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POSTHARVEST INSTITUTE FOR PERISHABLES

NIS Potato Storage Project

in

Russia and Ukraine

April, 1993

 University of Idaho
College of Agriculture

**NIS Potato Storage Project
In
Russia and Ukraine**

Trip Report:

**Project Organization
Potato Storage Monitoring**

Prepared by:

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Rick Jackson, Global Steel
Bob McGee, Postharvest Potato Specialist**

**Under USAID Grant No: CCS-0006-00-2028-00
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For:

USAID/NIS Task Force Office

Submitted by:

**The Postharvest Institute for Perishables
University of Idaho
Moscow, Idaho**

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List of Acronyms/Abbreviations

AKKOR	Russian Association of Farmers Enterprises and Agricultural Cooperative Societies
C	Centigrade
cm	Centimeter
cwt	Hundredweight
F	Fahrenheit
ft	Feet
ha	Hectare
hr	Hour
in	Inch
kg	Kilogram
km	Kilometer
lb	Pound
m	Meter
min	Minute
mt	Metric Ton
NIS	New Independent States
Pa	Pascal (International System of Units) (SI)
PC	Peace Corps
PIP	Postharvest Institute for Perishables
RH	Relative Humidity
RPC	Russian Potatoes Concern
UI	University of Idaho
UIPR	Ukrainian Institute for Potato Research
USAID	U.S. Agency for International Development
USDA	United States Department of Agriculture
VOCA	Volunteers in Overseas Cooperative Assistance

I. Introduction

The United States Agency for International Development (USAID) has awarded the Postharvest Institute for Perishables (PIP) an initial grant (Project No. CCS-0006-G-00-2028-00) and a Cooperative Agreement (Project No. CCN-0006-A-00-3007-00) to reduce losses of potatoes during storage and handling in Russia and Ukraine. A PIP technical assistance team, visited Russia and Ukraine under the initial grant in July and August 1993 to assess the extent of potato losses in the two countries.¹ The Cooperative Agreement resulted from that initial assessment. The project consists of training to improve postharvest handling and storage management, including exchange visits by Russian, Ukrainian and U.S. potato specialists; and technical assistance in the identification of storage losses and in renovation, design, and construction of storage facilities.

The following report summarizes first phase activities of the project which occurred during a visit to Russia and Ukraine from January 25 to February 8, 1993. The report consists of three segments. The first, by Team Leader Richard Abbott, documents PIP's initial work in Russia and Ukraine under the Cooperative Agreement. This segment of the trip was primarily organizational in nature. Project activities were discussed in detail with PIP's collaborative organizations in the Russian Potatoes Concern (RPC) and the Ukrainian Institute for Potato Research (UIPR). Discussions on exchange of specialists produced tentative agreements on disciplines and dates of exchanges. Protocol agreements were signed on the sites for the construction of the three potato storage facilities to be financed by USAID.

The second report segment is by Mr. Rick Jackson of Global Steel (Denver, Colorado), the firm responsible for construction of three potato storage facilities in Russia and Ukraine. These consist of a 5,000 ton capacity storage in Ukraine and two 2,500 ton storage facilities in Russia. His report documents discussions with RPC and UIPR on selection of storage facility sites and other aspects of the construction agreement.

PIP's responsibility in the construction of the storage facilities was to help select the appropriate construction sites and the beneficiaries of the storage facilities, and after construction is completed, to inspect the facilities and report to USAID on fulfillment of the contract requirements.

The third report segment is by Mr. Bob McGee, Postharvest Potato Specialist. He visited Russia and Ukraine to observe potatoes in storage under PIP's initial grant. Mr. McGee's scope of work was to observe a number of potato storage facilities in Russia and Ukraine and attempt to verify reported large potato losses during the storage period and to determine, to the extent possible, the causative agent(s) for these losses.

¹Richard Abbott et al., *Reducing Potato Losses in Russia and Ukraine*, October 1992.

II. Team Leader Report, Mr. Richard Abbott

A. Russia

1. Russian Potatoes Concern (RPC)

During discussions with RPC officials it became apparent that there was even greater emphasis than before on the role of RPC as the national seed certification agency and proprietor of the potato gene bank. In fact, the main use of the new storage facility would be to store "minitubers" of up to 30 varieties being grown in Russia. Since our last visit, additional scientific personnel and facilities of eight seed potato laboratories have been transferred to RPC. Operating funds for RPC come almost exclusively from the state budget. While there is talk of realizing income from sale of seed potatoes, any possibility of creating a self-supporting business activity is some time in the future. Some assistance in business planning is necessary and this might be aimed at setting up the seed potato operation as an enterprise separate from research activities.

Site Selection. Criteria for site selection used by the PIP/Global Steel team were: accessibility by all-weather highway, adequacy of power and water supplies at or near the site, close proximity of a concrete mixing plant and living quarters for Global Steel personnel near the site, and location remote from commercial potato operations to avoid disease contamination of seed potatoes.

Visits were made to three places in the Moscow region--the Dimitrov, Ramenskiy, and Sholkovski districts (raions). The first and second of these are 65 to 70 km from Moscow and the third is 45 km. RPC chose to limit site selection to the Moscow region because convenient access for their Moscow-based technical personnel was considered essential. Access for persons coming from other parts of Russia for training, and for Global Steel and PIP specialists working at the site, would also be easier.

At Dimitrov raion we were hosted by officials of the Dimitrovsky Agro-industrial Complex, a "kombinat" of state and collective farms and processing enterprises. Three sites were visited. One site next to a large base storage facility was rejected due to possible contamination from diseases carried by market potatoes. A second site on a state farm was marginally acceptable, and the third, near an agricultural technical school, was considered the best, mainly because it might be possible to tie in training courses through the school. This is a large complex that does not appear to have moved very far toward privatization.

At Ramenskiy raion, the proposed site was on a private farm of 180 ha. Its remote location was considered good from a contamination standpoint but road and electric power access were inadequate.

The site at Sholkovski raion was at a state farm (now becoming a joint stock company) which was formerly run by the military to supply food for the army. It has

400 ha of arable land (180 ha in potatoes) and is entirely fenced in--considered an advantage because theft of machinery and equipment is common now in Russia. The location is near Star Village, the cosmonaut training center. Former military officers have been granted land for private farming on land formerly in a military reserve. So far there are about 300 ha being farmed privately, all with potatoes. The site is not near any commercial potato operations and soil conditions are considered good. Road, power and water availability is good and concrete availability is not a problem. Living quarters for Global Steel personnel are available nearby.

The team felt that the Sholkovskiy site was the best. RPC was pleased as this was also their preferred site, though they had been careful not to indicate that during the visit. It also developed that RPC already has some seed multiplication operations on this farm and they have confidence in farm management. The team met Farm Director Valery S. Ginin and was impressed with his knowledge and experience.

Storage Utilization. RPC has been designated as the seed certification agency for Russia and the proprietor of the national gene bank for potatoes. There are 30 common varieties of potatoes grown in Russia. RPC initially said they wanted to store 100 to 300 tons of seed for each variety but later agreed that 15 varieties would be more manageable. RPC will be involved in every stage of seed production, beginning with meristem culture, then growing the resulting plants in greenhouses to produce "minitubers", the production of first-generation seed potatoes (G-1 or super-super-elite) from the minitubers, and the subsequent production of second generation (G-2 or super-elite) and third generation seed (G-3 or elite). Production of the seed potatoes will be on selected private and state farms, RPC selling the seed and buying back the next generation from the farmer. RPC also expects to sell the fourth generation seed to commercial farmers for production of market potatoes. The financial implications of these operations has apparently not been considered. A business plan covering the initial development period and hopefully ending in a viable commercial operation is badly needed.

Construction Arrangements. It was not possible to determine exactly who will be the local contractor preparing the site, laying the concrete slab and providing local labor and a crane. Rick Jackson was introduced to a state construction company, Elavatorspectstroy, which has extensive experience constructing agriculture storage buildings. In fact they have a panel forming machine identical to the one which Global Steel plans to ship to Russia (one of ten originally procured by the Ministry of Agriculture in 1981) and have already put up buildings like those which will be built by our project (though without the air systems planned for our storage facilities). However, Vladimir Chebotaryov, Commercial Director of RPC, states that he has his own means to take care of construction and did not appear to favor our working with any other entity. We received no guidance in this matter from Dr. Moiseev.

As it was not possible for Rick Jackson to resolve this issue, he has left it to RPC to make the necessary arrangements. There will be an exchange of letters between

RPC and Global Steel, by which Global Steel will specify exactly what services are to be provided by RPC (basically those listed in his proposal to USAID) and RPC will confirm that these services will be provided and paid for by RPC. We told RPC that this was a precondition for proceeding with the project. Our second precondition is that we receive written confirmation from RPC that it has the right to use the land at the proposed site and that all approvals have been obtained. Dr. Moiseev states that he will be able to obtain approval for the project from Agriculture Minister Hlistun in short order and that the Minister will instruct local authorities to give RPC a 49 year lease to the land (1.5 ha). He will confirm this in writing to us.

Timing of Technical Assistance. The PIP team reviewed with RPC the list of major activities contained in the Implementation Plan and agreed upon the following revised schedule:

U.S. Specialists Going to Russia:

Potato inputs/plant protection	One visit of two to three weeks in June
Weed control	One visit of two to three weeks in June
Storage management	Three visits of two to three weeks, April, August/September and December (Note: Extended visit from August to December preferable)
Seed improvement	Two visits of two to three weeks in June and August
Business organization	One visit ASAP for up to four weeks.
Extension advisor	Open at this time (see AKKOR report)(Note: Bob McGee has available a business plan he developed for a Polish potato cooperative which could be used as a model for a RPC business plan. It would be desirable if Bob's next visit could be timed to overlap with the business organization specialist so that he/she could discuss with McGee how the plan should be generated.)

