywood.
- Exterior of 3/16-inch steel with an intermediate layer of 3 inches of hardwood with an interior lining of 3/4 inch of plywood.
- Exterior of 1/8-inch steel with an interior lining of 5 inches of hardwood.
- Exterior of 1/8-inch steel with an interior lining of 9 inches of softwood.
- Exterior of 1/8-inch steel with an intermediate layer of 4 inches of hardwood and an interior lining of 3/4 inches of softwood.
- An exterior of any type of fire-resistant material which is structurally sound with an intermediate layer of 4 inches solid concrete block or 4 inches solid brick or four inches of solid concrete and an interior lining of 1/2-inch plywood placed securely against the masonry lining.
- Standard 8-inch concrete block with voids filled with well-tamped dry sand or well-tamped sand/cement mixture.
- Standard 8-inch solid brick.
- An exterior of any type of fire resistant material which is structurally sound with an intermediate 6-inch space filled with well-tamped dry sand or well-tamped sand/cement mixture.
- An exterior of 1/8-inch steel with a first intermediate layer of 3/4-inch plywood, a second intermediate layer of 3 5/8 inches well-tamped dry sand or sand/cement mixture and an interior lining of 3/4-inch plywood.
- An exterior of any type of fire-resistant material with a first intermediate layer of 3/4-inch plywood, a second intermediate layer of 3 5/8-inch well-tamped dry sand or sand/cement mixture, a third intermediate layer of 3/4-inch plywood, a fourth intermediate layer of 2 inches of hardwood or 14-gauge steel and an interior lining of 3/4-inch plywood.
- 8-inch thick solid concrete.

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1) All steel and wood dimensions are actual thicknesses. All concrete block and brick dimensions are nominal thickness.

Source: 27 CFR 181

TABLE 7

TYPE 1 STORAGE REQUIREMENTS

ITEM	REQUIREMENTS
Walls	See Table 5
Foundations	Shall be constructed of brick, or concrete, or cement block, or stone or wood posts. (If piers or posts are used, space under buildings shall be enclosed with metal.)
Floors	Shall be constructed of nonsparking material. Shall be strong enough to bear weight of maximum quantity to be stored.
Roof	Outer roof (except fabricated metal roofs) shall be covered with either 26-gauge iron fastened to 7/8" sheathing, or 26-gauge aluminum fastened to 7/8" sheathing. Where possible for a bullet to be fired directly through roof and into storage facility, magazine shall be protected by either a sand tray, filled with not less than 4" of coarse dry sand, covering the entire ceiling area, except that necessary for ventilation, or fabricated metal roof construction of 3/16" plate steel, lined with 4" hardwood (for each additional 1/16" of plate steel, hardwood may be decreased 1").
Doors	Shall be constructed of 1/4" steel. Shall be lined with 2" of hardwood.
Hinges, Hasps, and Locks	See Table 5
Interior	Shall be constructed of or covered with a nonsparking material. No sparking metal construction shall be exposed below top of walls in interior. All nails shall be blind-nailed or countersunk.
Ventilation	2" air space shall be left around ceiling and perimeter of floors, except at doorways. Foundation ventilators shall be not less than 4"x 6". Vents in foundation, roof, or gables shall be screeded and offset.
Ground	Ground around storage facility shall slope away for drainage.
Igloos, Army-type Structures, Tunnels and Dugouts	Shall be constructed of reinforced concrete, masonry, metal, or a combination of these materials. Shall have an earthmount covering of not less than 24" on the top, sides and rear. Interior walls and floors shall be covered with a nonsparking material. Floor, door, lock, ventilation, exposed metal, and lighting requirements are as stated above.
Lighting	See Table 5
Heating	See Table 5