Russians coming to U.S.:

Storage construction specialist (Gluyanov)	Three weeks, leaving approximately Feb 23
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Storage management specialist (Yeliseeva)	Three weeks, leaving approximately April 1
Seed improvement specialist (Anisimov)	Three weeks, leaving approximately April 1
Processing specialist	Open at this time

2. USAID:

Deputy Director Robert Burke
 Project Officer Elisabeth Kvitashvili
 Asst. Project Officer Kathy Norris

Kvitashvili and Norris attended the first hour of our initial meeting with RPC but left before any substantive matters were discussed. I met with them both the next day at the Mission. They informed me that the Mission would want to approve the site selection for the potato storage facility, just as they are doing for the grain storage facilities. Questions were raised as to why the potato storage facility was to be near Moscow and not in the main potato growing areas of Russia. The Mission had no documentation on the project other than a copy of our first phase report. I gave them a copy of the cooperative agreement-- which, incidentally, only required us to review and coordinate our activities with the Mission. After the meeting, Mrs. Norris called Washington (Linda Marks) and received assurances that we were operating within the terms of our scope of work and that our first phase report was found acceptable. She also called Mike Korin at the Egypt Desk, who was complimentary about our work and said that he fully supported our approach to working with RPC.

In a second meeting with Burke and Norris, Burke raised the question as to why we were working with what he termed a "parastatal" instead of with private farmers. He said that it was Mission policy to work with the private sector and to promote private farmers in Russia. I summarized the reasons for our approach--our first trip confirmed the need to work with the entire system starting with seed potatoes in order to reduce losses; RPC was the technical center for potato development through which we could transfer improved technology in all aspects of potato growing, harvesting, storage, processing and distribution; and the fact that private farmers were scattered, not yet organized, and short of credit, and that working with them would not be the best way to transfer technology. Having met with RPC in the meantime and discussed USAID's views, I was able to tell Burke that we had agreed with RPC that 50 percent of RPC's sales and purchases would be from private farmers and that the storage must be available to private farmers for training in potato storage technology. I also said that we were attempting to work with AKKOR to reach the private farmer with improved techniques through farmer publications. We agreed that the protocol we planned to sign with RPC would contain the stipulation that it was subject to Mission approval. I also promised to keep the Mission informed on our activities throughout the year.

I told Kathy Norris that we felt that RPC needed a full time advisor to assist with business organization and planning. We did not have funding for that, and VOCA works only with short-term advisors. I suggested the Peace Corps (PC), who is just finishing training for the first group of volunteers, many of whom are older people with experience in agribusiness. She arranged for me to meet with the PC Director, Jon Darrah. Jon said that PC program involves setting up "business development centers" where private businessmen can come for help. Two regions were selected: several cities along the Volga from Nizhny to Volgograd, and the Russian Far East. They had decided to work only outside Moscow and to avoid having anything to do with agencies of the central government. So there was no way they could place an advisor with RPC.

Mrs. Norris had another suggestion, which had to do with the new Food Systems Restructuring Program USAID has just started in Russia. Three large grants have been made and each grantee is supposed to make sub-grants to other organizations. The Citizens Network got the largest one (about \$45 million). Norris suggested that PIP contact them about a possible sub-grant to cover the costs of working with RPC. I understand that under this grant Citizens Network is supposed to promote joint ventures with American firms. The other grantee is ACDI Tri Valley Growers.

3. AKKOR

I met with Konstantin Mezentsev, head of public relations for AKKOR. Mr. Mezentsev was pretty discouraged about the way things were going. He said they had disbursed all of the 79 billion rubles they had, 70 percent of which was for loans of three to five years. The interest rate was eight percent. Only one-year loans totaling 20 billion rubles had been paid back. He thinks there is little prospect of getting more. Authorities at the oblast and raion level are seeking to take over this loan function, and there is a plan to use state funds as a partial guarantee to commercial banks making loans to farmers. Farmers associations which have been created in 1,400 of the total of 1,800 raions would be the vehicle for the loan program.

Concerning the government's agrarian policy, he said that the "reactionaries were making a counterattack". While Yeltsin favors centralization, which would work in AKKOR's favor, his opponents, including Rutskoi, want to decentralize authority for agricultural programs, including loans. Mezentsev said that farmers don't have a voice at the oblast level and that decentralization would work against them. AKKOR, which bills itself as a "confederation of farmers associations", will hold its annual conference Feb. 9-11 in Moscow and hopes to use this as a platform to argue for centralization.

A disturbing development reported by Mezentsev was that in some oblasts local authorities are taking back land already given to private farmers from the land reserves (10 to 15 percent of the total arable land in each oblast designated for private farming). Rutskoi, who is responsible for land reform, is claiming that distribution was improperly done in some cases, whereas more land than indicated

by the "norms" having been given out. Mezentsev says a total of 230 farms in three oblasts have been taken away from farmers.

Concerning Rutskoi, Mezentsev says he is after quick results and does not have the patience to wait the 10 to 12 years it would take to develop a true private farming sector. Instead, he wants to distribute available credit funds to five large agroindustrial enterprises which would be set up around the country. These enterprises would, in turn, set up from a "land bank", a limited number of fully-equipped private farms of what is considered viable size, the actual size and farming system varying according to the region. Qualified farmers would then be selected to operate the farms, and they would be expected to pay for the land and equipment out of earnings over a period of 50 to 75 years. Mezentsev thinks that given the available funds, no more than about 2,000 farms of this type could be set up.

I proposed that we provide an extension specialist to generate information on potato handling techniques to be published in their newspaper. Mezentsev says there are two publications, the Peasant Farmer News (weekly newspaper) and the Russian Farmer monthly magazine. Both could be used for such articles (see VOCA discussion below). Mezentsev was not optimistic about the future of these publications--he says they will have to be self-supporting and farmers don't have the money to buy them. He was much more interested in talking about his TV and video cassette operation called AKKORVIDEO. He wants to set up a weekly TV program for farmers and also to produce video cassettes which could be shown to farmers in villages across the country. He would like to make this a self-supporting operation and thinks that he could get video films made by U.S. and European companies marketing ag inputs and charge them for the use of their films since it would be advertising for them. I did not encourage him on this point. He says he has already purchased TV equipment which is due to arrive in April.

Mezentsev was quite negative on the role of short-term experts coming to Russia. He says they need money more than they need experts, although people coming on long-term assignments could be useful.

4. VOCA

I met with Brian Foster, who heads the Moscow office of VOCA, and later Bob McGee and I had breakfast with him. Brian was more positive about RPC than during our previous visit. Two VOCA volunteers, Duane Smith and Dale Grant, had just completed a two-week assignment with RPC developing a potato seed production and certification program (based on the Maine model). Brian gave me a two-page "debriefing" paper on their visit and has promised to send me the full report when completed. The volunteers concluded that RPC had the means to accomplish their objectives but needed to take some positive actions in the near future if they were to have Ministry support. VOCA would be happy to cooperate with us in the future at RPC. There are no immediate plans to bring the volunteers back.

Foster was interested in our idea to assist AKKOR with extension services on potatoes through AKKOR publications. He told me that AKKOR supports two publications: Peasant News (Igor Abakumov, Editor), which is published weekly in each oblast and is the most popular, and Fermer, a monthly magazine published in association with the Berezin Publishing House. This publishing house is trying to develop a relationship with the Meredith Company of Des Moines who publish Successful Farmer. He says that Peasant News has distribution problems due to lack of funds, as farmers don't have the money to buy it. Bryan also showed me samples of "Novi Fermer", which is affiliated with Rodale Publishers of the U.S. and has a circulation of 50,000.

VOCA has received a request for assistance from the Ministry of Agriculture to help produce video-based educational programs for private farmers, peasant associations, and cooperatives. The request does not mention AKKOR though, as noted above, that organization is beginning such an activity.

VOCA is currently working in the Seratov oblast helping to set up an extension service covering 36 out of the 38 raions in the oblast. Part of this activity is establishing a Farmer Information Service. (A farmer association at the oblast level is engaged in the farm input supply businesses and is making money at it.) Foster plans to translate and distribute U.S. Agricultural Extension Service bulletins from the U.S. The first two will be on pasture management and grain storage and handling. He would like to do one on potatoes after that. I said that we might be able to work together on that through our current project. I have a copy of his concept paper on this initiative which includes estimated costs.

VOCA is trying to arrange for a visit from an agricultural journalist, Earl Ainsworth of Farm Journal Publishing, who recently completed an assignment for VOCA in Bulgaria, to assist with agricultural publications (it is not clear who he would work with in Russia). I would recommend we coordinate with Foster on any plans to bring somebody under the PIP contract to avoid duplication of effort.

5. USDA Advisor to Ministry of Agriculture

At USAID/Moscow's request, I met with Craig Infanger, USDA agriculture advisor to the Ministry of Agriculture. Craig arrived in November and returned with his family only in January for a one-year assignment. He appears to have the Minister's ear, as he was to meet with him later that same afternoon. The day before he had spoken at a conference on agricultural reform organized at the Agrarian Institute with support from the Gorbachev Foundation. Craig is from the University of Kentucky and is not a USDA employee. The idea he is currently working on is to help relieve the serious shortage of credit in the rural sector by using counterpart rubles earned from sales of donated U.S. commodities. He says that funds now being generated disappear into state budgets and do not benefit farmers.

B. Ukraine

1. Ukraine Potato Institute

Anatolij Kuchko, Director of the Ukrainian Institute for Potato Research (UIPR), hosted the team this time and he was joined by seven others on the staff, most of whom we had met on the last trip. At the beginning Kuchko, who was not present at our meetings in July, asked for an explanation of the project. After these preliminaries, Kuchko told us about the activities of the Institute. Its mandate is the breeding and selection of potato varieties and the production of potato seed. It receives funds from the state budget to support its operations. Kuchko said his institute carried out 70 percent of all research related to potatoes at its main location and at 21 other stations around the country. Thirty-three varieties of potatoes have been identified in Ukraine, and the Institute produces seed from nineteen of these varieties.

Kuchko said that there were 1.7 million hectares of potatoes grown in Ukraine, of which 330,000 ha were on state and collective farms and the rest on private farmers and small household plots. Total annual production is between 20 and 21 million tons, of which 6 to 7 million tons are produced by state and collective farms and 14 million by private farmers. (This would indicate large farm yields of close to 20 kg/ha and small farm and plot yields averaging 10 kg/ha). Potatoes procured by official agencies and moved to urban distribution bases amount to 3.5 million tons and it is these potatoes which suffer up to 50 percent loss rates due to improper handling and storage. Loss rates are much lower for potatoes produced by private farmers.

In December 1991, an association known as UKRELITKARTOFFEL was formed, bringing together 63 organizations producing "elite seed" for sale to farmers. Members include state and collective farms, the Ministry of Agriculture, the Academy of Agricultural Sciences, and the Ukraine Potato Institute. Eventually this will become a share company; at present profits are to be shared in proportion to the capital contributed. It is intended to be fully self-supporting. UIPR is the largest contributor and is responsible for producing all the earlier generations of seed. Director Kuchko heads the association. About 65,000 tons of elite seed will be produced and marketed annually by the association and one of their main objectives is to have enough to meet the demand of all private farmers in the country. The USAID supported storage will be used to store elite seed for sale to growers.

As the producer of potato seed, UIPR cannot also be the official seed certification agency of Ukraine. This function will be carried out by a new agency being created under a law which is expected to pass soon. The agency will be modeled on the "NAK" organization in the Netherlands. We do not need to assist them with setting up a seed certification program.

Storage Facility Site Selection. UIPR proposed only one location for the storage and that was on the grounds of the Institute at Nemashaevo (Borodiansky Raion, Kiev Oblast). We visited the site and Rick Jackson was satisfied with it as far as access to electric power, water, and roads were concerned. It was a low-lying area and Rick requested that the concrete slab be raised and put on a crushed rock base. The local contractor will be arranged by UIPR. We did not question the choice of site, since given the planned mode of operation, this would be the most logical choice. We stated that the facility was being provided by the U.S. government on the understanding that it would benefit the private farming sector through training activities in storage management and the sale of quality seed. This fit well with UIPR's extension role and they were in full agreement. Arrangements between UIPR and Global Steel will be confirmed by exchanges of correspondence. Mr. Anderson of Global Steel will visit UIPR in March and will bring blueprints of the building, which will allow UIPR to secure the necessary building permits before construction starts in May. UIPR agreed to provide local accommodations for Global Steel technicians during construction. This would be at a sanitorium located in a wooded area about 1 km from the Institute. Mr. Jackson found the accommodations acceptable.

Schedule for Exchange of Specialists. The basis for discussion was that there would be an exchange of specialists in four disciplines: storage management, seed improvement, harvesting and handling equipment, and potato processing. In each case, a specialist from UIPR would visit the U.S. and this would be followed by a visit of the corresponding U.S. specialist to Ukraine (in some cases, more than one visit).

There was a separate discussion with Mr. Jackson present concerning the upcoming visit of the storage construction specialist. The person selected is Evgeny Petrov. Petrov will travel with Mr. Chugunov of PPC from Moscow to the U.S.

Storage Management. The UIPR candidate is Vasily Kutsenko. His biodata was sent earlier. UIPR said they want him to visit storage facilities, observe planting (his university training is in agronomy), visit research installations, and discuss future collaboration with UI. We agreed on a time frame of late March/early April for a three-week trip, which would allow him to see seed potatoes coming out of storage and planting operations in some parts of Idaho, and to visit UI research facilities. This timing would also allow him to travel with the seed specialist (see below). If this is acceptable, he will need a letter of invitation immediately in order to get his visa in time.

The U.S. specialist would make two visits--one in late September when seed potatoes would be going into the new storage and one in December to check on storage conditions there. Mr. Kutsenko would be his counterpart. This specialist (Bob McGee or someone similar) would also carry on McGee's work of monitoring storage at both existing seed storage facilities and at the urban storage bases. UIPR confirmed that providing technical assistance to potato storage facilities of all kinds was part of their mandate.

Seed Improvement. The UIPR candidate is Victor Svertoka (biodata already sent). Svertoka is interested in everything relating to production of virus-free seed and how it is kept free of viruses (virology). He also wants to know how seed is multiplied under field conditions. If he arrived in late March, McGee thought he could see seed-cutting and planting. He would travel to the U.S. with Kutsenko and they would make many of the same visits.

The U.S. seed person should come in the latter half of April, according to UIPR. This would make it immediately after the return of the UIPR specialist. It would be a ten-day visit, splitting a three week trip with Russia, timed to view seed potatoes coming out of storage and being planted. UIPR said that if the person is a specialist in seed multiplication they would like to have several visits. If his specialty is seed handling, one April visit would suffice. It was agreed that a possible second visit would be discussed later.

Harvesting and Handling Equipment. UIPR will send Valerij Kononuchenko, as we were already informed by Kuchko. The purpose of his visit would be to gather information so that specifications could be drawn up for manufacture of improved potato handling equipment of all types in Ukraine. This is part of the UIPR mandate. Kononuchenko would like to see equipment being manufactured and to discuss use of the equipment in the field with farmers. We suggested May, which would mean that he would not see harvesters or storage loading equipment in operation. An alternative would be August/September, provided he could see harvesting and return to Ukraine in time to be there when the U.S. specialist comes.

The U.S. specialist should come for three weeks in early September to view harvesting and storage loading operations and make suggestions for improvements. One visit should suffice.

Potato Processing. Though there was no Ukrainian specialist originally planned for this position, we felt that it would be good to use the same "exchange" approach as with the other specialist positions--and since we had cut back on some other visits there should be enough funds. The Ukrainian specialist would be named later and it would be an engineer UIPR is in the process of hiring to run their new processing laboratory. His visit to the U.S. would help him design the lab, in which they would like to install pilot processing lines. At the same time, he would find out about desirable processing varieties suitable for potato chips and dehydrated potatoes, the two areas they are most interested in. They would be ready to send someone in the fall of this year.

The U.S. specialist, who should be with the UIPR person while he is in the U.S., would recommend the type of pilot plant equipment to purchase. While in Ukraine, the U.S. specialist could discuss suitability of local varieties for processing, view existing processing plants and review plans for future plants, and, depending on the type of person selected, assess the feasibility of setting up a joint venture with a U.S. company, or alternatively, the licensing of technology by a U.S. firm to a qualified Ukrainian company.

Living Arrangements for PIP Specialists. UIPR will attempt to cover some of the costs of meals and hotels for PIP specialists. Only the hotels which agree to payment from UIPR in coupons could be used, and this includes the Moskva, the Libid, and the Ukraine. We could not use the new Intourist Hotel, where the team stayed this time. We visited the Moskva and the Libid, and found the Moskva acceptable. It is on a hill overlooking the main street, so it is close in but a bit removed from the traffic. There is a snack bar open most of the day, in addition to the dining room. Lobby shops, including dollar stores, are comparable to the Intourist.

Small Equipment. The type of small equipment which Bob McGee described (see Section IV G, Equipment List) and which could be provided under the contract (stem thermometer, anemometer, psychrometer) is mostly available at UIPR. There was a request to use the equipment funds to purchase a used diesel car for transport. Diesel is preferred because they can get around the fuel shortage problem by using fuel obtained for tractors. UIPR is also interested in having video films (converted to the PAL system) which would show any or all operations relating to potato handling in the U.S. If a Russian language sound track (or written text to accompany a silent film) were available, so much the better. I told them I would have to refer budget issues to Mr. Neese but would inform him of their wishes.

Documents. UIPR has received the potato handbook. No additional copies are needed as they say they can copy from the one they have. They were given the two document request forms from the PIP Information Center and their use was explained.

Training. We asked how UIPR would organize training using the project storage facility and said that we wanted to be sure that the private farming sector was included. UIPR said that organizing seminars was an important part of their activities and that conference facilities and housing for this purpose are located on the grounds of the Institute. We were assured that private farmers and farmer associations would be included in training courses on potato storage using the Global Steel supplied storage facility.

Protocol. At the conclusion of the visit a protocol of understanding was signed, a copy of which is attached on page 14.

2. Academy of Agricultural Sciences

Director Kuchko asked the team to accompany him to a meeting with the President of the Ukrainian Academy of Agricultural Sciences, Prof. Olexiy Sozinov. Fifty-two institutes in agriculturally related fields fall under his purview. Mr. Kuchkov wanted to be sure of obtaining Sozinov's support for our project and for related Institute expenditures such as the local construction costs. Based on what we and Mr. Kuchko told him, Prof. Sozinov said he fully agreed with the objectives of the project. He also said he would like to arrange cooperation with U.S. scientific organizations on a broad range of activities. Shipping arrangements for the storage

in six or seven containers were also discussed and it was recommended that we use the port of Odessa. UIPR will handle the port clearances; forwarding agents will not be used. Theft is a serious problem at the port of Odessa, but the use of sealed containers will minimize the risk.

3. VOCA

The team met with Marty Robinson and Mr. Yevtushenko to describe the status of our project and to find ways in which we might support each other. VOCA is working with farmer associations and can be helpful in offering opinions on which associations are likely to be the most viable.

4. USAID

The team met with Jim Osborne, Project Officer, and briefed him on the status of the project. He was given a copy of the report on the first phase of the project, as well as a copy of Global Steel's offer to USAID for the storage. We also promised him a copy of our report on the current trip. Jim asked particularly for a short summary of the project which could be used for a press release. We discussed our ideas on the desirability of continuing the project after 1993 since many of the problems we were dealing with were, in fact, long-term in nature. This includes the transfer of potato storage management techniques, the establishment of private market channels for potatoes, and making links with U.S. firms which might provide the technology for potato processing. In the latter connection, Jim encouraged us to contact Citizen's Network, which had just been awarded a grant to encourage U.S. private sector agribusiness activity in Ukraine and other NIS republics.