Source: 27 CFR 181

TABLE 8

TYPE 2 STORAGE REQUIREMENTS

ITEM	REQUIREMENTS
Hinges, Hasps and Locks	See Table 5
Lighting	See Table 5
Heating	See Table 5
	RESTRICTIONS ON TYPE 2 OUTDOOR STORAGE FACILITIES
Size	Shall be at least 1 cubic yard in size
Ground	Outdoor storage facilities shall be supported in such a manner so as to prevent direct contact with the ground. Ground around storage facility shall slope away for drainage.
Construction	Sides, bottoms, tops, and covers or doors shall be constructed of ¼-inch steel and lined with 2-inches of hardwood.
Unattended Storage	Unattended vehicular storage facilities shall have wheels removed or shall be immobilized by kingpin locking devices.
	RESTRICTIONS ON TYPE 2 INDOOR STORAGE FACILITIES
Location	No indoor storage facility for storage of high explosives shall be located in a residence or dwelling. Storage facilities located in a warehouse, or wholesale or retail establishment, shall be provided with substantial wheels or casters to facilitate removal therefrom. No more than two indoor storage facilities shall be located in any one building. Two storage facilities may be kept in the same building only when one is used for storage of blasting caps and the other for storage of other high explosives. Each storage facility shall be located on the floor nearest ground level and within 10 feet of an outside exit. Indoor storage facilities within one building shall be separated by a distance of not less than 10 feet.
Quantity Restrictions	No indoor storage facility shall contain a quantity of high explosive in excess of 50 pounds or more than 5,000 blasting caps.
Walls	Shall be of either Wood (Shall have sides, bottoms, and covers or doors constructed of 2" hardwood and shall be well braced at corners. They shall be covered with sheet metal (not less than 20 gauge). Exposed nails shall be countersunk), or Metal (Shall have sides, bottoms, and covers or doors constructed of 12-gauge metal and shall be lined inside with a nonsparking material. Edges of metal shall overlap sides at least 1").
	CAP BOXES
	Storage facilities for blasting caps in quantities of 100 or less shall have sides, bottoms, and covers constructed of 12-gauge metal, with hinges and hasps attached by welding. One five-tumbler proof lock shall be sufficient for locking purposes.

Source: 27 CFR 181

TABLE 9

TYPE 3 STORAGE REQUIREMENTS

ITEM	REQUIREMENTS
Construction	Doors or covers, sides, bottoms, and tops shall be constructed of 1/4-inch steel and lined with 2-inch hardwood.
Hinges, Hasps and Locks	See Table 5
Ground	Ground around storage facility shall slope away for drainage.
Unattended Storage	No explosive materials shall be left in storage facility if unattended. Explosive materials must be removed to types 1 or 2 storage facilities for unattended storage.
Lighting	See Table 5

Source: 27 CFR 181

TABLE 10

TYPE 4 STORAGE REQUIREMENTS

ITEM	REQUIREMENTS
Walls	Shall be of either masonry, or metal-covered wood, or fabricated metal, or combinations of these materials.
Doors or Covers	Shall be constructed of either metal or solid wood covered with metal.
Foundations	Shall be constructed of either brick, or concrete, or cement block, or stone or wood posts. (If piers or posts are used, space under buildings shall be enclosed with metal.)
Interior	Shall be lined with nonsparking material. No sparking metal construction shall be exposed below top of walls in interior. All nails shall be blind-nailed or countersunk.
Hinges, Hasps and Locks	See Table 5
Lighting	See Table 5
Heating	See Table 5
	RESTRICTIONS ON TYPE 4 OUTDOOR STORAGE FACILITIES
Ground	Ground around storage facility shall slope away for drainage.
Unattended Storage	Unattended vehicular storage facilities shall have wheels removed or shall be immobilized by kingpin locking devices.
	RESTRICTIONS ON TYPE 4 INDOOR STORAGE FACILITIES
Location	No indoor facility for the storage of low explosives shall be located in a residence or dwelling. Storage facilities located in a warehouse, or wholesale or retail establishment, shall be provided with substantial wheels or casters to facilitate removal therefrom. No more than one indoor storage facility shall be kept in any one building. Storage facility shall be located on floor nearest ground level and within 10 feet of an outside exit.
Quantity Restrictions	No indoor facility shall contain a quantity of low explosives in excess of 50 pounds.

Source: 27 CFR 181

TABLE 11

TYPE 5 STORAGE REQUIREMENTS

ITEM	REQUIREMENTS
Doors or Covers	Shall be constructed of either solid wood, or metal.
Hinges, Hasps, and Locks	See Table 5
Heating	See Table 5
RESTRICTIONS ON TYPE 5 OUTDOOR STORAGE FACILITIES	
Ground	Ground around storage facility shall slope away for drainage.
Unattended Storage	Unattended vehicular storage facilities shall have wheels removed or shall be immobilized by kingpin locking devices.
RESTRICTIONS ON TYPE 5 INDOOR STORAGE FACILITIES	
Location	No indoor storage facility for storing of blasting agents shall be located in a residence or dwelling.

Source: 27 CFR 181

3.3.3 Mixing Facilities for Blasting Agents and Water Gels

Buildings or other facilities used for mixing blasting agents and water gels should be located, with respect to inhabitated buildings, passenger railroads and public highways, in accordance with the distances shown on Table 4. In addition, the mixing facility should be separated from permanent explosive storage facilities in accordance with the distances shown on Table 12.

Buildings used for mixing blasting agents and water gels should conform to the following requirements:

- Buildings shall be of either non-combustible construction or of sheet metal on wood studs.

- Floors in a mixing plant shall be concrete or other non-absorbent material. Floors should be constructed to eliminate open floor drains and piping into which molten materials could flow and be confined in case of fire.