PROTOCOL

This protocol will confirm discussions held in Ukraine between the Ukrainian Potato Institute (UPI) and the Postharvest Institute for Perishables (PIP) during the period Feb. 2-5, 1993.

The parties to the protocol agree to cooperate during 1993 on a program of exchange of specialists in (1) potato seed, (2) potato storage management, (3) potato harvesting and handling equipment, and (4) potato processing.

UPI specialists in these four disciplines will visit the U.S. during 1993 at the invitation of PIP. Costs of these trips will be shared in accordance with the terms of the agreement signed 13 Jan. 1993 by the two parties.

Four PIP specialists in the disciplines mentioned above will make one or more visits to Ukraine during 1993. The exact dates of travel for the Ukrainian and U.S. specialists will be agreed upon later by means of an exchange of fax messages. The UPI agrees to pay for hotel and meal costs of the U.S. specialists and to provide local transportation.

A related activity is the construction of a 5000 metric ton potato storage on the premises of the UPI. All arrangements for installation of this storage are the subject of a separate agreement between UPI and the supplier, Global Steel Inc. PIP agrees to support this activity by paying for a study trip to the U.S. for a UPI storage construction specialist, and to monitor performance of seed potato storage in this building by PIP specialists during 1993.

It is understood that the storage to be supplied will be used by UPI for both storage of seed potatoes and for training in storage management. It is likewise understood that private farmers will benefit from the storage and from U.S. specialists by being allowed to purchase seed potatoes and participate in training programs arranged by UPI.

For the Ukrainian Potato Institute
Anatoly A. Kuchko, Director

For the Postharvest Institute
Harvey A. Neese, Director

[Handwritten signature]
5.02.93

[Handwritten signature]
5 Feb 93

Approved

USAID /Ukraine

[Handwritten signature]
2/5/93

III. Global Steel Report, Mr. Rick Jackson

The purpose of this report is to document the results of the Russia/Ukraine trip. The main objective of the trip was to finalize choice of potato storage facility building sites and confirm the NIS entities that will serve as the NIS partners.

A. Russia

The first portion of the trip was spent in the Moscow, Russia area. The entity Global Steel will be working with in Russia is the Russian Potatoes Concern or Concern Roskar (RPC). Three construction sites were presented by RPC for our consideration. Present with me on the trip were two representatives of the Postharvest Institute for Perishables (PIP), Mr. Richard Abbott and Mr. Bob McGee. The three sites listed were Dimitrov, Ramenskiy, and Sholkovskiy districts (raions). The Ramenskiy raion had a private farm of approximately 80 ha. This site was at a remote location and was deemed unacceptable due to inadequate roads, distance from a concrete plant, and limited electric power. In the raion Dimitrov, we were hosted by The Agro Industrial Complex (COMBINAT), a collection of state and collective farms involved in processing enterprises. In the Dimitrov region an agricultural technical school was chosen as one of the potential sites. The school could use the potato storage facility as another technical training course for their school. The Dimitrov region is 65-70 km from Moscow.

The next site that was chosen for a potato storage facility was the Sholkovskiy district. Sholkovskiy was formerly a farm to produce food to support the military. The farm is completely fenced, which is a security advantage. The farm director is Valery S. Ginin. He was knowledgeable about potatoes and eager to work with RPC to provide seed potatoes to the independent farms surrounding his farm as well as to private farms throughout Russia.

After visiting all three sites, we indicated that the Sholkovskiy site was the best. RPC indicated that this was also their first choice, but had not tried to influence us until we had visited all of the sites. As the week progressed, we decided at the request of RPC, to split the potato storage facility into two separate buildings as opposed to one building joined with a center plenum. In the Moscow area there were not enough potatoes to support one large facility. Two sites using the Sholkovskiy region and the Dimitrov region would serve to meet the future demands of the RPC quite well. After discussions with the RPC and the rest of the team, it was decided to confirm with USAID in the U.S. that two sites would be utilized. This is made possible at no additional expense to the project by eliminating the refrigeration system for the facility and adding one extra air system.

We met with the commercial director of RPC, Mr. Vladimir Chebotaryov, to discuss the construction. Mr. Chebotaryov is anxious to sign a protocol on behalf of the RPC indicating that they can take care of any of the construction needs that we may have. Additionally, any unforeseen needs and expenses will be met by the RPC.

Criteria for site collection were as follows:

- Distance from concrete plant
- Distance from housing for technicians
- Cubic meters of concrete needed
- Use of full time RPC translator
- Transportation of sea containers
- Methods of air supply to potato pile
- Electricity and water supply

A copy of the criteria will be faxed to RPC listing each point specifically (what Global Steel and RPC will provide). Our copy will be hand carried by William Anderson in March during his trip to Russia and Ukraine.

The snowload for the Moscow region is reportedly 100 kg/m²; the wind load is 180 km/hr. Frost depth is 1.5 m. Housing for Global Steel technicians will be provided by RPC at "Star Village" in the Sholkovskiy region. The Star Village is a cosmonaut training center. Housing in the Dimitrov region will be provided by RPC in a resort area less than 3 km from the building site. Elizabeth Kvitashbili and Kathy Norris from USAID were present during the initial meeting with RPC. They met again later in the week with Richard Abbott from PIP. Deputy Director Robert Burke was also present. The USAID mission in Moscow confirmed that the use of two sites and separating the buildings was a workable plan. This has since been confirmed with Linda Marks and Angela McNerney of USAID/NISTF (New Independent States Task Force) in a telephone conversation with Rick Jackson. The team felt the Russian portion of the trip was profitable.

Dr. Victor Chugunov will be traveling to the United States on February 23, 1993 to spend one week with Global Steel to review blueprints, visit existing potato storages and experience demonstration of each phase of the construction process at the Global Steel shop in Alamosa, Colorado. The main points of contact for the RPC are Dr. Jury Moiseev, President, and Mr. Vladimir Chebotaryov.

B. Ukraine

On February 1, 1993 the team traveled to Kiev, Ukraine. The Director of the Ukrainian Institute for Potato Research (UIPR) is Anatolij Kuchko. UIPR is very well established and they have not made drastic changes in their operation since the independence of Ukraine. UIPR had chosen one location with two potential building sites. Based on the way they desire to utilize the storage, this site was found to be acceptable by all team members. The site presented by UIPR was close to a source of electricity and had an adequate water supply. A concrete plant is less than 5 km away. The building site needs to be raised approximately one foot with a solid earth and rock base. This was agreed to by UIPR. UIPR has a full-time construction manager on staff, Mr. Evgeny Petrov. Mr. Petrov is scheduled to join Mr. Chugunov of RPC on his trip in February to the U.S. The trip will be videotaped and transferred to the PAL video system and sent to UIPR and RPC. The same construction concerns were discussed with UIPR as with RPC in Moscow. UIPR agreed to each point and, in addition, will house Global Steel employees less than 5 km

from the site at a local sanitorium. The sanitorium is in a nicely wooded area which has a resort atmosphere. They have agreed to remodel two of the rooms specifically for the Global Steel technicians.

Protocol will be sent via fax and hard copy carried by William Anderson on his trip to Ukraine in March, 1993. UIPR has agreed to receive the sea containers at the port of Odessa. There is a question as to the safety of equipment shipped through this port. Global Steel will check with its freight forwarder to determine if shipment to Poland over land by truck is better for security purposes.

The team felt that the meetings with UIPR and the negotiations for the facility went well. UIPR demonstrated an eagerness and ability to support the project and utilize the facilities for private farmers throughout Ukraine.

Other meetings held in Ukraine included a meeting with VOCA and its director, Martin Robinson. Mr. Robinson was excited about the USAID project to provide concrete and tangible assistance to the Ukrainian people in their food restructuring programs.

To assist in obtaining proper financing for UIPR, the team met with the President of the Ukrainian Academy of Agricultural Sciences, Professor Olexiy Sozinov. The academy has 52 different institutes, and 40 different research stations. They control two million ha of arable land. 700,000 of those ha near the Black Sea are irrigated. The 52 institutes work in a range that includes animal husbandry, economics, veterinary medicine, crops, etc. Mr. Olexiy Sozinov assured us that he would do everything to the best of his ability to assure success in the project.

The team also met with the USAID Assistant Director, James Osborne. Mr. Osborne was enthusiastic about the hands-on help that will be afforded the people of Ukraine as a result of the USAID potato storage project. Mr. Osborne was agreeable with the site selection and the plans to work very closely with UIPR. Mr. Osborne also suggested we should get in touch with the American Chamber of Commerce in Kiev to network with other U.S. citizens working in Ukraine.

Follow-up to the trip will be to forward storage design blueprints to USAID, RPC, and UIPR. On February 23, representatives from RPC and UIPR will be in Colorado to spend one week with Global Steel. The first week of March, William Anderson will travel to the NIS to begin follow-up on the storage project and assess needs for further assistance and technology transfer covered under this cooperative agreement.

It will be exciting to see the assistance afforded Russian and Ukrainian potato industries as a result of the cooperative agreement. Russia grows more pounds of potatoes per capita than the U.S. Assistance to the Russian and Ukrainian people with better storage and handling of their potatoes will increase use of existing production and thus begin to reduce the potential threat of food shortages.

IV. Assessment of Potato Storage Facilities in Russia and Ukraine, Mr. Bob McGee

A. Executive Summary/Recommendations

The potato storage facilities observed in Russia and Ukraine were of three basic types: underground/semiunderground units, above ground bin units, and cold storage rooms as found in public warehousing. In only a few cases did these facilities have air ventilation/humidification systems; when observed, these systems were operated by manual controls. Losses due to suboptimum storage conditions (improper control of relative humidity; temperature fluctuations; inadequate air ventilation) were estimated at 15 percent. Losses due to disease and mechanical damage were estimated at an additional 10 percent. However, the storage operators are doing the best they can to maintain stored potato quality with the facilities and equipment they have.

Potatoes coming out of storage can be only as good as potatoes going into storage. In order for stored potatoes to be of high quality, potatoes going into storage must be received at the storage facility in the best condition possible. Proper seed potatoes must be used. The best agricultural practices, with appropriate fertilization, weed and insect control, and irrigation (if possible) should be followed. Further, proper harvesting, handling, and transport of potatoes to the storage facility must be practiced to minimize damage. Stored potatoes observed in Russia and Ukraine exhibited excessive bruising and disease which accounted for approximately fifty percent of storage losses. Potato storage facilities require properly designed air ventilation/humidification systems to minimize potato losses due to shrinkage and to maintain quality from one crop season to the next.

In order for Russia and Ukraine to enter the potato processing business, they must have adequate potato storage facilities in order to be able to deliver high quality potatoes to processing plants. Without this, potato processing is not feasible.

Recommendations. The following are recommendations for decreasing potato storage losses in Russia and Ukraine:

1. Improve the potato seed program to supply top quality seed potatoes for planting.
2. Improve agricultural practices during the production phase.
3. Improve potato harvesting, transport and handling to reduce potato bruising.
4. Modify existing potato storage facilities to add air ventilation/humidification systems with appropriate control mechanisms.
5. Provide potato storage management training.
6. Monitor weight loss during storage.

In order to obtain an accurate measure of potato weight loss during storage, samples of bags of approximately 50 kg of clean potatoes (dirt and debris removed) should be weighed and placed in storage. When the potatoes are removed from storage, the sample bags can be retrieved and reweighed, and a percent weight loss calculated. This should be done in existing potato facilities and in the new facilities to be constructed this summer in Russia and Ukraine. This information will be used to monitor losses and compare loss rates in existing facilities to those of the new facilities. It will also aid in evaluating the efficacy of air ventilation/humidification systems in controlling losses.

B. Introduction

This report documents technical assistance in identifying potato storage losses under the continuation of the University of Idaho/Postharvest Institute for Perishables project, "Reducing Potato Losses in Russia and Ukraine."² This project was initiated in the summer of 1992 by a five member agricultural team specializing in potato production, storage, and marketing.

One element of the program proposed in the initial report was to provide technical assistance to monitor potato storage facilities in Russia and Ukraine during the storage cycle. This was to be accomplished by on-site visits to selected storage facilities to monitor storage conditions and potato quality approximately four months after harvest. (See project scope of work, Appendix G-1).

Due to time, travel and weather conditions, fewer storage facilities were visited than outlined in the project scope of work. A total of nine base/central, collective/state farm, and seed potato storage facilities were visited to obtain the information necessary to make an accurate assessment of potato storage management in Russia and Ukraine (see list of storage facilities visited, Appendix G-2).

During the visit described in this report, observations were conducted both visually and using monitoring equipment brought from the United States (see List of Equipment, Appendix G-3). Measurements included:

- potato storage supply air temperature (temperature of the air applied to the potato mass),
- potato storage ambient relative humidity,
- potato temperature, and
- air velocity rate (obtained in storage facilities where ventilation systems were operative.)

A complete set of data was not obtained in all storage facilities as many did not have air ventilation/humidification systems or, if they did, the systems were inoperative. In facilities where air ventilation systems were installed and in operation, the air velocity rates were

² "Reducing Potato Losses in Russia and Ukraine", Postharvest Institute for Perishables, University of Idaho, October 1992, GTS Report NO. 114, Cooperative Agreement AID/DAN-1323-A-00-5039-00, USAID Bureau for Research and Development.

much higher than in western style storage facilities. Measurements were off scale of the anemometer, exceeding 1,016 cm/sec (2,000 ft/min). In western style potato storage facilities, air velocity ranges from 406 to 508 cm/sec (800 to 1,000 ft/min).

Further, it was difficult to obtain accurate measurements of potato weight loss during storage, as no base line had been established when the storage facilities were filled at harvest. In order to obtain accurate weight loss measurements, control bags of weighed potatoes should have been placed in the storage initially, recovered upon removal of potatoes from storage, then reweighed and a percentage weight loss calculated. Only a subjective evaluation of potato weight loss and visual observations could be made to determine weight loss at this time. This evaluation was based upon the consultant's 30 years experience in potato storage and processing.

C. Assessment of Potato Storage Conditions

The potato storage facilities constructed in the NIS countries of Russia and Ukraine are of improper design structurally with respect to air ventilation and humidity systems and as measured against standard practice in western countries. The storage facilities are of three basic types: (1) base or central storage facilities located near major cities, (2) state and collective storage facilities located on or near state/collective farms and (3) seed potato storage facilities. There are some private storage facilities but they are only capable of storing one to two metric tons and do not account for a large portion of the total quantity of potatoes stored.

Base or Central Storage Facilities. The base or central storage facilities are large cold storage rooms where potatoes and other vegetable crops such as carrots, cabbage, beets, etc. are stored in tote bins or crates (see Appendix G-4, Photographs 4.10 - 4.12). The approximate tote bin weight of potatoes is 227 kg (500 lbs). Bins are stacked four high with each room capable of storing 100 to 500 bins. The storage environment is controlled by a central air system consisting of a large centrifugal fan which distributes air through an overhead duct system mounted on the ceiling either in the center or along one side wall of the room. The air return is located at floor level near the intake of the fan. These facilities have an ammonia refrigeration system capable of holding room temperature at 3-4C (38-40F). No method was observed for defrosting evaporative coils. It was noticed that the bottom two rows of evaporative coils contained heavy frost, which impairs the cooling efficiency of the refrigeration system.

Potatoes in both Russian and Ukrainian base storage facilities exhibited excessive weight loss (shrinkage) due to improper air flow through the potatoes. The air follows the path of least resistance, going around the bins and not up through the potatoes, causing the potatoes in the center of the bin to suffer from lack of air. Losses due to shrinkage are estimated at 10 percent over four months of storage. In addition to shrinkage, losses due to disease and mechanical damage are estimated at 15 percent, for a total of 25 percent. This percentage will increase as potatoes remain in storage. The consultant was informed that the potatoes will be removed from storage in April and May.

State and Collective Farm Storage Facilities. These facilities are located on state or collective farms. They are constructed of concrete and are designed for bulk loading of potatoes into storage bays (see Appendix G-4, Photographs 4.6 - 4.9). This design is similar to bin storage facilities constructed in the North Central area of the United States. A central air ventilation system (see Appendix G-4, Photograph 4.7) consisting of large centrifugal fans supplies air to two bays through an in-floor air duct system located under the potato pile (see Appendix G-4, Photograph 4.8). There is no humidification system installed in these facilities, which is one of the major causes of excessive potato loss. The ambient storage relative humidity was 70 percent as measured by a sling psychrometer, much lower than the recommended 95 percent RH or higher.

No automatic air ventilation control systems were installed in these facilities. The air ventilation systems are manually operated to obtain the desired constant air temperature around the potatoes. They are regulated by an on/off switch and air mixing is accomplished by a manually-operated slide gate. This causes the potatoes to undergo a wide temperature swing and produces a large temperature gradient between the bottom and top of the pile. The consultant was informed that there is a temperature difference of as much as 5C (9F) between the bottom and the top of the pile, which is an indication of poor air flow, improper control of outside air temperature when available for cooling potatoes, and inadequate air ventilation time. The acceptable temperature differential between the bottom and top of the potato pile is 0.8 - 1.1 C (1.5 to 2F). This low temperature differential is maintained with a properly designed air ventilation/humidification system and sufficient operating time. The air temperature in the base storage was 3.8 - 4C (38 - 40F) with a potato pulp temperature of 3.8C (38F).

A typical state or collective farm potato storage facility consists of four or more bays with each bay holding approximately one thousand mt of potatoes stored at a depth of 5.48 m (18 ft). Unfortunately, operators were piling potatoes only 2 m (6.58 ft) deep in order to cool the potato pile down to final temperature and to control the temperature once the final temperature was reached. Most storage bays were filled partially with bulk potatoes and partially by potatoes stored in tote bins. Some bays were totally filled with tote bins. In the case of tote bins stored in the bays, the air was not moving up through the potatoes but around the bins.

Based upon observation of the building and facility layouts, updating is recommended. The updating would consist of installing new air ventilation/humidity systems with new semi-automated (electro-mechanical) control systems.

Seed Potato Storage Facilities. The seed potato storage facilities in Russia and Ukraine were of the underground type constructed in the 1950s (see Appendix G-4, Photographs 4.1 - 4.5). These facilities are of the same pole and straw potato storage design constructed in Idaho during the 1930s to early 1960s. In Russia and Ukraine they are constructed either entirely of wood or of concrete beams, with a concrete roof deck. Dirt is placed on the top of the structure for insulation (see Appendix G-4, Photograph 4.3).

Some of the seed potato storage facilities had an air ventilation system installed but no humidification system. The air ventilation systems observed consisted of large centrifugal

fans, a common practice found in all potato storage facilities observed in Russia and Ukraine (see Appendix G-4, Photograph 4.5). The fans supply large volumes of high velocity air through underground air ducts to the potato bins. An attempt was made to obtain air flow measurements, but the air flow rate was too high for the measuring equipment to obtain a reading, at over 36,580 m/hr (2,000 ft/min). In potato storage facility design, plenum air flow should not exceed 18,290 m/hr (1,000 ft/min) at 249-374 Pa (1 - 1.5 in. of water).

Seed potatoes in these facilities are piled approximately 1 to 2 m (3.28 to 6.56 ft) deep. The potato pulp temperature was approximately 4C (39F) in facilities both with and without air ventilation systems. In facilities having an air ventilation system, the supply air temperature was 3.8 to 4C (39F) with an air temperature on top of the potato pile of 5C (41F). Air temperature on top of the potato pile was measured at only one storage facility where the air ventilation system was operating at the time of the consultant's visit. No humidification systems existed in any of the seed potato storage facilities visited. A check of the relative humidity using a sling psychrometer indicated a RH of 70 to 80 percent, much below the desired 95 percent (or higher).