- All fuel oil storage facilities shall be separated from the mixing plant and be placed so that, in case of tank rupture, the oil will drain away from the mixing plant building.

- The building shall be well ventilated.

- Heating units which do not depend on a combustion process, when

TABLE I2

RECOMMENDED SEPARATION DISTANCES OF AMMONIUM NITRATE AND BLASTING AGENTS[1,6] FROM EXPLOSIVES OR BLASTING AGENTS

Donor Weight		Minimum separation distance of receptor when barricaded (ft.)[2]		Minimum Thickness of artificial barricade (in.)[5]
Pounds over	Pounds not over	Ammonium nitrate[3]	Blasting agent[4]	
	100	3	11	12
100	300	4	14	12
300	600	5	18	12
600	1,000	6	22	12
1,000	1,600	7	25	12
1,600	2,000	8	29	12
2,000	3,000	9	32	15
3,000	4,000	10	36	15
4,000	6,000	11	40	15
6,000	8,000	12	43	20
8,000	10,000	13	47	20
10,000	12,000	14	50	20
12,000	16,000	15	54	25
16,000	20,000	16	58	25
20,000	25,000	18	65	25
25,000	30,000	19	68	30
30,000	35,000	20	72	30
35,000	40,000	21	76	30
40,000	45,000	22	79	35
45,000	50,000	23	83	35
50,000	55,000	24	86	35
55,000	60,000	25	90	35
60,000	70,000	26	94	40
70,000	80,000	28	101	40
80,000	90,000	30	108	40
90,000	100,000	32	115	40
100,000	120,000	34	122	50
120,000	140,000	37	133	50
140,000	160,000	40	144	50
160,000	180,000	44	158	50
180,000	200,000	48	173	50
200,000	220,000	52	187	60
220,000	250,000	56	202	60
250,000	275,000	60	216	60
275,000	300,000	64	230	60

1) Nearby stores of high explosives or blasting agents are "donors". Ammonium nitrate, by itself, is not considered to be a donor when applying this table. Ammonium nitrate, ammonium nitrate-fuel oil or combination thereof are acceptors. If stores of ammonium nitrate are located within the sympathetic detonation distance of explosives or blasting agents, one-half the mass of the ammonium nitrate should be included in the mass of the donor.

2) When the ammonium nitrate and/or blasting agent is not barricaded, the distances shown in the table shall be multiplied by six. These distances allow for the possibility of high velocity metal fragments from mixers, hoppers, truck bodies, sheet metal structures, metal containers, and the like which may enclose the "donor". Where storage is in bullet-resistant magazines recommended for explosives or where the storage is protected by a bullet-resistant wall, distances and barricade thicknesses in excess of those prescribed in Table 4 are not required.

3) The distances in the table apply to ammonium nitrate that passes the insensitivity test prescribed in the definition of ammonium nitrate fertilizer promulgated by the National Plant Food Institute; and ammonium nitrate failing to pass said test shall be stored at separation distances determined by competent persons and approved by the authority having jurisdiction.

4) These distances apply to nitro-carbo-nitrates and blasting agents which pass the insensitivity test prescribed in the U.S. Department of Transportation (DOT) regulations.

5) Earth, or sand dikes, or enclosures filled with the prescribed minimum thickness of earth or sand are acceptable artificial barricades. Natural barricades, such as hills or timber of sufficient density that the surrounding exposures which require protection cannot be seen from the "donor" when the trees are bare of leaves are also acceptable.

6) When the ammonium nitrate must be counted in determing the distances to be maintained from inhabited buildings, passenger railways and public highways, it may be counted at ½ times its actual weight because its blast effect is lower.

Source: Alaska Occupational Safety and Health Standards, Subchapter 09.

properly designed and located, may be used in the same building.

- All direct sources of heat shall be provided exclusively from units located outside the mixing building. All internal-combustion engines used for electric power generation shall be located outside the mixing plant building, or shall be properly ventilated and isolated by a firewall. The exhaust systems on all such engines shall be located so any spark emission will not be a hazard to any materials in or adjacent to the plant.

3.3.3.1 Mixing Equipment for Blasting Agents

The design of the mixer should minimize the possibility of frictional heating, compaction, and confinement. All bearings and drive assemblies should be mounted outside the mixer and protected against the accumulation of dust. All surfaces should be accessible for cleaning.

Mixing and packaging equipment should be constructed of materials compatible with the fuel, ammonium nitrate, or mixed composition.

Suitable means should be provided to prevent the flow of fuel oil to the mixer in case of fire. In gravity flow systems, an automatic spring-loaded shutoff valve with fusible line should be installed.

All electrical switches, controls, motors, and lights located in the mixing room should conform to the requirements in the National Electrical Code for Class II, Division 2 locations; otherwise they should be located outside

the mixing room, The frame of the mixer and other equipment that may be used should be electrically bonded and be provided with a continuous path to the ground.