In general, the seed potatoes observed in storage approximately four to five months after harvest had been under stress and could be termed "physiologically aged." There had been excessive weight loss: the majority of the potatoes examined were soft, not rigid or firm. Also, the potatoes had suffered excessive bruising caused by improper harvesting, handling, and transport.

Physiologically aged seed will produce more stems upon germination, which in turn will produce increased numbers of smaller potatoes. Also, such seed will produce sprouts before normal germination time, a condition observed during this visit. The consultant observed sprouts ranging in length from 1 to 3 cm to 12 to 15 cm (5-6 in). (See Appendix G-4, Photograph 4.1.) Seed potatoes are not scheduled for removal from storage until April. With two to three months of storage remaining, the sprouting will continue to deteriorate the quality of seed potatoes. These physiologically aged seed potatoes are one of the major causes of low potato yields. It was estimated that seed potato weight loss was 15 percent. Additional losses from bruising and diseased potatoes were estimated at 10 percent, for an estimated total loss of 25 percent with another three months remaining before the potatoes are removed for planting.

Underground concrete seed potato storage facilities could be updated by the addition of air ventilation/humidification systems. Most of these facilities had ventilation systems when they were constructed, but the systems have since been removed or decommissioned. The air plenum and air ducts are still in place. Each storage would have to be evaluated separately to determine the feasibility and cost of retrofitting.

D. General Potato Storage Conditions:

The potato storage facility operating conditions observed were similar in Russia and Ukraine. Potato tuber temperatures at harvest ranged from 15C (59F) in Russia to 20C (68F) in Ukraine. The rate of potato pulp "pull down" was approximately 1C (0.6F) per day

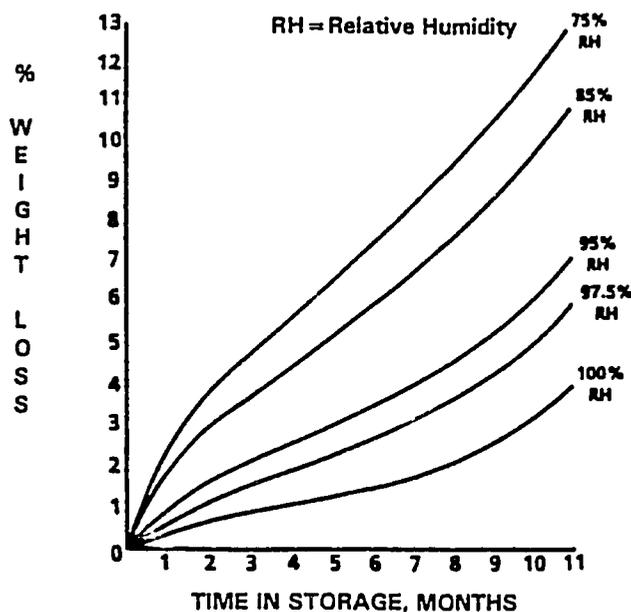
to a low of 12.7C (55F) for potato suberization (wound healing), after which this temperature was maintained for approximately two weeks. After potato suberization, the potato temperature was further reduced to 3.8C (38F) at a rate of 0.5 - 1C (0.9-1.8F) per day.

In the consultant's opinion, it would be very hard to obtain the described pull down rate in facilities lacking air ventilation and humidification systems. In facilities lacking air ventilation systems, the pull down temperature would be a function of outside ambient air temperature and the possibility of night time cooling. Night time cooling could be achieved only when the outside (ambient) air temperature was less than the temperature of the potatoes in storage. An air ventilation system would have to be operated at least one to four hours per day, just long enough to maintain the appropriate potato temperature.

The potato is a living, breathing organism that must be provided with an optimum environment if high quality is to be maintained. As the potato tuber respire, it takes in oxygen and releases carbon dioxide, water and heat. To maintain healthy potato tubers in storage, accurate temperature control, high relative humidity (percent of water vapor in air) and oxygen levels must be maintained on a constant basis to minimize weight loss (shrinkage).

The following figure shows percent weight loss in potatoes stored at various relative humidity levels over an eleven month storage cycle.

FIGURE 1³



³Waelti, H. 1972, Rev. 1992 Potato Storage and Ventilation in the Pacific Northwest. Pacific Northwest Extension Publication EM 2799. Cooperative Extension, Washington State University, Pullman, WA.

As indicated in Figure 1, as relative humidity is increased, percent weight loss (shrinkage) is lessened during storage. It is very important to have a high relative humidity level (95 percent or higher) to minimize weight loss and provide high quality potatoes upon removal from storage.

Potato storage management personnel had little or no formal training in potato storage operation and management. All training was on-the-job through many years of experience. Considering deficiencies in facilities and training, the storage managers are doing an excellent job. Potato handling equipment and potato harvesters are poorly designed and obsolete by western standards, although there was some recently acquired potato unloading equipment at a state farm in Ukraine. All potato handling equipment had large drops and unpadding areas, both of which is causing excessive potato bruising.

E. Potato Diseases:

The potato diseases observed in storage and mentioned during discussions with storage management in Russia and Ukraine personnel are:

- Late Blight
- Fusarium Dry Rot
- Early Blight
- Soft Rot
- Blackleg
- Ring Rot
- Scab
- Rhizoctonia
- Stock Nematodes
- Leak
- Wireworm

The two major potato diseases are Late Blight and Fusarium Dry Rot; the other diseases are secondary and appear only on occasion. Hollow Heart will occur in a good growing season, but did not occur in the 1992 crop due to a drought in both Russia and Ukraine.

F. Potato Varieties

Potato varieties that were stored in Russia and Ukraine were:

- Neusky
- Gatchinsky
- Temp
- Lugousky

The main varieties stored were Neusky, Gatchinsky, and Temp. Lugousky was a secondary variety. These varieties appear to store very well under the present storage conditions. If the quantity of diseased, bruised, and mechanically damaged potatoes were reduced to an acceptable level, the quality of potatoes in storage would improve dramatically.

There is a red-skinned potato variety named Svitanok Kievski. This variety has good cooking quality and taste, and it stores well. It could be a candidate for processed "frozen white good" potatoes. A "frozen white good" is a potato product packaged for the retail or institutional market that has been peeled or partially peeled, cut into slices, dices, quarters, then blanched and frozen. This type of frozen product can be made with low capital investment in equipment as compared to frozen french fries which is capital intensive.

Section G
Appendices

Appendix G-1 Scope of Work

OBJECTIVE: The identification of potato storage losses in Russia and Ukraine.

BACKGROUND:

The Project's purpose is to continue the identification of potato losses in the NIS via follow-up trips to identify areas of losses that the original NIS Potato Team were not able to evaluate because of the timing aspect. The primary goals of this evaluation project is to identify losses during storage at several base, collective/state and on-farm locations including those due to technical, equipment, management, procedures, or training deficiencies. Secondary emphasis will be on transportation and handling losses from on-farm storage to the base storage.

TASKS:

1. To make on-site visits to potato storage facilities in Russia and Ukraine to observe and identify the following:
 - 1.1 Observe the potatoes in storage.
 - 1.2 Identify sources and percentage of storage losses i.e. rot, mechanical damage, shrinkage, and disappearances.
 - 1.3 Determine the potato curing procedure. Where and for how long are the potatoes cured. The curing conditions, i.e. temperature, relative humidity, air volumes, etc.
 - 1.4 Identify storage procedures. The temperature of storage when the potatoes were delivered. The temperature reduction rate and final holding temperature after the potatoes are placed into storage.
 - 1.5 Use of relative humidity and procedure.
 - 1.6 Air delivery systems, i.e. ventilation system operating time, control systems, etc.
2. Determine the varieties being stored.
3. Identify the level of education, training, and/or experience of the storage facility managers.
4. Provide on-the-spot technical assistance whenever possible.

TENTATIVE SCHEDULE:

25	Jan	93	Depart for Moscow, Russia
26	Jan	93	Arrive Moscow, Russia (for six days)
01	Feb	93	Depart Moscow, Russia and arrive Kiev, Ukraine (for five days)
06	Feb	93	Depart Kiev, Ukraine for USA
07	Feb	93	Arrive USA

REPORT:

A report to University of Idaho, Postharvest Institute for Perishables to include observations, conclusions and recommendations, and a list of principal contacts upon return to the United States.

Appendix G-2

List of Storage Facilities

RUSSIA

Mitrov Potato Storage	Base/Central Storage
Regchovsky Potato Storage	Seed Potato Storage
Technical School Potato Storage	Seed Potato Storage
Akatyev Potato Storage	Seed Potato Storage Private Farmer
State Farm No. 14	Seed Potato Storage

UKRAINE

Ukraine Institute for Potato Research	Seed Potato Storage
Ukraine Potato Institute	Research Potato Storage
Borodianka Potato Storage	State/Collective Potato Storage
Kiev Central Storage	Base/Central Storage

Appendix G-3

Equipment List

KURZ 490 Series Mini-Anemometer 0-2000 Ft/min Range
KURTZ Instruments, Inc.,
Carmel Valley, CA

Electric TM-99 Digital Thermometer Combination Degree Celsius/Fahrenheit Scale
Industrial Ventilation, Inc.
Boise, ID

Pocket 301T Dial Thermometer 30 - 120 Degree Fahrenheit Range
Industrial Ventilation, Inc.
Boise, ID

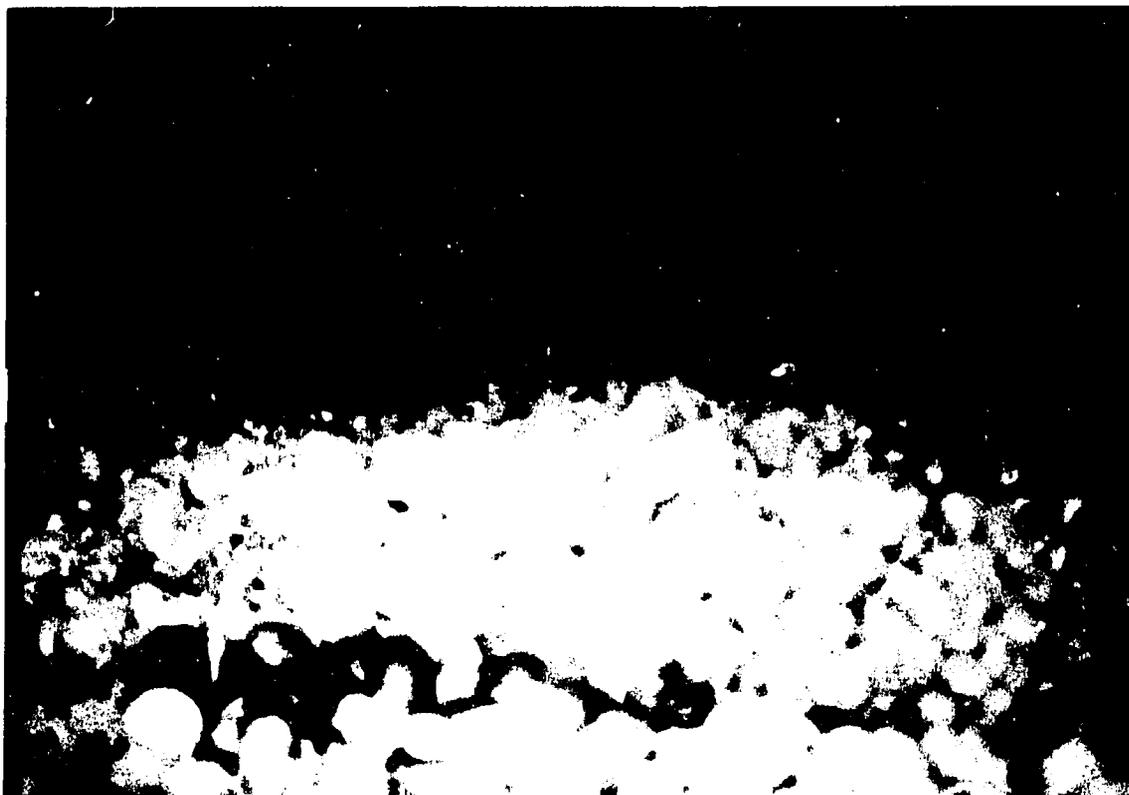
Portable Sling Psychrometer
Bacharach Instrument, Inc.
Pittsburgh, PA

Note:

Use of equipment names is for identification purpose only and does not constitute endorsement by the University of Idaho, Postharvest Institute for Perishables and USAID.

Appendix G-4

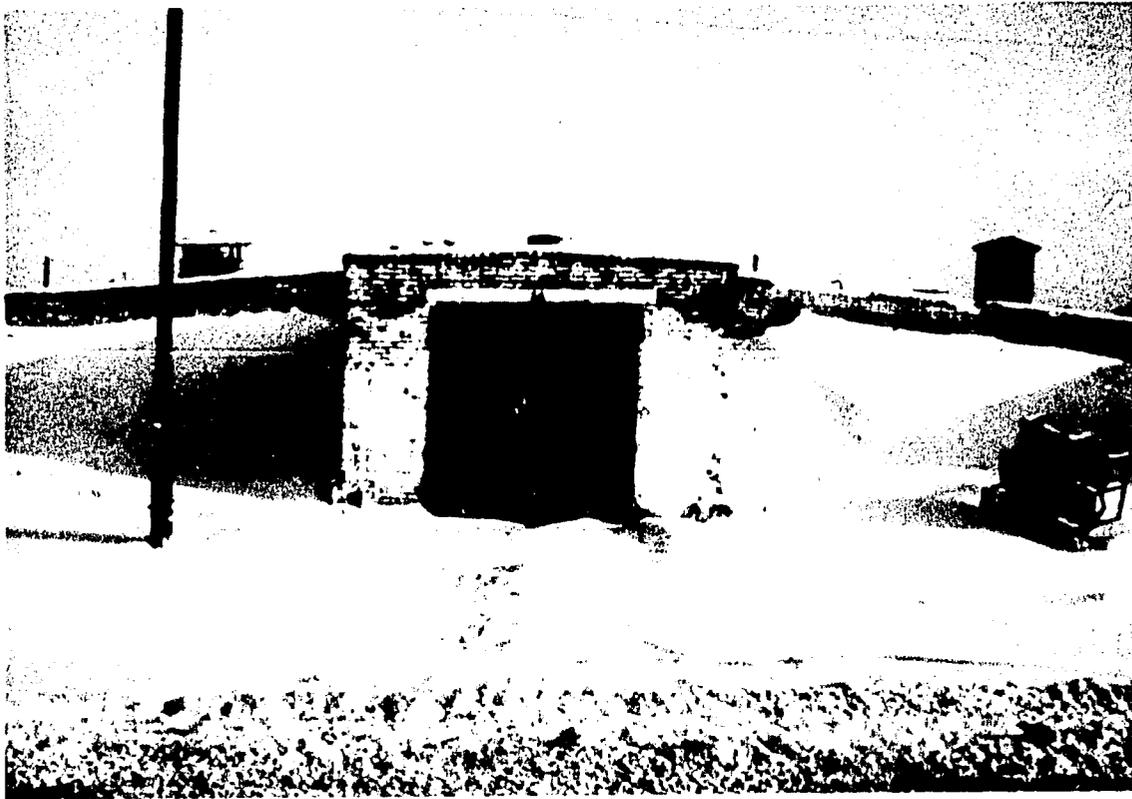
Photographs



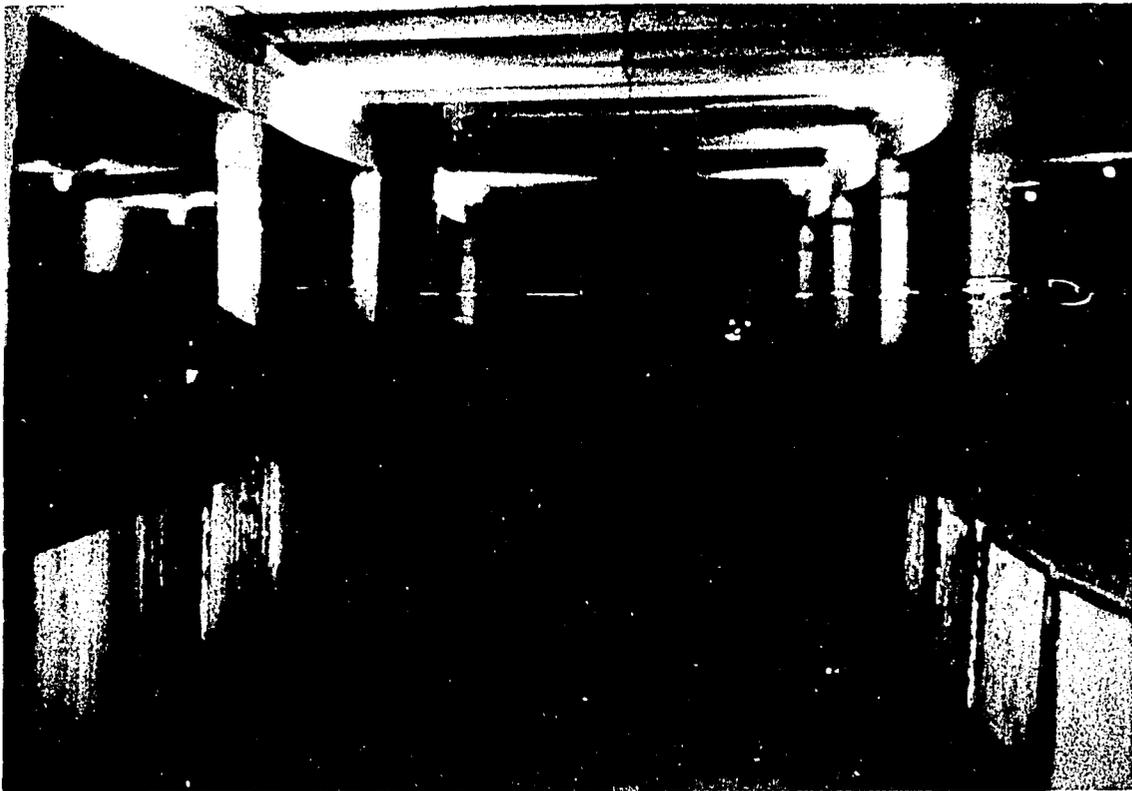
Photograph 4.1: Seed potatoes in an underground seed potato storage facility in Russia. These seed potatoes have been in storage approximately four months and have developed sprouts up to approximately 15 cm (6 in) in length. These potatoes will be removed from storage in April for planting.



Photograph 4.2: Seed potatoes in a Russian seed potato storage facility. This photograph shows some of the disease and greening that has taken place.



Photograph 4.3: A typical underground seed potato storage facility in Russia and Ukraine, constructed in the 1950s.