3.3.3.2 Mixing Equipment for Water Gels

The design of the processing equipment, including mixing and conveying equipment, should be compatible with the relative sensitivity of the materials being handled. Equipment should be designed to minimize the possibility of frictional heating, compaction, overloading, and confinement.

Both equipment and handling procedures should be designed to prevent the introduction of foreign objects or materials.

Mixers, pumps, valves and related equipment should be designed to permit frequent flushing, cleaning, dismantling and inspection.

All electrical equipment including wiring, switches, controls, motors and lights, should conform to the requirements of the National Electrical Code for Class II, Division 2 locations. All electric motors and generators should be provided with suitable overload protection devices. Electrical generators, motors, proportioning devices, and all other electrical enclosures should be electrically bonded. The grounding conductor to all such electrical equipment should be effectively bonded to the service-entrance ground connection and to all equipment ground connections in a manner so as to provide a continuous path to ground.

CHAPTER 4 - HAZARDOUS WASTES

RCRA applies to the management of hazardous wastes on Power Authority projects. Hazardous wastes, as defined in the RCRA regulation, will not be treated or disposed of at Power Authority project sites. Hazardous wastes will be identified by the Disposal Coordinator as described in Chapter 2, segregated from non-hazardous wastes, and transported offsite by a licensed transporter to an EPA-permitted hazardous waste treatment, storage and disposal site.

Prior to transport, hazardous wastes may be accumulated (i.e. stored) onsite for 90 days or less without obtaining a permit from EPA, provided that the generator (i.e. those who produce hazardous waste) complies with the RCRA regulations applicable to short-term storage (40 CFR 262.34). Generators who accumulate waste for greater than 90 days are subject to EPA permitting requirements and additional regulations applicable to hazardous waste facility operators (40 CFR 264 and 265). The Power Authority intends that all hazardous wastes generated from a project will be transported offsite within 90 days.

It is important to note, however, that RCRA also imposes comprehensive and detailed requirements on generators who store hazardous wastes onsite for 90 days or less (see 40 CFR 262). The RCRA generator regulations at 40 CFR 262 require generators to conduct hazardous waste determinations (see Chapter 2), obtain EPA identification numbers, and comply with manifesting, pre-transport, recordkeeping and reporting requirements. Additionally, on-site storage for 90 days or less must be in accordance with RCRA container management and inspection (40 CFR 265, Subpart I), tank storage (40 CFR 265, Subpart J), preparedness and

prevention (40 CFR 265, Subpart C), contingency planning and emergency procedures (40 CFR 265, Subpart D), and personnel training requirements.

This manual is not intended to serve as field guidance on hazardous waste management. The foregoing is a brief overview of some of the regulations applicable to hazardous waste identification, treatment, storage, and disposal. The RCRA regulations and state law (see 18 AAC 60) applicable to hazardous waste management must be consulted and complied with on each project.

Applicable regulatory authorities should also be consulted during the pre-design phase of a project to assist in identifying types and quantities of hazardous wastes that may be generated by the project, appropriate handling and storage practices, and applicable regulatory requirements. Inadequate initial planning and piecemeal staging facilities design efforts negate the goals of effective management of hazardous materials which are to meet statutory obligations and minimize potential risk to human health and the environment.

CHAPTER 5 - REGULATORY AUTHORITIES

Hazardous materials and hazardous wastes are identified and regulated by numerous state and federal agencies because of their potential to adversely impact health and the environment. Some of the principal regulatory authorities and agencies are listed below.

U.S. Environmental Protection Agency

40 CFR 116 - designation of hazardous substances

40 CFR 260-270 - hazardous waste regulations

40 CFR 112 - oil pollution prevention

40 CFR 110 - discharges of oil into waters

U.S. Bureau of Alcohol, Tobacco and Firearms

27 CFR 181 - explosive materials

U.S. Occupational Safety and Health Administration

29 CFR 1926 - occupational safety and health standards

29 CFR 1910 - hazardous materials

U.S. Department of Transportation

49 CFR 107-179 - hazardous materials program procedures, requirements for shipments and packagings, transport, container specifications

U.S. Coast Guard

33 CFR 153-156 - oil pollution prevention for marine oil transfer facilities

33 CFR 126 - handling of explosives or other dangerous cargoes within or contiguous to waterfront facilities

Alaska Department of Environmental Conservation

18 AAC 60 - solid waste management

18 AAC 75 - spill containment and countermeasure plans

Alaska Department of Labor

8 AAC 6 - general safety code, petroleum, explosives, occupational health and environmental control, toxic and hazardous substances

Alaska Department of Public Safety

13 AAC 50 - codes and standards