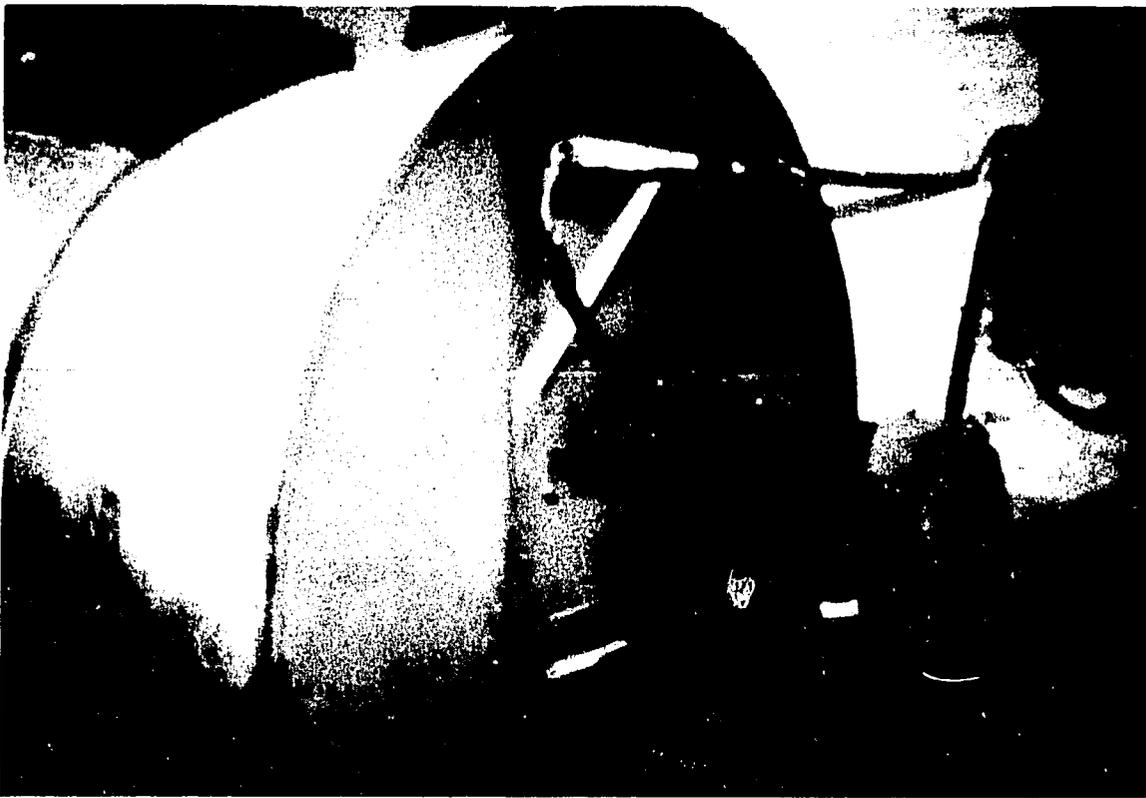
Photograph 4.4: The interior of an underground seed potato storage facility. The main structure of this type of facility is concrete columns with a preformed double tee roof deck. These facilities could be updated by adding air ventilation/humidification systems with simple electro-mechanical control panels to obtain additional years of service at a reasonable cost.



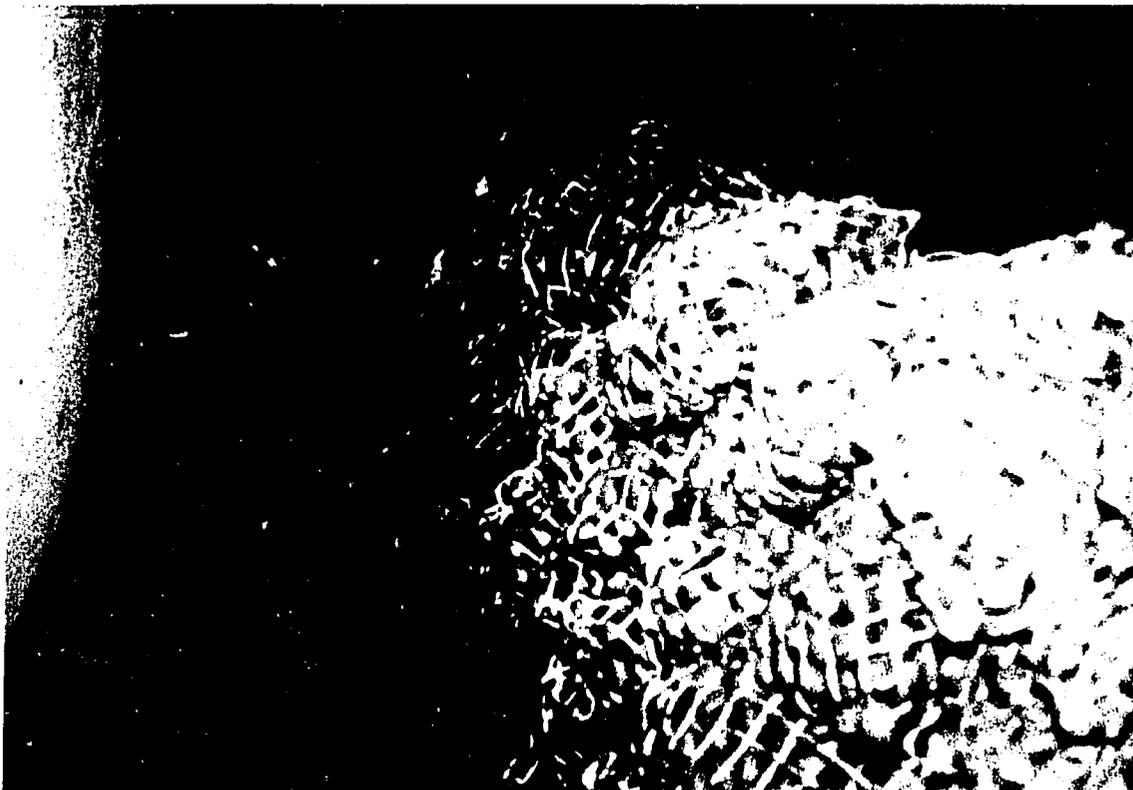
Photograph 4.5: The fans of an air ventilation system in a private farmer seed potato storage facility in Russia. The system consisted of two side by side centrifugal fans. Note that the fresh/return air is regulated by the sliding gates located between the fan intakes. This was the only seed potato storage facility visited that had an operating air ventilation system. There was no humidification system in this facility.



Photograph 4.6: A state/collective farm potato storage facility constructed in 1989. It is a concrete structure with four bulk storage bins. This is a typical design for state/collective potato storage facilities in Russia and Ukraine.



Photograph 4.7: The air ventilation system of a state/collective farm potato storage facility. Each bulk storage bin ventilation system consists of a centrifugal fan supplying air to an in-floor air duct as shown in photograph 4-8.



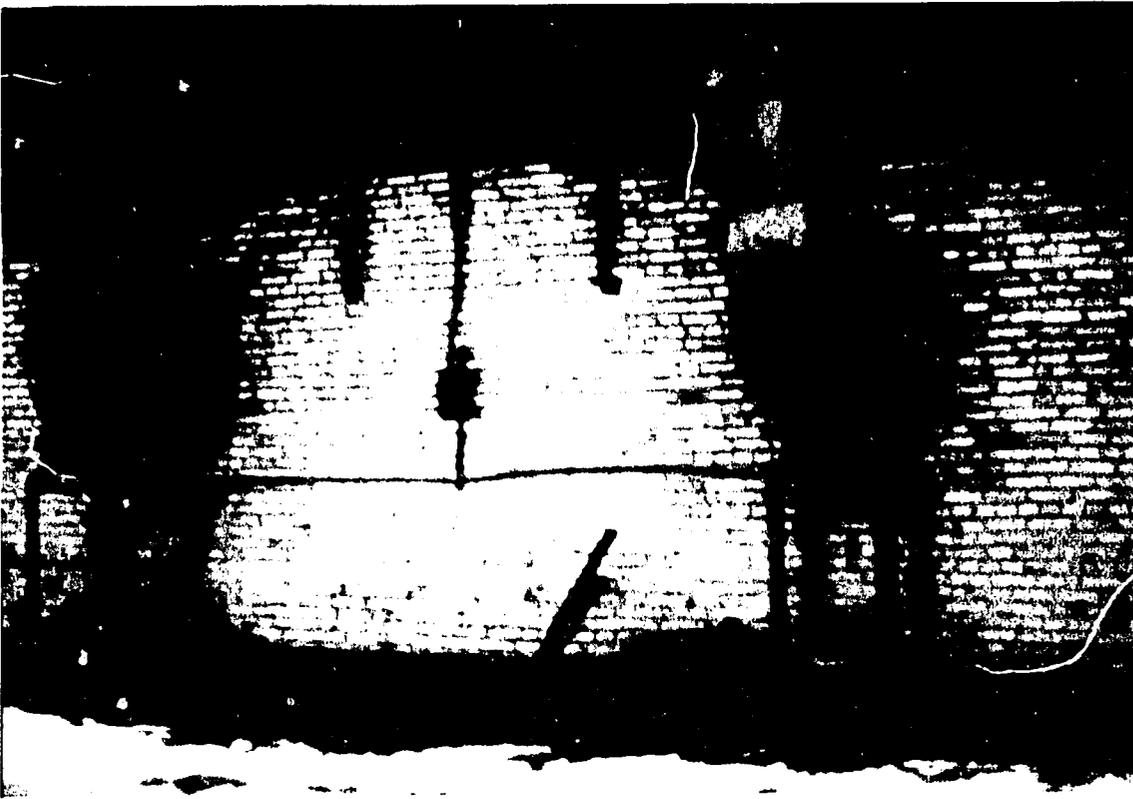
Photograph 4.8: The bulk bin of a state/collective farm potato storage facility, in which are stored both bulk and bagged potatoes. Note the in-floor air duct in the bin. With this type of bin storage, air does not circulate up through the potatoes; instead, the air circulates around the potatoes.



Photograph 4.9: Bulk Bin Storage. Stored in this bin are bags, bulk, and tote bins in the foreground. With this type of storage, it is impossible for air from the in-floor air ducts to flow through the potatoes. This type of storage facility can be updated with a new air ventilation and humidification system along with an electro-mechanical control panel. With a new air system, this facility could be used for bulk potato storage.



Photograph 4.10: An interior photograph of a typical base/central cold storage facility. Note the overhead air duct for air distribution and the refrigeration coils on the side wall. These facilities are very inefficient for long-term potato storage. They should be utilized for short-term storage and/or as a distribution center.



Photograph 4.11: The mechanical system of a base/central storage facility. The fans obtain air from the cold room and recirculate the air through the overhead duct located in the center of the cold room or along the side wall.



Photograph 4.12: An interior photograph of a base/central storage facility where the air distribution duct is located along the side wall. Potatoes in base or central storage facilities are stored in the tote bins holding approximately 227 kg (500 lbs) per tote bin.

Appendix G-5

List of Contacts

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